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**KNOWLEDGE MANAGEMENT SYSTEMS SUCCESS MODEL
FOR HEALTHCARE**

A thesis presented in partial fulfilment of the
requirements for the degree of

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ABSTRACT

Healthcare professionals depend on access to high quality, up-to-date, contextualized knowledge to create optimal healthcare outcomes for their patients. They rely on information technology to create, capture, and transfer knowledge. Ad hoc or formal information systems employing information technology to facilitate knowledge management are known as knowledge management systems (KMS). Even though the importance of KMS for healthcare organisations is frequently emphasized in the literature, there is a dearth of empirical studies of the system and organisational factors contributing to the success of KMS in healthcare. Therefore, the purpose of this study is to (a) formulate a model explaining the success of KMS in the healthcare context by taking into account both system and organisational factors, and to (b) validate the model by testing it against empirical data.

A KMS success model for healthcare was formulated by adapting and extending the KMS success model of Kulkarni et al. (2007) (based on the DeLone and McLean, 2003, IS success model) to accommodate the specifics of the healthcare context. The model includes leadership, incentives, culture of sharing, and subjective norm as organisational factors; knowledge content quality, system quality, and perceived security as system factors relating to specific aspects of the system; and perceived usefulness and user satisfaction as system factors relating to user perceptions of the system overall. KMS use for sharing and KMS use for retrieval were used as the outcome variables—proxy variables for KMS success.

The KMS success model for healthcare was tested using a quantitative, cross-sectional survey involving all doctors practicing in two mid-sized cities in New Zealand: 525 doctors in Hamilton and 639 doctors in Wellington. The survey yielded a 25 percent response rate. Partial least squares structural equation modelling was used to test the model against the data.

The model explained 31 percent of the variance in KMS use for sharing and 58 percent of the variance in KMS use for retrieval, suggesting an acceptable model fit. Of the organisational factors, leadership had the strongest total effects on both KMS use for sharing ($\beta = 0.169$) and KMS use for retrieval ($\beta = 0.169$). Incentive, however, affected

KMS use for sharing only ($\beta = 0.145$). The rest of the organisational factors had no effects. Of the system factors relating to specific aspects of the system, knowledge content quality had the strongest effects on both the outcome variables ($\beta = 0.275$ for KMS use for sharing and $\beta = 0.471$ for KMS use for retrieval). System quality had much weaker effects ($\beta = 0.094$ and $\beta = 0.175$, respectively), and perceived security had no effect. As to the system factors relating to user perceptions of the system overall, perceived usefulness strongly affected both of the outcome variables ($\beta = 0.435$ and $\beta = 0.664$), but user satisfaction affected only KMS use for retrieval ($\beta = 0.208$).

Thus, the findings of the present study suggest that both system and organisational factors affect KMS use in healthcare, with system factors having stronger effects than organisational factors. The effects on KMS use for sharing clearly differed from the effects on KMS use for retrieval, suggesting that KMS use in KMS success studies should be treated as a two-dimensional construct.

The findings of the present study suggest that managers at healthcare organisations should visibly and directly support KMS use and should focus on knowledge content quality as the most important aspect of KMS.

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LIST OF ABBREVIATIONS

AVE	Average Variance Extract
CFA	Confirmatory Factor Analysis
CG	Clinical Governance
CKO	Chief Knowledge Officer
CPOE	Computerised Physician Order Entry
CR	Composite Reliability
DHB	District Health Board
EHR	Electronic Health Record
EKR	Electronic Knowledge Repository
EMR	Electronic Medical Record
ERP	Enterprise Resource Planning
ICT	Information and Communication Technology
IS	Information Systems
IT	Information Technology
KM	Knowledge Management
KMS	Knowledge Management Systems
OCP	Organisational Culture Profile
PLS	Partial Least Squares
SEM	Structural Equation Modelling
TAM	Technology Acceptance Model

CHAPTER 1. INTRODUCTION

The knowledge-based view of the organisation suggests that knowledge is the organisational resource that enables organisations to maintain their ability to generate value for their customers (Grant, 1996). Therefore, an organisation's capability to use its existing knowledge effectively and to generate and act upon new knowledge is critical to the organisation's success (Alavi & Leidner, 2001). Thus, many successful organisations are those that best harness the knowledge of their employees. Driven by the need to manage organisational knowledge assets, knowledge management (KM) has emerged as a new discipline that brings together people, processes, and technologies to leverage and manage knowledge activities such as knowledge creation, capture, transfer, and application (Alavi & Leidner, 2001).

The widespread availability of information and communication technology (ICT), such as the Internet and organisational intranets, enabled the development of general communication and collaboration tools such as e-mail, bulletin boards, online discussion forums, and video conferencing (Davenport & Prusak, 1998; Earl, 2001). ICT based communication and collaboration tools have played important roles in enabling and supporting knowledge management in organisations, along with specialized IT tools explicitly developed to support knowledge management (Nielsen & Ciabuschi, 2003; O'Dell & Grayson, 1998; Voelpel, Dous, & Davenport, 2005). ICT-based systems supporting knowledge management are known as knowledge management systems (KMS). KMS have been recognised as contributing to the success of companies such as IBM, Hewlett Packard, Texas Instruments, British Petroleum, and Buckman Labs (Earl, 2001).

1.1 Knowledge Management in Healthcare

The focus of the present study is on the use of Information Technology to support knowledge management in healthcare. The reason for focusing on healthcare is that although healthcare is an industry that is information and knowledge intensive and populated with people with unique and specialized expertise, KMS in healthcare as an area of research has received little attention (Wickramasinghe, Bali, & Geisler, 2007).

Managerial processes in the healthcare industry may be similar to those of other industries, but the norms, culture, and practices reflect the combination of high knowledge intensity due to constantly evolving medical knowledge with the need to maintain high ethical standards. Healthcare organisations consist of people with specialised and unique expertise and are characterised by highly institutionalised organisational structures with strong professional boundaries. Although a high degree of specialization makes it easier for health professionals to become and to remain experts in their particular areas, it may hinder sharing of knowledge across different areas of specialization (Nicolini, Powell, Conville, & Martinez-Solano, 2007).

The role of KM in healthcare organisations is to enable healthcare professionals to keep current with the ever-expanding medical knowledge and with changing government legislation and regulations, thus maintaining and improving the overall efficiency and the quality of service they provide (Wickramasinghe, Bali, Lehaney, Schaffer, & Gibbons, 2009). KMS support healthcare professionals, as the healthcare professionals create and sustain optimal healthcare outcomes relying on knowledge accessed, exchanged, and shared via the ICT infrastructure.

KMS may rely on general information technologies that already exist in organisations (e.g. email, shared databases, and intranets), or on specialized technologies built specifically for use in KMS. Some examples of the uses of special purpose technologies to support knowledge management in healthcare are the uses of data-mining tools supporting acquiring and sharing healthcare knowledge (Abidi, Cheah, & Curran, 2005) and the uses of computerised decision-support systems facilitating clinical decision making (Bose, 2003; Kawamoto, Houlihan, Balas, & Lobach, 2005).

Although much of the attention of previous studies has been focused on specialized KMS applications, other studies have focused on the uses of generally available IT for knowledge management. Informal email networks are used by healthcare professionals to exchange knowledge (Dixon, McGowan, & Cravens, 2009). Video conferencing is used by health professionals for knowledge exchange and collaboration (Paul, 2006). Telehealth may involve the use of video conferencing by healthcare practitioners for discussion of patient's treatment, with specialists' knowledge thus shared at a distance (Dwivedi, Bali, James, & Naguib, 2001). Electronic libraries and repositories of scientific information in the form of articles, guidelines, and clinical protocols are used by health practitioners to

access medical knowledge (Gray & de Lusignan, 1999; Kronenfeld & Doyle, 2003). When practitioners use commonly available technology to share knowledge, they do not necessarily perceive themselves as using a "knowledge management system". Nonetheless, a combination of information technology tools, procedures and practices (formal or informal) used to facilitate the management of knowledge should be seen as a knowledge management system.

The widespread use of KMS in healthcare organisations raises the issue of understanding factors leading to their success. Understanding the factors that determine the success of KMS in healthcare is highly relevant to practice, as it would enable managers in healthcare organisations to facilitate knowledge creation, sharing, and application, thus facilitating the management of a resource critical to the success of their organisations (Nicolini et al., 2007).

1.2 KMS Success

Understanding the determinants of KMS success is crucial to the successful use of information technology to facilitate knowledge management in organisational contexts (Jennex & Olfman, 2005). Although some organisations have achieved successful outcomes, others have failed to realise the potential benefits of information technologies for KM. One of the potential causes of these failures is the assumption that when the relevant information technologies are available in organisations, employees will use them for knowledge management. However, many organisations experienced exactly the opposite: information technologies explicitly implemented for knowledge management were not used (Barth, 2000; Brazelton & Gorry, 2003; Orlikowski, 1993).

The success of KMS depends on an organisation's ability to use information technology to effectively leverage knowledge that resides in its employees' minds. Thus, the success of KMS is highly dependent on the employees using KMS for sharing and retrieving knowledge. Ultimately, it is a human-to-human process that requires more than just technology for its facilitation. Early implementations of KMS in organisations overemphasised the information technology aspects, and organisations realised that this strategy seldom worked (O'Dell & Grayson, 1998). The implementation of sophisticated technology cannot guarantee that employees will contribute their knowledge or retrieve the

knowledge of others. There were cases of KM initiatives failing due to the reluctance of employees to use the systems. Orlikowski (1993), in her study on implementations of Lotus Notes, found that the availability of tools, such as email and group support systems, did not motivate people to share knowledge. Barth (2000) in his article titled “KM Horror Stories” described how a scientist at the Pillsbury Co. of Minneapolis, a company that worked on products and technologies associated with flour, batter, and dough, proposed a forum in which everyone could contribute knowledge about batter related products. The IT department built the system, seeded it with a few thought-provoking questions, and invited participation by all relevant parties via e-mail. After waiting for six months, the scientist found that not a single user had signed on. The application had failed. O’Dell and Grayson (1998) reported a large number of cases of companies creating internal electronic directories and databases, announcing that they were available, and waiting for people to use them. Nothing happened. In the view of O’Dell and Grayson, employees did not use the systems because a culture of sharing was not present and because there were no incentives to reward them for sharing their knowledge.

As illustrated by these studies, the simple availability of technology does not of itself result in the creation, sharing, or use of knowledge. People are the creators, transferers, and users of knowledge. The view that an over-emphasis on IT at the expense of the social and cultural facets of KM is unlikely to result in successful KMS is widely shared in the literature (Alavi & Leidner, 1999; Davenport & Prusak, 1998; Gold, Malhotra, & Segars, 2001; O’Dell & Grayson, 1998). The success of KMS depends on the willingness of employees to participate in the creation of the knowledge base and to communicate with others, as well as on their willingness to rely on information technology as a facilitator of these activities.

The importance of organisational factors, such as incentives, support from leaders, and a culture of sharing, in influencing employee behaviours crucial for KMS success has been emphasised in numerous studies (Alavi, Kayworth, & Leidner, 2006; Alavi & Leidner, 1999; Davenport, De Long, & Beers, 1998; Hall, 2001; Ko, Kirsch, & William, 2005; Money, 2007). Other studies revealed that lack of attention to social and cultural factors might impair the effectiveness of purely technological implementations (Barth, 2000; Davenport et al., 1998; O’Dell & Grayson, 1998; Orlikowski, 1993; Wickramasinghe, 2002). The security of knowledge (Desouza, 2002; Gold et al., 2001; Jennex & Olfman,

2005; Lindsey, 2002) and the influence of peers (Gabbay & Le May, 2004; Ryu, Ho, & Han, 2003) were also cited as important for the success of KMS. The study by Kankanhalli, Tan, and Wei (2005a) focused on the effects of trust, pro-sharing norms, and material rewards on employee behaviour with respect to contributing to electronic knowledge repositories. Other researchers focused on extrinsic and intrinsic motivation for knowledge sharing (Lai, 2009; Lin, 2007). A number of researchers focused on factors, such as rewards, that affect knowledge seeking (Bock, Kankanhalli, & Sharma, 2006; Kankanhalli, Tan, & Wei, 2001, 2005b).

A knowledge management system is an information system, and therefore research on general IS success is relevant to understanding KMS success. In particular, the well-established DeLone and McLean IS success model (DeLone & McLean, 1992, 2003; Seddon, 1994, 1997) can be applied to KMS. (The two variations of the DeLone and McLean IS success model, published in 1992 and in 2003, are introduced in depth in section 2.4.1; henceforth, when the distinctions between the two variations are not important, I just refer to the DeLone and McLean IS success model, without stating the year of publication.) By relying on the DeLone and McLean IS success model in studying KMS success, researchers ensure that the results of their research can be put in the context of general IS success research, as well as benefit from using measures developed for the IS success model and from the existing rich body of research on the relationships between the constructs of the IS success model (Petter, DeLone, & McLean, 2008).

Wu and Wang (2006) developed a KMS success model by interpreting the net benefits construct in the DeLone and McLean (2003) IS success model as KMS use and empirically tested the model with data collected from firms in Taiwan. Halawi, McCarthy, and Aronson (2007) proposed a model very similar to that of Wu and Wang and tested it with data collected from knowledge-based organisations in USA. Taking a view that KMS success is determined by both technological and organisational issues (as argued earlier in this section), Kulkarni, Ravindran, and Freeze (2007) proposed an extension of the DeLone and McLean IS success model. The model included leadership, incentives, co-worker (perceived use of the system by co-workers), and supervisor factors (perceived use of the system by the respondent's supervisor) along with the technological factors (such as knowledge quality and system quality). Kulkarni et al. found that both organisational and

technological factors affected knowledge use (which Kulkarni, Ravindran, & Freeze used to operationalise the net benefits concept).

The only study of KMS success conducted in the context of healthcare (Hwang et al., 2008) used the DeLone and McLean (2003) IS success model with net benefits interpreted as reducing costs of knowledge transfer and improving knowledge worker efficiency. As the DeLone and McLean IS success model it was based on, the model by Hwang et al. (2008) included only system factors.

1.3 Problem Statement and Research Questions

As seen from the discussion in section 1.1 (and from the more in-depth coverage of the literature in Chapter 2), knowledge management and knowledge management systems are an important issue in healthcare. Even though healthcare organisations differ from organisations in other industries in terms of their knowledge needs and in terms of the context for knowledge management they provide, the studies of KMS success in healthcare are limited.

Technology factors alone are not sufficient to explain KMS success, and it is essential to take into account the organisational factors influencing employee behaviour with respect to KMS use. Therefore, it is essential that a KMS success model in healthcare takes into account both system (related to technology and to technology perceptions) and organisational determinants of KMS success. Because such a model has never been considered in prior research, I intend to address this problem in the present study.

Therefore, the research questions for this research are formulated as follows:

1. What are the system factors that determine the success of KMS in healthcare?
2. What are the organisational factors that determine the success of KMS in healthcare?

1.4 Research Model and Hypotheses

This section briefly explains the theoretical foundations of the KMS success model in healthcare (see Figure 1-1 and Figure 3-1) formulated and tested in this study. The model is introduced in detail in Chapter 3. The model is based on the KMS success model by Kulkarni et al. (2007), which in turn is based on the DeLone and McLean (2003) IS success model.

The model uses KMS use for sharing and KMS use for retrieval as outcome variables (see sections 3.3.2 and 3.3.3 for an argument justifying the use of these variables as proxy variables for KMS success). The model accounts for system and organisational factors that directly or indirectly determine KMS success in healthcare.

System factors include factors derived from the DeLone and McLean (2003) IS success model and perceived security. Factors derived from the DeLone and McLean IS success model are knowledge content quality, KMS system quality, user satisfaction, and perceived usefulness (derived from the variation of the DeLone and McLean IS success model by Seddon, 1997). Perceived security is viewed as environmental and behavioural uncertainty (Ring & Ven, 1994).

Organisational factors include leadership and incentive (corresponding to transformational and transactional leadership by Burns, 1978 and Bass, 1985) and culture of sharing and subjective norm, corresponding, respectively, to the relevant aspects of the overall culture of the organisation and to the influence of immediate colleagues.

The major difference between the KMS success model in healthcare formulated and tested in the present study and the model by Kulkarni et al. (2007), is that the proposed model includes culture of sharing and perceived security (the two models are compared in detail in section 3.5.) It is suggested that a culture of sharing and perceived security are particularly important in the context of healthcare, because healthcare organisations have strong cultures and because the knowledge managed at healthcare organisations is highly sensitive. Detailed justifications of the hypotheses included in the model, with an emphasis on their meaning and relevance in the healthcare context, are given in section 3.5.

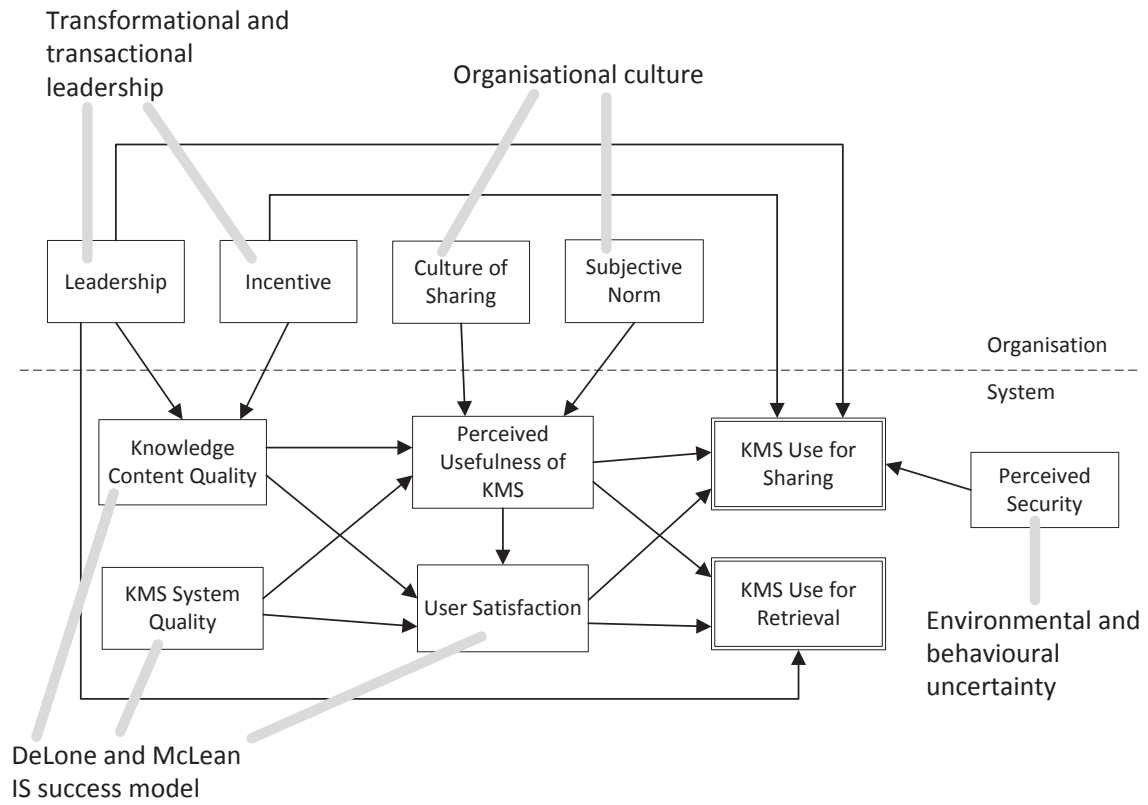


Figure 1-1. Preview of the KMS success model for healthcare.

Table 1-1 *Theoretical Foundations of the KMS Success Model for Healthcare in Figure 1-1*

Theory	Factors	Introduced in section
Information systems success model	Knowledge content quality, KMS system quality, user satisfaction	2.3.1
TAM2	Subjective norm, perceived usefulness	2.3.2
Organisational culture profile (OCP) framework	Culture of sharing	2.3.2
Transformational and transactional leadership	Leadership, incentive	2.3.3
Perceived security and behavioural and environmental uncertainty	Perceived security	2.3.4

Table 1-1 lists the theories underlying the hypotheses in the model, with references to the sections in the literature review of this thesis where these theories are introduced.

1.5 Summary of Methodology

This research relied on a positivist epistemology. Following a preliminary study that established the existence of KMS use in the New Zealand healthcare sector (see Appendix A), the model of KMS success in healthcare was formulated as a set of hypotheses and tested by fitting it to empirical quantitative data. The hypotheses were formulated based on the existing studies and theories.

The data were collected in a cross-sectional survey. For as much as possible, the survey instrument relied on reusing measures available in the literature, and rewording items to fit the healthcare context as necessary. For three of the constructs in the model, KMS use for sharing, KMS use for retrieval, and culture of sharing, measures were not available. Therefore, the items were formulated based on the understanding of the domain obtained from the literature. A content validity survey involving experts from the healthcare sector

and from the KMS research community was conducted to validate the measures. Pilot tests were conducted to iron out any presentation problems.

The survey involved doctors from Wellington and Hamilton (two middle-size cities in New Zealand). Mean replacement was used for missing data. Statistical checks for non-response bias (by comparing early and late respondents), for sample representativeness (by comparing age and gender characteristics for the respondents with the population), and for common method bias (by using Harman's single factor analysis) were conducted.

Structural equation modelling utilising the partial least squares technique, was used to test the model, which included convergent and discriminant validity checks. The overall model fit was judged based on the amount of variance explained and on the values of path coefficients. The overall research process is summarized in Figure 1-2.

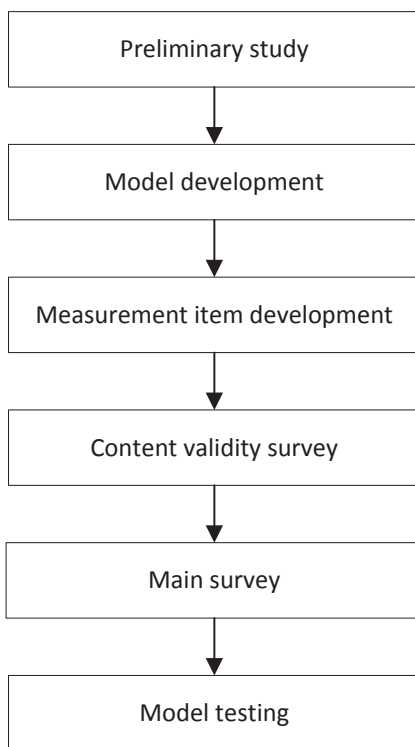


Figure 1-2. Overall research process.

1.6 Significance of the Study

This research contributes by formulating a model of KMS success in healthcare and by validating it with empirical data. The model is based on the DeLone and McLean IS success model, and thus the results of the model testing are interpreted based on the existing body of literature on general IS success and further add to that body of literature.

The existing KMS success models include organisational and system factors. The model introduced in the present study also includes both organisational and system factors. The present study contributes by adding organisational factors (culture of sharing and subjective norm) and a system factor (perceived security) not covered in prior research. These factors were added to formulate a KMS success model fitting the healthcare context. Nonetheless, they may be relevant to other contexts of KMS success. The model formulated and tested in this study is the first KMS success model distinguishing knowledge sharing and knowledge retrieval as separate activities.

The model formulated and tested in this research should provide a useful tool for the management of healthcare organisations to understand the determinants of KMS success and plan for strategies to use information technology to facilitate access to knowledge and knowledge sharing.

1.7 Delimitations

The present study adopts a broad view of knowledge management systems, inclusive of the use of commonly available technologies, such as email, intranets, and video conferencing, for knowledge management. The study did not focus on any particular type of KMS.

The present study focused on KMS success in healthcare. The study focused on doctors as a category of healthcare employees with the most knowledge intensive jobs. Other healthcare employees, such as nurses or pharmacists, were not included.

The target population for this study were doctors practicing in Wellington and Hamilton. Hamilton and Wellington are similar in terms of their mid-size population. Care should be taken in generalizing the results to other areas.

1.8 About the Researcher

I was born and raised in Malaysia, in a rural area, and my ethnic background is Malay. After completing high school in Malaysia, I continued my education overseas and obtained a BSc degree in Computer Science from Texas State University, Texas, USA (originally known as Southwest Texas State University), followed by an MSc degree in IT in Business from University of Lincoln, Lincoln, England (originally known as University of Humberside).

I have worked both in industry, as an IT project officer at the MIS department of a large government-owned housing development company in Malaysia, in charge of IS and IT planning and implementation, and in academia, as a lecturer at a major private university in Malaysia. As a lecturer, I have developed a course in knowledge management, which has led me to being interested in knowledge management research.

My interest in healthcare started when I was studying in the USA and had opportunities to compare the US and the Malaysian healthcare systems (from the perspective of a consumer of health services). As an IT professional, I was particularly fascinated with the potential of applying IT to improve healthcare services. The interest in healthcare inspired my application to enter a PhD program in the UK; the application was devoted to exploring the potential of using pervasive computing in healthcare (the proposal did not go ahead because of lack of funding). Later, based on my experience working as an IT project officer, I realized the importance of organisational aspects. I realized that I could contribute more to the community if I focused my research on organisational, rather than technical aspects of using IT in healthcare. Therefore, when I was offered a scholarship to do a PhD in New Zealand, I decided to focus on knowledge management in healthcare.

When working as an IT project officer, I was part of a team responsible for planning and implementing IT and IS at my organisation. Some of the computers and networking that were installed were not used. Although training was conducted, many of the employees were not inclined to accept the new environment where most tasks are computerised. This

experience sensitized me to issues relating to the success of information systems at organisations. Thus, while working on the present study, I approached the research problem (stated in section 1.3) as an IT professional with an experience of dealing with organisational issues around the success of IS implementation, as an educator teaching knowledge management at a major university in Malaysia, and as a consumer of health services who has been exposed to health systems in different countries.

1.9 Outline of the Thesis

The present study is presented in six chapters. Chapter 1 outlines the research background for KMS in healthcare, presents the research questions, outlines the methods used and the expected contributions of the study, and gives the delimitations of the study.

Chapter 2 presents a review of the literature that sets the foundations for the research. The review of the literature is presented in two themes: a theme focusing on KMS and KMS in healthcare and a theme focusing on IS and KMS success. The first theme begins with the discussion of KMS concepts and practice, which includes defining the basic concepts of KM and KMS; this is followed by the discussion of KMS in healthcare. The second theme begins with the discussion of the theoretical foundations for the factors of KMS success considered in this study, followed by the discussion of prior KMS success studies.

Chapter 3 proposes a theoretical framework and the research model. The research model introduces the system and organisational factors that are expected to affect the use of KMS for sharing and the use of KMS for retrieval. Then, the research hypotheses are proposed and justified.

Chapter 4 describes the research methodology used in this study. The chapter discusses different IS research approaches and justifies the approach applied in this study. Then, the chapter presents the instruments used in this study, the pre-test, the pilot study, the content validity study, the sampling design and the unit of analysis, the data collection methods, and the data analysis techniques.

Chapter 5 presents the results of data analysis. Outcomes of checks for bias are discussed; followed by the results for the measurement and for the structural model.

Chapter 6 discusses the overall research findings and their implications for theory and practice, along with the limitations of the study and the suggestions for further research. The chapter ends by stating the conclusions for the whole thesis.

CHAPTER 2. LITERATURE REVIEW

2.1 Introduction

This chapter presents the literature relevant to the research undertaken in this thesis, organised along two themes: knowledge management systems (KMS) practice and knowledge management systems (KMS) success.

The discussion of KMS practice starts by defining the basic concepts of knowledge management (KM) and knowledge management systems (KMS). Models of KMS are discussed and illustrated by examples from the literature. This is followed by an in-depth discussion of KMS practice in healthcare and of the drivers of KMS adoption and emergence in healthcare, including patient-centred care, clinical governance and evidence-based medicine, and communities of practice.

The discussion of KMS success starts with a brief introduction of the relevant theories, followed by a description of studies of KMS success, with the emphasis on factors found to affect KMS success. Studies based on the Delone and McLean IS success are discussed. The chapter ends by discussing in detail the Kulkarni et al.'s (2007) KMS success model, which is particularly relevant to this study, and by identifying the research gaps.

2.2 Knowledge Management Systems—Concepts and Practice

First, this section introduces knowledge management systems and the related concepts. Then, it describes the current practice in using knowledge management systems, focusing on the use of knowledge management systems in healthcare.

2.2.1 Knowledge, Knowledge Management and Knowledge Management Systems

To study knowledge management systems in health, it is essential to define knowledge, knowledge management, and knowledge management systems.

2.2.1.1 Knowledge

In the literature, there are numerous attempts to define the concept of knowledge and to distinguish it from information and data. In general, scholars agree that knowledge is more than just data or information, but it also involves the application of the expertise of individuals to use and capitalize on information.

Some scholars argue that knowledge only resides in the mind. For example, Alavi and Leidner (2001) define knowledge as information that is processed in the mind of the individual. Once knowledge is articulated and presented in the form of text, graphics, words, and other symbolic forms, it becomes information. Similarly, Nonaka and Takeuchi (1995) suggest that information—but not knowledge—can be stored in external storage, such as databases, books, libraries, or the internet. They argue that the beliefs and commitment of the possessor of knowledge are an essential aspect of knowledge.

However, some scholars distinguish between two types of knowledge: tacit and explicit. Tacit knowledge is deeply rooted in an individual's actions and thus is subjective in nature. It is highly personal, difficult to put into words, and is, therefore, difficult to communicate or share with others (Li & Gao, 2003; Stefanelli, 2004). This type of knowledge is in alignment with the perspective that knowledge resides in the heads of individuals.

In contrast, explicit knowledge is knowledge that can be formalized, documented, and archived (Duffy, 2001; Nonaka & Takeuchi, 1995; von Hippel, 1994). Explicit knowledge is more objective and rational (Alavi & Leidner, 2001). Examples of explicit knowledge are organisational routines, policies, manual procedures, research reports (Zack, 1999), or evidence-based medicine (Wyatt, 2001). Because explicit knowledge can be captured, it can be easily disseminated, and is, therefore, easy to reuse within organisations for decision-making. In contrast, tacit knowledge is difficult to reuse, because the transfer of tacit knowledge requires prolonged direct interaction between the individuals involved (Stenmark, 2000).

Though many definitions of knowledge have been proposed, this study has adopted the definition of knowledge proposed by Davenport and Prusak (1998) because it best captures the complexity of the knowledge phenomenon:

...knowledge is a fluid mix of framed experiences, values, contextual information, and expert insight that provides a framework for evaluating and incorporating new experiences and information. It originates and is applied in the minds of knower [*sic*]. In organisations, it often becomes embedded not only in documents or repositories but also in organisational routines, processes, practices and norms. (p. 35)

The definition by Davenport does not explicitly distinguish between tacit and explicit knowledge. Nonetheless, the definition does allow knowledge to be separated from the individuals who created it. Indeed, the distinction is difficult to draw precisely, in quantitative terms. Consequently, the model formulated in this study (see section 3.5 for an introduction of the model) does not distinguish between tacit and explicit knowledge.

2.2.1.2 Knowledge Management

The need to manage knowledge in organisations has led to the concept of knowledge management. In view of the multidisciplinary nature of KM, various definitions of KM have been proposed.

Dalkir (2011) identified ten different perspectives from which KM has been viewed in the literature, of which the organisational perspective and cognitive science perspective are most relevant to this study. From the cognitive science perspective, KM has been defined as the accumulation of expertise by individuals (Wiig, 1997). From the organisational perspective, KM has been defined as the activities that focus on managing knowledge-related tasks to achieve business objectives. It involves the management of knowledge that comes from the accumulation of expertise at an organisation, with the knowledge contributing to achieving business objectives when it is applied to conduct knowledge-related work.

Alavi and Leidner (1999) viewed KM as having three perspectives: information-based, technology-based, and cultural-based. The information-based perspective of KM refers to KM resulting in information that is accessible, real-time, and actionable. The technology-based perspective refers to KM relying on information technology and thus being supported by various IS that are used as knowledge management systems. The cultural-

based perspective of KM refers to KM being associated with learning, communication, and intellectual property cultivation.

This study adopted the definition by Wickramasinghe (2002) that combines organisational and cognitive perspectives; this study put emphasis on the organisational perspective. Wickramasinghe defined KM as a discipline that provides an integrated approach that can identify, manage, and share organisational information assets, including databases, documents, policies, and procedures, as well as expertise and experience of individual workers. In terms of Alavi's distinction between information-based, technology-based, and cultural-based perspectives, all of these are reflected in the model formulated in this study (see section 3.5 for an introduction of the model).

In managing knowledge, two approaches are often distinguished: personalisation (person to person) and codification (Hansen, Nohria, & Tierney, 1999). The personalisation approach deals with managing tacit knowledge and requires an environment that encourages social interactions among employees as a means for employees to share what they know. Communities of practice (see section 2.2.2.3) are commonly used to implement the personalization approach (Amin & Roberts, 2008). The personalisation approach focuses on promoting the sharing of tacit knowledge. In contrast, the codification approach deals with managing explicit knowledge. It involves the (possibly, highly formalized and structured) processes of identifying knowledge, capturing it, and then disseminating and applying the captured knowledge (Hansen et al., 1999). In the context of Information Systems research and practice, the term *personalization* is most frequently used, with a very different meaning, to refer to the personalization of user interfaces. Therefore, henceforth when referring to the personalization approach to knowledge management, I clarify it by also mentioning *person-to-person* in parentheses.

2.2.1.3 Knowledge Management Systems

Knowledge management systems (KMS) are information systems used to facilitate the management of knowledge. KMS may involve the use of specialized information technology tools created for the purpose of facilitating knowledge management, or can be based on commonly available, generic information technologies, such as email or intranets. KMS may be implemented on purpose, as part of knowledge management initiatives (as it is the case when specialized technology is involved), or may emerge at grassroots level as

informal communities of practice using technology available to support their activities (Maier, 2004).

Some specialized technologies used in KMS are artificial intelligence, data mining, and expert systems (Hendriks & Vriens, 1999; Maier, 2004). There are a number of studies of organisations purposely building KMS to fulfil their knowledge management requirements (Griggs, Wild, & Li, 2002; Kwan & Balasubramanian, 2003; Voelpel et al., 2005). Alternatively, commonly available technologies have also been used for KM in organisations, resulting in ad hoc knowledge management systems that may not be explicitly labelled as such. Recently, there has been an increased interest by researchers in the use of commonly available technologies for knowledge management. Edwards, Shaw, and Collier (2005), for example, conducted computer-supported group workshops in ten organisations and found that there was a clear emphasis on the use of general information technology tools to support knowledge management activities rather than the use of tools specific to knowledge management. The organisations studied used their available IT for sharing knowledge, such as the Internet, intranets, email, bulletin boards, and shared files. In another study (Earl, 2001) video-conferencing, lists of contact details of knowledgeable employees made available on the organisation's intranet, and discussion forums were reported as commonly available technologies used for knowledge management.

The present study adopts the view that a combination of information technology tools, procedures, and practices (formal or informal) used to facilitate the management of knowledge should be seen as a knowledge management system (as already mentioned in section 1.1). Thus, the study takes an inclusive view of knowledge management systems, and includes systems that do not involve the use of specialized knowledge management technologies and systems that have emerged at grassroots level rather than having been purposely implemented by the management.

It is common to distinguish between repository and network models of KMS (Alavi, 2000). The repository model focuses on using information technologies to facilitate organising, storing, and accessing explicit knowledge to support the codification approach to KM. The network model focuses on using information technologies to connect employees to enable the sharing of tacit knowledge to support the personalization (person to person) approach to KM.

The repository model suggests including features that enable collection, summarization, organisation, and integration of knowledge across multiple sources in an organisation (Bose, 2002). Knowledge in knowledge repositories is kept in structured form. Retrieval functions in knowledge repositories include features such as indexing, classification, and searching that enable employees to find and to retrieve knowledge for reuse. Some examples of explicit knowledge stored in knowledge repositories are procedures, clinical guidelines, organisational routines, processes, or best practices (Abidi, 2007; Jadad, Haynes, Hunt, & Browman, 2000). Document management systems, organisational intranets, databases, expert systems, and data warehouses are examples of knowledge repositories. Creating a repository is often one of the objectives of KM projects (Davenport et al., 1998). Knowledge available in a repository can be easily accessed by employees throughout the organisation, so that knowledge can be disseminated more widely than when the network approach is used (Wakefield, 2005). An effective repository depends on employees contributing knowledge to the system and retrieving knowledge from the system for reuse. Among the issues influencing the successful use of the repository are the technical issues such as the quality of its content, ease of use, and the search capabilities it provides for easy access as well as an organisational environment that encourages employees to contribute their knowledge.

In contrast to the repository model, the network model of KMS primarily supports the transfer of tacit knowledge. According to the network model, the function of the KMS is to enable employees to access tacit knowledge such as expertise, opinions, or judgement that can be accessed only via direct person-to-person contact (Hansen et al., 1999). KMS following the network model involve information technology in two ways: online knowledge directories are used to enable employees to find knowledgeable individuals, and communication and collaboration technologies are used to enable the interactions resulting in the transfer of tacit knowledge (Bowman, 2002).

Knowledge directories contain profiles of experts and descriptions of their expertise (Alavi, 2000). They enable employees to access an expert directly to get answers that are not available from a repository. To access the knowledge, one has to communicate with the expert (either face-to-face or by using communication technologies, as discussed in the following paragraph). Thus, knowledge directories are less efficient than knowledge repositories in enabling the dissemination of explicit knowledge; the advantage of

knowledge directories is that they enable the dissemination of tacit knowledge. Knowledge directories are known under a variety of names, including yellow pages, corporate directories, and knowledge maps (Earl, 2001; Edwards et al., 2005). The activities involved in the use of online directories include defining knowledge categories that are relevant to the organisation, identifying knowledge possessors for each category, and creating a searchable directory to help the employees in the organisation to identify and locate knowledge possessors (Bowman, 2002). For example, at Teltech Resource Network Corporation, an expert network was set up to provide a technical expert referral service by maintaining a database of technical experts (Davenport et al., 1998). Teltech paid its employees to participate in the expert network.

Some examples of communication and collaboration tools enabling network model KMS are electronic mail, electronic discussion forums, and groupware (Bhatt, 2001; Bhatt, Gupta, & Kitchens, 2005; Earl, 2001). Discussion forum software enables the exchange of knowledge within communities of practice, such as online communities for nurses (Currie & Suhomlinova, 2006; Hara & Hew, 2007). For a closer approximation to actual face-to-face interaction, video conferencing is used (Davenport et al., 1998; Hansen et al., 1999).

The aspects of KMS discussed in this section are summarized in Figure 2-1. KMS in an organisation may reflect all of these aspects simultaneously. It can be in part built on purpose (e.g., a shared folder set up to share documents throughout the organisation, with employees contributing by emailing documents to a designated person) and, in part, emerging (e.g., informal mailing lists set up as needed to discuss topics). It can, in part, follow the repository model (e.g., via the shared drive) and, in part, follow the network model (with a list of employee contact details available as web pages on the intranet serving as a directory, and with employees using both conventional phones and video conferencing via Skype to access the tacit knowledge of experts). As such, it would support the transfer of both tacit and explicit knowledge. The management might be consciously promoting the use of technology for knowledge sharing via a combination of personalization (person to person) and codification approaches; alternatively, these activities may be happening entirely as grassroots initiatives.

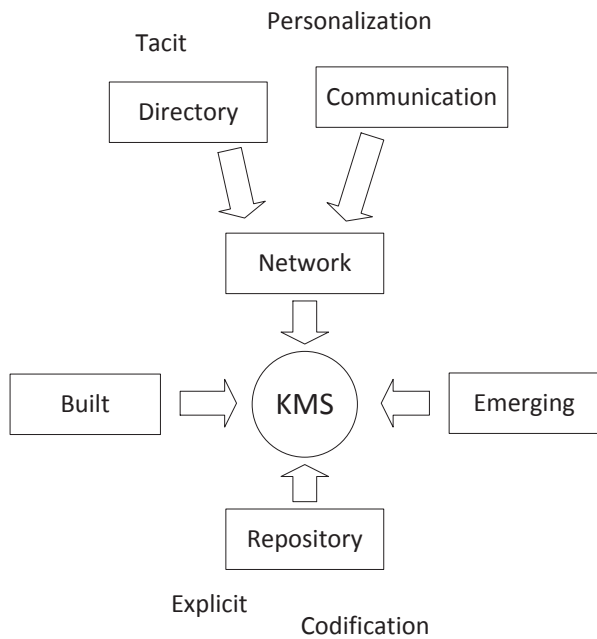


Figure 2-1. KMS aspects.

2.2.2 Knowledge Management Systems in Healthcare

Healthcare is an information intensive industry, and the use of information systems is well established. Some examples of the use of information systems in healthcare documented in the literature are computerised physician order entry (CPOE) systems that can reduce medical error rates (Doolan & Bates, 2002) and electronic medical record (EMR) systems that help automate the daily administration of hospitals, facilitating activities such as record keeping and billing (Miller & Sim, 2004). Electronic health record (EHR) systems, telemedicine systems, and computer decision support systems (Garg, Adhikari, & McDonald, 2005; Jadad et al., 2000), as well as systems relying on personal digital assistants (PDAs) to facilitate information flows by improving accessibility, have been reported as helping improve the services of healthcare professionals (Wickramasinghe, 2004).

Recently, the issue of knowledge management (rather than just information management) has gained prominence in the healthcare field. The interest in KM was brought about by the substantial growth of knowledge in the medical field. There is a need to improve the access to knowledge by all healthcare professionals and to facilitate the transfer of knowledge among healthcare professionals (Kothari, Hovanec, Hastie, & Sibbald, 2011;

Nicolini et al., 2007). The interest in the use of information technology to facilitate KM is also growing. A number of studies have been conducted in the area of KMS in healthcare (Abidi, 2001; Dwivedi, Bali, James, Naguib, & Johnston, 2002; Fennessy, 2001; Guptill, 2005; Jadad et al., 2000; Keeling & Lambert, 2000; Pavia, 2001; Yu-N & Abidi, 1999).

In order to deliver the best possible care, medical practitioners need access to knowledge. Timely access to relevant up-to-date general medical knowledge as well as to local, contextualized, knowledge improves the quality of clinical decisions and medical advice and can lead to better clinical outcomes. Insufficient access to knowledge may negatively affect practitioners' performance; for example, ineffective routines are continued, and new approaches are not explored (Gunderman & Chan, 2003). Thus, there is a need for effective and efficient sharing of knowledge among healthcare practitioners within and across organisations (Ackerman, Pipek, & Wulf, 2003). The knowledge relevant (and essential) for a health practitioner ranges from general and broad to highly localized, including knowledge about specific patients. For example, oncologists and cardiologists work with general practitioners and home-care nurses and thus, they need tools to allow easy sharing of knowledge relating to patients' conditions (Desouza, 2002). KMS help medical practitioners to both access up-to-date medical knowledge (through knowledge repositories) and share local, contextualized knowledge with other specialists directly, which enables the practitioners to apply knowledge to help their patients (Winkelman & Wei, 2003).

The recent emphasis on patient-centred care, on using clinical governance to promote evidence-based medicine, and on establishing and maintaining communities of practice have further highlighted the relevance of knowledge management and knowledge management systems in the healthcare field. Patient-centred care, clinical governance and evidence-based medicine, and communities of practice in health are discussed in the following subsections.

2.2.2.1 Patient-centred care

Patient-centred healthcare is a healthcare paradigm in which patients are actively involved in making decisions about their health (Stewart, 2001). In a patient-centred healthcare organisation, patients are seen as experts with respect to their own conditions. Patients collaborate and share knowledge with care providers. Care providers provide the clinical

care based on both the best and most relevant medical and scientific knowledge and on the knowledge they gain from the patients (Beveren, 2003).

Therefore, in patient-centred healthcare, in addition to the need for health practitioners to access up-to-date medical knowledge and to share local, contextualized knowledge with each other, patients need access to general medical knowledge and need to exchange knowledge with health practitioners and, possibly, with each other (Beveren, 2003).

2.2.2.2 Clinical Governance and Evidence-based Medicine

Clinical governance (CG) (Halligan & Donaldson, 2001) is one of the management approaches used by healthcare organisations to assure the quality and the effectiveness of their services. CG emphasizes continuing learning, clinical audits, risk management, and research and development to ensure that high standards of clinical care are maintained (Plaice & Kitch, 2003). Clinical governance was established as an attempt to integrate all activities involving the improvement of the quality of information available to health practitioners, the support for collaboration, the application of evidence-based medical knowledge, as well as the audits of clinical services within a single strategy to continually improve the quality of service in healthcare (Degeling, Maxwell, Iedema, & Hunter, 2004; Halligan & Donaldson, 2001; Plaice & Kitch, 2003; Scally & Donaldson, 1998).

A core component of CG is evidence-based medicine, which aims to incorporate research-based evidence into clinical practice (Halligan & Donaldson, 2001). Evidence-based medicine has been established as a healthcare management paradigm that is based on the concept that medical practice must be based on scientifically sound, unbiased research (Sackett, Rosenberg, Gray, Haynes, & Richardson, 1996). Evidence-based medicine identifies and integrates the explicit knowledge obtained in medical research into practice in order to support clinical decision-making (Fennessy & Burstein, 2007). Hence, medical knowledge should be made available to practitioners to enable them to practice evidence-based medicine.

Some of the information systems supporting evidence-based medicine are MEDLINE and the Cochrane Library (Young, Young, & Ward, 2001). MEDLINE and Cochrane Library are knowledge repositories used by healthcare practitioners to access up-to-date medical knowledge available as research articles and as systematic reviews. Some of the answers

are not provided by these databases. Healthcare practitioners have to use their experience and expertise and combine them with evidence-based knowledge to make decisions (Fennessy, 2001). Knowledge created through this process can then be shared in communities of practice of healthcare practitioners (Sandars & Heller, 2006).

2.2.2.3 Community of Practice

A community of practice is a group of people who share a common interest in a topic and who deepen their knowledge and expertise through continuous communication (Hara & Hew, 2007; Wenger & Snyder, 2000). The members of a community of practice exchange knowledge and create new knowledge; therefore, communities of practice are highly relevant to knowledge management (Wenger & Snyder, 2000). Communities of practice are often informal self-organising, self-managing networks, driven by grassroots initiatives rather than by management (Wenger & Snyder, 2000). Communities of practice may form inside organisations, such as when a group of specialists who frequently interact in their professional activities form a community of practice (Eardley & Czerwinski, 2007). Communities of practice may also form across organisations, with the participants sharing an interest that is relatively broad in scope (Tagliavanti & Mattarelli, 2006).

While the focus of evidence-based medicine is on general explicit knowledge (Eardley & Czerwinski, 2007; Fennessy, 2001), communities of practice support the exchange of local, contextualized, and tacit knowledge. The practice of clinical care demands knowledge beyond published scientific facts, such as tacit knowledge attained from direct experience or via interactions with colleagues (Beveren, 2003; Wyatt, 2001). Some clinicians feel that emphasizing explicit knowledge may result in tacit knowledge being undervalued, which may negatively affect the quality of decision-making (Gabbay & Le May, 2004). The results of an ethnographic study by Gabbay and Le May (2004) suggested that clinicians rely for their decision making on tacit knowledge acquired through interactions and discussions with colleagues more often than they rely on knowledge obtained from written sources. Moreover, beyond just allowing the practitioners to exchange knowledge, discussions within the communities of practice result in the creation of new, relevant, and usable knowledge. Practitioners participating in communities of practice create new knowledge by making sense of the evidence-based knowledge (obtained via medical research at research institutions, and thus, not contextualized to a particular context of

practice). They make evidence-based knowledge meaningful for their context. Moreover, they integrate it into their tacit knowledge (Bate & Robert, 2002; Sandars & Heller, 2006).

Information and communication technology has had a profound effect on communities of practice by enabling global (the Internet) and local (the organisational intranets) connectivity. Information technology enables both synchronous (videoconferencing, teleconferencing, text-based on-line chat) and asynchronous (discussion forums, email, social networking sites) communication, freeing the participants from the constraints of time and place (Hara & Hew, 2007).

When the members of a community of practice use the available information technology relying on self-imposed norms and procedures, an informal knowledge management system is formed. Such emerging (rather than purposefully designed) knowledge management systems can be highly effective in supporting the management of knowledge (Dalkir, 2011).

2.3 Theoretical Foundations

This section introduces the theoretical foundations of the research model (see section 3.5 for an introduction of the model). The DeLone and McLean IS success model (1992; 2003) was used to conceptualise KMS success dimensions in healthcare. The theories of transformational and transactional leadership, organisational culture and subjective norm, and behavioural and environmental uncertainty as aspects of security were used to suggest the factors affecting KMS success.

The theories of transformational and transactional leadership, organisational culture, and subjective norm are behind the organisational factors in the research model. The dimensions of the DeLone and McLean IS success model and the behavioural and environmental uncertainty are behind the system factors. These theories are presented diagrammatically in Figure 2-2 and are introduced in the remaining subsections of this section.

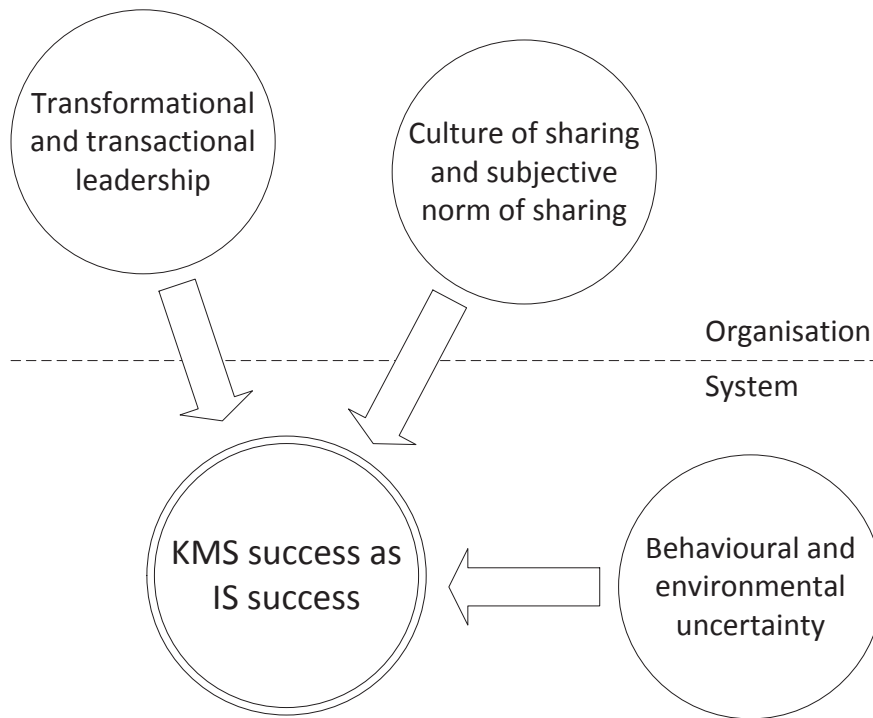


Figure 2-2. Theoretical foundations of this study.

2.3.1 Information Systems Success Model

DeLone and McLean (1992) proposed six dimensions of IS success: system quality, information quality, user satisfaction, use, individual impact, and organisational impact. The definitions of the six dimensions of are presented in Table 2-1.

Table 2-1 *Dimensions of DeLone and McLean IS Success Model*

Construct	Definition ^a
System quality	System usability and performance; aspects such as response time and ease of use.
Information quality	Quality of information; aspects such as accuracy, currency, relevance, and completeness.
User satisfaction	The extent to which the system meets the expectations of its users.
Use of IS	The extent to which the system is used; aspects such as frequency of use.
Individual impact	Outcomes of the system use for individual users.
Organisational impact	Outcomes of the system use for the organisation.

^aBased on DeLone and McLean (1992).

The DeLone and McLean (1992) IS success model suggests that system quality and information quality influence system use and user satisfaction, which in turn influence the impact of the system on the individual user, resulting in an impact on the organisation (as shown in Figure 2-3).

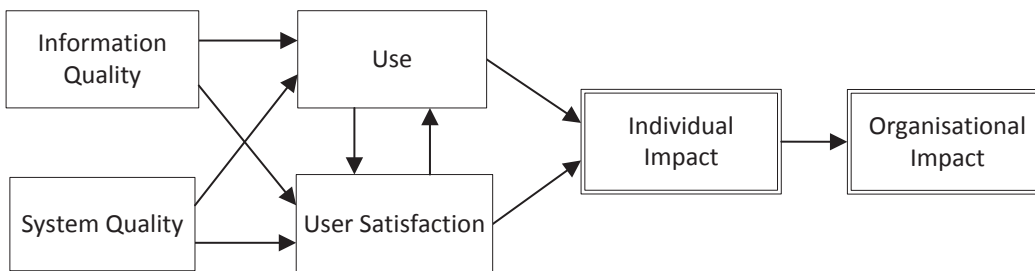


Figure 2-3. DeLone and McLean (1992) IS success model.

DeLone and McLean (2003) updated their model based on a literature review of relevant research publications from IS journals that had appeared since their model was first published. They extended the DeLone and McLean (1992) model by adding service quality (the overall support to users delivered by the support personnel) as an independent variable and by combining individual and organisational impacts into net benefits (overall positive impact of the IS on the user, the organisation, and beyond) (see Figure 2-4). They also recommended that researchers adopt a multidimensional measure for system use to differentiate system use for different kinds of tasks.

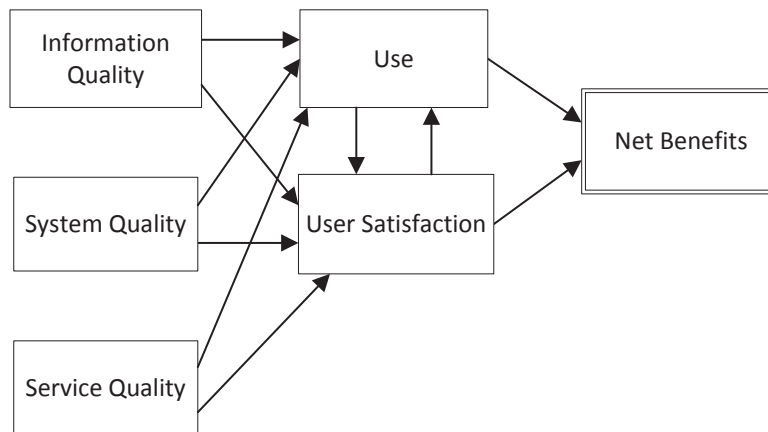


Figure 2-4. DeLone and McLean (2003) IS success model.

Table 2-2 Applications of DeLone and McLean IS Success Model

Authors	Model ^a	System	Industry	Country
Agourram (2009)	1992, modified to include the effect of national culture on IS success	ERP	Multinational organisation	Germany
Skok, Kophamel & Richardson (2001)	1992	Point of sale	Health club	UK
Almutairi & Subramanian (2005)	1992	General IS	Private sector	Kuwait
Wu & Wang (2006)	1992, modified to replace use with perceived KMS benefits, interpreted net benefits as system use	KMS	Business	Taiwan
Kulkarni, Ravindran & Freeze (2007)	1992, modified to replace use with perceived usefulness, interpreted net benefits as knowledge use	KMS	Business	USA
Halawi, McCarthy, & Aronson (2007)	2003	KMS	Knowledge-based organisations	USA
Hwang, Chang, Chen, & Wu (2008)	2003 modified to replace use with perceived usefulness	KMS	Healthcare	Taiwan
Pai & Huang, 2010	1992 modified to include perceived usefulness and ease of use	Health IS	Healthcare	Taiwan

Note. ERP = enterprise resource planning; KMS = knowledge management system.

^aDelone and McLean did not specify exactly how individual and organisational impacts (for 1992 version of the model) or net benefits (for 2003 version of the model) should be interpreted; interpretations judged particularly relevant for this study are noted in this column.

The DeLone and McLean (1992) and DeLone and McLean (2003) IS success models have been validated in a broad range of contexts. Some of the studies that validated the model (or its variations) are listed in Table 2-2. As seen from the table, the 1992 version of the model has been in use even after 2003. A review of studies validating the IS success models by DeLone and McLean is given by Petter and McLean (2009). Henceforth, when the distinction between the two versions of the model is not important, I refer to the two DeLone and McLean IS success models collectively as the DeLone and McLean IS success model.

2.3.2 Culture of Sharing and Subjective Norm of Sharing

Organisational culture is a set of values, assumptions, and beliefs shared by the members of an organisation. Organisational culture influences employee behaviour, including the behaviour with respect to managing knowledge (De Long & Fahey, 2000). Culture is a broad concept that has many facets. The organisational culture profile framework (OCP) captures a broad range of facets of organisational culture as a set of cultural attributes (O'Reilly, Chatman, & Caldwell, 1991). The cultural attributes from OCP were empirically tested with respondents from 27 organisations in the US by Park, Ribier, and Schulte (2004) to identify the attributes that are viewed as contributing to knowledge sharing and to the use of KMS technology.

Although organisational culture captures the norms and values organisation-wide, individuals may be influenced by their immediate social environment that is not always in sync with the culture of the organisation overall. The influence of the immediate social environment is captured by the concept of subjective norm (Ryu et al., 2003) initially introduced in the context of the theory of reasoned action in social psychology.

In information systems research, subjective norm has been used in TAM2 (Technology Acceptance Model 2, see section G.8), a theory explaining technology acceptance and use (Venkatesh & Davis, 2000). In TAM2, it is hypothesized that subjective norm influences perceived usefulness and intention to use. In a study involving the members of the Information Processing Society in Canada, Hartwick, and Barki (1994) found that subjective norm affected intention in mandatory settings but not in voluntary settings.

2.3.3 Transformational and Transactional Leadership

Leadership broadly refers to influencing people in an organisation, from the perspectives of goal setting, behaviour involved in achieving goals, group maintenance, and the overall organisational culture (Yukl, 1989).

Burns (1978) and Bass (1985) distinguished transformational and transactional leadership. Transactional leadership provides rewards and punishments to encourage performance and thus bases the leader/worker relationship, essentially, on economic transactions. Transactional leadership relies on close connections between goal achievement and rewards or punishments. In contrast, transformational leadership refers to leadership by aligning employee aspirations with the strategic goals of the organisation, resulting in employees who are intrinsically motivated to pursue such goals. In transformational leadership, leaders provide support, encouragement, and developmental experiences, as well as lead by example, by visibly demonstrating the leaders' commitment to pursuing the strategic goals of the organisation through the leaders' own behaviour, thus influencing the attitudes and assumptions of the organisation's members and building organisation-wide commitment for the organisation's mission, objectives, and strategies (Yukl, 1989).

Bass and Avolio (1994) characterised transformational leadership as composed of four unique but interrelated behavioural sub-dimensions: inspirational motivation (communicating an appealing vision, using symbols to focus followers' effort, and modelling appropriate behaviours), intellectual stimulation (increasing followers' awareness of problems and influencing followers to view problems from a new perspective and promoting creativity and innovation), idealised influence (arousing strong follower emotions and identification with the leader), and individualised consideration (providing support, encouragement, coaching, and mentoring to individual followers). Bass and Avolio synthesized the prior research on leadership in terms of distinguishing the role of transformational leadership, and concluded that leaders who rely on these four behaviours are able to influence the followers' values and norms, promote positive changes in both personal and group behaviour, and help the followers to improve their performance beyond the followers' own expectations and beyond what is stipulated by explicit employment agreements.

Transactional leaders exert influence by setting goals, providing feedback, and issuing rewards and recognition for followers' accomplishments (Bass, 1985). Transactional leadership may be effective in changing followers' behaviour for as long as the link between the behaviour and the rewards or punishments can be established and is maintained. Transactional leadership, however, does not encourage followers to engage in behaviours that promote the organisational goals in ways that are not visible to the management, and thus is limited at mobilizing creativity.

A number of studies have considered the effects of transformational and transactional leadership on technology acceptance. Schepers and Wetzels (2005) studied the effects of transformational and transactional leadership on perceived usefulness. Based on a survey of after-sales service employees in the Netherlands, they found that transformational (but not transactional) leadership affected the employee perceptions of an innovative information system. Employees led via encouragement rather than coercion were more likely to view the system as useful because the employees realized that the system contributed to the organisation's goals and the employees cared about these goals. In a similar vein, Neufeld, Dong, and Higgins (2007), based on a study of employee acceptance of enterprise information systems at large manufacturing companies in Canada, found that charisma (an aspect of transformational leadership) positively affects several determinants of system acceptance (the system performance and effort expectancy, subjective norm, and facilitating conditions—the perception of the ability of the organisation to facilitate the use of the system). Similarly, Prybutok, Zhang, and Ryan (2008), in a US based study of e-government in city government, found that transformational leadership affected the employee perceptions of IT quality (system quality, information quality, and service quality). Once again, in the climate of transformational leadership organizational members are more likely to see value in information systems.

Both transformational leadership and transactional leadership were included as determinants of knowledge acquisition behavioural traits by Politis (2001). Politis conducted a survey at a large high technology manufacturing organisation in Australia. He found that both transformational and transactional leadership affected knowledge acquisition. Politis also included self-management leader behaviour, consideration leader behaviour, and initiating structure leader behaviour. The results of the study are

summarized in Table 2-3. The study by Politis demonstrated that different approaches to leadership affect knowledge acquisition behaviour in different ways.

Table 2-3 *Management Behaviour Types and Their Effects on Knowledge Acquisition (compiled based on Politis, 2001, and Mykytyn, Mykytyn, and Raja, 1994)*

	Leadership style	Knowledge acquisition attributes ^a affected
Self-management	Encourage self-observation, self-goal setting, self-reinforcement (teams recognise and reinforce their performance), self-criticism, self-expectation, rehearsal (practice a task before performing it) (Manz & Sims, 1986)	Communication/problem understanding, personal traits, organisation
Transformational	Charisma, individual consideration, intellectual stimulation (Bass, 1985).	Negotiation
Transactional	Contingent reward, management-by-exception (the leader avoids giving directions and allows followers to follow conventional ways if goals are met) (Bass, 1985).	Personal traits, organisation
Consideration	Mutual trust and respect for ideas and feelings (Robbins, Bergman, & Stagg, 1997)	No effects
Initiating structure	Directing tasks, “getting people to work hard”, planning, explicitly scheduling work activities, “ruling with an iron hand”. (Daft & Lane, 2008, p. 46).	Communication/problem understanding, personal traits, organisation, negotiation

^aKnowledge acquisition attributes (based on Mykytyn, Mykytyn, and Raja, 1994, p. 99, which Politis, 2001, cited): communication/problem understanding referred to “interviewing, listening, sensitivity, open-minded, probing, conceptualise, rational thinker, hindsight”; negotiation referred to “diplomacy, patience, cooperation”; personal traits referred to “empathy, sense of humour, tolerant, amiable”; and organisation referred to “leadership, speaking, writing, management, knowledge”.

Politis (2001) did not publish the questionnaire that he used. However, based on a citation provided by Politis, one would assume that the questionnaire defined knowledge acquisition skills based on the lists of attributes provided by Mykytyn, Mykytyn, and Raja

(1994). I found the precise meaning of some of the attributes (such as “management” as an attribute of organisation) not entirely clear even after carefully reading both of the articles, and the respondents were likely to have had similar problems. The overall gist, however, was clear enough.

Further examples of relevant prior studies are given in sections 3.4.2.3, 3.5.2.3, 3.4.2.4, and 3.5.2.4. Overall, the prior studies of the effects of different styles of leadership on technology acceptance and on knowledge management behaviours suggest that leadership is likely to affect KMS success in healthcare. One might expect that both transformational and transactional leadership explicitly directed to promote constructive knowledge management behaviours would influence the behaviour of health practitioners. Nonetheless, one would expect that because of the complexity, specialization, and context-specificity of healthcare related knowledge, the potential of transactional leadership may be limited. Leaders may be unable to verify whether followers shared all of their knowledge or took into account knowledge shared by others. The behaviour of highly qualified professionals acting, to a considerable degree, autonomously (as is the case in healthcare) with respect to knowledge sharing is difficult to observe and assess. Therefore, the ability of the leaders to establish links between the behaviour and the rewards (or punishments), which are necessary for effective transactional leaderships, may be rather limited. Nonetheless, some of the relevant behaviours are visible and explicit (for example, one cannot tell if health practitioners contribute all of their knowledge to the best of their ability, but one can judge the contributions superficially, based on the number and on the volume of postings). Thus, the effects of both transactional and transformational leadership are worth investigating.

2.3.4 Perceived Security and Behavioural and Environmental Uncertainty

Behavioural and environmental uncertainty relate to information systems security being achieved via a combination of an appropriate technological infrastructure (environment) with security enhancing ethical and compliant behaviours of the employees using the information systems (behaviour). The distinction between behavioural uncertainty and environmental uncertainty was suggested in the context of e-Commerce systems by Ring

and Ven (1994). Environmental uncertainty is related to security risks that are technology-driven, while behavioural uncertainty is related to security risks that are people-driven (Ring & Ven, 1994). According to Pavlou (2003), the perceptions of information system users about security (perceived risk) are captured by combining items corresponding to user perceptions of environmental uncertainty with items corresponding to user perceptions of behavioural uncertainty. Pavlou conducted a survey of online consumers and found that perceived risk had an effect on intention to transact.

2.3.5 Other Theories Relevant to This Literature Review

A number of theories from social psychology that have been used in studies covered in the rest of this literature review are introduced in Appendix G, including the theory of reasoned action, the decomposed theory of planned behaviour, the social exchange theory, the social capital theory, the social cognitive theory, the technology acceptance model (TAM), and the technology acceptance model 2 (TAM2). Unlike the theories introduced in sections 2.3.1, 2.3.2, 2.3.3 and 2.3.4, none of these theories were a major source for the research model of the present study (see Figure 3-1); therefore, their introduction is relegated to the appendix.

2.4 Knowledge Management Systems Success

This section discusses the studies of KMS success. The section is organised by two themes relevant to the problem addressed in this thesis that were identified in the literature. First, studies adapting or extending the DeLone and McLean IS success model are discussed (see section 2.3.1 for an introduction of the DeLone and McLean IS success model). Second, studies of the effects of social and organisational factors on knowledge sharing and seeking behaviours are discussed. Finally, in the last subsection of this section studies that do not fall under the two themes are discussed (these studies tended to focus on organisational aspects as determinants of KMS success).

2.4.1 Knowledge Management Systems Success Models based on the DeLone and McLean IS Success Model

This section discusses the studies of KMS success based on the DeLone and McLean IS success model. Some of the studies covered in this section were briefly introduced in Table 2-2 in section 2.3.1 that introduced the DeLone and McLean IS success model. The main features and results of the studies are summarized in Table 2-3.

Wu and Wang (2006) conducted a study of firms in Taiwan that used KMS. They modified the DeLone and McLean IS success model (DeLone & McLean, 1992) to replace the system use construct with perceived KMS benefits. The individual impact and the organisational impact were interpreted as KMS use. Thus, the system use construct was retained in the model, but was positioned differently from the original DeLone and McLean IS success model. Based on 204 responses, they found that the effects of knowledge quality on user satisfaction and perceived benefits were larger than the corresponding effects of system quality. This suggested that users depend on the quality of the content provided by KMS more than on system performance and functions.

Halawi et al. (2007) conducted a study of US organisations that implemented knowledge management systems. They used the DeLone and McLean IS success model (DeLone & McLean, 2003) and interpreted net benefits as knowledge management systems success (operationalized as productivity and control). Based on 117 responses, they found that multiple regression of KMS success on knowledge quality, system quality, service quality, intention to use, and user satisfaction resulted in 66 percent of variance in KMS success accounted for.

Kulkarni et al. (2007) conducted a study of midlevel managers enrolled in a part-time MBA programs at a university in the United States inquiring about the use of IT in knowledge management practice at their organisations. They extended the DeLone and McLean (1992) IS success model to include organisational support: leadership, incentives, co-worker, and supervisor (with the co-worker and supervisor accounting for different aspects of the subjective norm construct as it is introduced in section 2.3.2). Based on 111 responses, they found that organisational factors (leadership, incentive, co-worker, and supervisor) indirectly affected knowledge use.

Hwang et al. (2008) conducted a study of KMS users in hospitals in Taiwan. They modified the DeLone and McLean (2003) IS success model by replacing system use with perceived usefulness. Net benefits were interpreted as reducing costs of knowledge transfer and improving knowledge worker efficiency. Based on 163 responses, they found that system quality and information quality indirectly affected net benefits.

The main features and results of the studies introduced in this section are presented in Table 2-3. Half of the studies were based on the earlier version of the DeLone and McLean IS success model, and the rest on the later version.

The studies by Wu and Wang (2006) and Kulkarni et al. (2007) replaced system use in the DeLone and McLean (2003) model with, respectively, perceived KMS benefits and perceived usefulness of knowledge sharing. This was motivated by the argument by Seddon (1997) that system use is a consequence of perceived KMS benefits, rather than an antecedent. Perceived usefulness of knowledge sharing in the study by Kulkarni et al. (2007) was both defined and operationalized to refer to knowledge sharing in general (not explicitly via KMS).

Overall, the studies were not consistent in interpreting KMS net benefits. Although Halawi et al. (2007) and Hwang et al. (2008) tended to view benefits in terms of improving productivity and efficiency (and thus, in the business domain), Wu and Wang (2006) and Kulkarni et al. (2007) tended to view benefits in terms of KMS and knowledge use, and thus in the more immediate behavioural and IS domains.

Although the business outcomes, such as productivity and efficiency, are more interesting than immediate behaviours that may or may not lead to business outcomes, it is doubtful that the approach to measuring productivity and efficiency adopted by Halawi et al. and Hwang et al. leads to accurate results. Items intended to measure productivity and efficiency reflected the respondents' theories about the effects of KMS. Some examples are the item "the knowledge management system helped me meet customer needs" from the measure of net benefits by Halawi et al.'s and the item "using KMS could reduce knowledge search costs" from the measure by Hwang et al. On the other hand, the measures used by Wu and Wang and by Kulkarni ask the respondents to report observable behaviour. Although the respondents may be biased at reporting observable behaviour, and to an extent, their reports may reflect their local theories resulting in common method bias

(Podsakoff & Organ, 1986), they do have a chance to report the actual behaviour. If the respondents are explicitly asked to report their theories about outcomes, valid results are possible only if the theories are accurate, which is far from certain even if the respondents have perfect memory and are highly motivated to be accurate and impartial.

The model by Kulkarni et al. (2007) stood out by emphasizing organisational issues. The model by Kulkarni et al. had a particularly strong influence on this study; therefore, it is discussed in more detail in section 2.5.

Table 2-4 Main Results of KMS Success Studies Based on DeLone and McLean IS Success Model

Construct	Wu and Wang (2006)	Halawi et al. (2007)	Kulkarni et al. (2007)	Hwang et al. (2008)
System quality	Affected user satisfaction	Affected intention to use and user satisfaction	Affected user satisfaction	Affected perceived usefulness and user satisfaction
Information quality	Affected perceived usefulness and user satisfaction	Affected intention to use and user satisfaction	Affected user satisfaction	Affected perceived usefulness and user satisfaction
System use	Replaced by KMS benefits	Affected use satisfaction, KMS success	Replaced by perceived usefulness of knowledge sharing	Not included
Service quality	Not used	Affected user satisfaction	Not used	Affected perceived usefulness
User satisfaction	Affected system use	Affected system use, KMS success	Affected knowledge use	Affected net benefits
Net benefits	Interpreted as KMS use	Interpreted as KMS contributing to productivity and control	Interpreted as knowledge use	Interpreted as reducing costs of knowledge transfer and improving efficiency
Other constructs	KMS benefits affected user satisfaction and system use		Perceived usefulness and organisational factors affected KMS success dimensions ^a	Perceived usefulness affected user satisfaction and net benefits

Note. This table should be considered in conjunction with Figure 2-3, which depicts the DeLone and McLean (2003) IS success model.

^aPerceived usefulness affected user satisfaction; leadership affected knowledge content quality and knowledge use, incentive affected knowledge content quality and knowledge use, co-worker affected perceived usefulness, and supervisor affected perceived usefulness.

2.4.2 KMS Studies Focusing on Knowledge Sharing and Seeking Behaviours

The effectiveness of KMS in organisations depends on employees using KMS to share and retrieve knowledge (Kulkarni et al., 2007; Markus, 2001; Watson & Hewett, 2006). This section introduces empirical studies that investigated the factors influencing knowledge sharing and retrieval behaviours. The theories used to formulate hypotheses in these studies were introduced in section 2.3.5. The factors are summarized in Table 2-4.

Jarvenpaa and Staples (2000) conducted a survey of employees in a large state university in Australia to investigate individual perceptions of factors that underlie the use of collaborative electronic media (electronic mail, World Wide Web, electronic mail list servers, and other collaborative systems) for sharing information. Hypotheses were formulated based on the social exchange theory (Kelley & Thibaut, 1978). Based on 1125 responses, they found that task interdependence, perceived information usefulness, and user's computer comfort were most strongly associated with the person's use of collaborative media. In addition, they found that the use of electronic media for sharing information and contacting people was weakly associated with a more structured, closed information culture.

Ryu et al. (2003) conducted a survey of physicians in hospitals in Korea to investigate the factors that affect knowledge sharing behaviour. Hypotheses were formulated based on the theory of reasoned action (Fishbein & Ajzen, 1991). Based on 334 responses, they found that subjective norm, attitude, and perceived behavioural control affected knowledge sharing behaviour. The study by Ryu et al. was the only study of factors affecting knowledge sharing (or knowledge seeking) conducted in the context of healthcare.

Bock et al. (2005) conducted a survey of employees in 27 Korean organisations to investigate factors influencing knowledge sharing. Hypotheses were formulated based on the theory of reasoned action (Fishbein & Ajzen, 1991). Based on 154 responses, it was found that the attitude toward knowledge sharing, organisational climate, and subjective norm affected the intention to share knowledge.

Kankanhalli et al. (2005a) conducted a field study of 400 employees in public organisations in Singapore to examine the factors influencing employees to contribute to

an electronic knowledge repository (EKR). Hypotheses were formulated based on the social exchange theory (Kelley & Thibaut, 1978) and the social capital theory (Nahapiet & Ghoshal, 1998). Based on 150 responses, they found that trust, rewards, and self-efficacy influenced individuals to contribute to EKR.

Kankanhalli et al. (2005b) conducted a survey of employees in eight public sector organisations in Singapore to examine the factors that influence people to seek knowledge from an electronic knowledge repository. Hypotheses were formulated based on the technology acceptance model (TAM) and the decomposed theory of planned behaviour (Taylor & Todd, 1995). Based on 160 responses they found that perceived output quality affected the electronic knowledge repository use.

Wasko and Faraj (2005) conducted a survey of members of online communities of practice at a national legal professional association in the United States to examine the social capital factors influencing knowledge contribution online. Hypotheses were formulated based on the social capital theory (Nahapiet & Ghoshal, 1998). Based on 3000 responses, they found that reputation, centrality, and commitment affected knowledge contribution.

Bock et al. (2006) conducted a survey of working professionals who were pursuing a part-time graduate degree. Hypotheses were formulated based on the decomposed theory of planned behaviour (Taylor & Todd, 1995). Based on 134 responses, they found that collaborative norm positively affected individual's knowledge-seeking behaviour through EKR.

Choi et al. (2008) conducted a survey of employees in two organisations in the manufacturing industry in Korea to investigate factors affecting knowledge sharing. Hypotheses were formulated based on the theory of reasoned action (Fishbein & Ajzen, 1991). Based on 176 responses, they found that trust and rewards influenced knowledge sharing.

He and Wei (2009) conducted a survey of employees in manufacturing, research and development, and marketing departments of an international IT company operating in China. The hypotheses were inspired by the theory of cognitive integration (Anderson, 1971). Based on 161 responses, they found that management influence, social relationship, enjoyment in helping, and contribution effort affected knowledge contribution. User satisfaction was found to affect contribution indirectly via contribution attitude. Social

relationship and perceived usefulness affected knowledge seeking. User satisfaction affected knowledge seeking indirectly, via seeking attitude.

Paroutis and Saleh (2009) conducted a case study of a Techco (a technology cooperative) in the UK (data was collected by interviewing bloggers). Based on 11 interviews, they found that perceived benefits, rewards, management support, and trust affected participation of employees in knowledge sharing via blogs.

Chen and Hung (2010) conducted a survey of virtual communities in Taiwan. Hypotheses were formulated based on the social cognitive theory. Based on 323 responses, they found that the norms of reciprocity, interpersonal trust, self-efficacy, and perceived relative advantage affected knowledge sharing. The norms of reciprocity, interpersonal trust, self-efficacy, and perceived relative advantage affected knowledge seeking.

Yu, Lu, and Liu (2010) conducted a survey of members of three professional virtual communities in Taiwan to investigate factors influencing knowledge sharing in the communities. Hypotheses were formulated based on insights gained from the literature. Based on 442 responses, they found that culture (fairness, identification, and openness), enjoyment of helping, and usefulness affected knowledge sharing behaviour.

As seen from the text of this section and from Table 2-4, which summarizes the factors found to affect sharing and seeking, even though some of the studies shared a theoretical basis, overall, there was little consistency in the results. For sharing, factors that received relatively consistent support (supported by at least two studies) were subjective norm, enjoyment of helping, trust, reward, culture of sharing, reciprocity, usefulness, and self-efficacy. For seeking, none of the factors received consistent support. Unlike the studies introduced in section 2.4.1, none of the studies introduced in this section considered system factors, as the studies focused on organisational and social factors.

Table 2-5 Factors Found to Affect Sharing and Seeking

Source	Factors affecting KMS use ^a		Context
	Sharing	Seeking	
Jarvenpaa & Staples (2000)	Organisational ownership, propensity to share, task interdependence, computer comfort, CBI characteristics		A university in Australia
Ryu et al. (2003)	Subjective norm ^b , attitude, perceived behavioural control		
Bock, Zmud, Kim & Lee (2005)	Subjective norm ^b , organisational climate ^b		30 organisations in Singapore
Kankanhalli, Tan, & Wei (2005)	Reciprocity ^b , self-efficacy, enjoyment in helping others ^b		
Kankanhalli, Tan, & Wei (2005)		Perceived output quality, resource availability, incentive	Eight multinational companies and Singapore government
Wasko & Faraj (2005)	Reputation, enjoyment of helping ^b , centrality, commitment		National legal professional association in USA
Bock, Kankanhalli, & Sharma (2006)		Collaborative norm ^c , future obligation ^c	Professionals pursuing a part-time degree at a university in Singapore
Choi, Kang, & Lee (2008)	Trust ^b , intrinsic reward, extrinsic reward ^b		Manufacturing companies in Korea
He & Wei (2009)	Management influence ^b , social relationship, enjoyment in helping ^b , contribution effort	Satisfaction, social relationship ^c , perceived usefulness, user satisfaction ^c	An international company operating in China
Paroutis & Saleh (2009)	Perceived benefits, rewards ^b , management support, management trust ^b		An IT company in UK
Chen & Hung (2010)	Norm of reciprocity ^b , interpersonal trust ^b , self-efficacy, perceived relative advantage	Norm of reciprocity, interpersonal trust, self-efficacy, perceived relative advantage	Members of virtual communities in Taiwan
Yu, Lu, & Liu (2010)	Enjoyment of helping ^b , sharing culture ^b , usefulness		Three virtual communities in Taiwan

^aAll of the studies, with the exception of Paroutis and Saleh, 2009, used quantitative surveys. Correspondingly, factors found statistically significant are listed. Paroutis and Saleh used a case study; for their study, factors judged important based on qualitative data analysis are listed. ^bFactors supported by at least two studies. ^cFactors found to affect negatively.

2.4.3 Other Empirical Studies of KMS Success

This section discusses other relevant empirical studies of KMS (not falling under subsections 2.4.1 and 2.4.2 of section 2.4). Factors affecting KMS success suggested by these studies are summarized in Table 2-5.

Davenport et al. (1998) conducted a multiple case study on 31 KM projects using KMS (in 24 companies). In their study, eighteen projects were found to be successful, five were considered failures, and eight were too new to be rated. Eight factors were identified that were common in successful KM projects. These factors were linkages to economic performance, senior management support, technical and organisational infrastructure, clearly communicated KMS purpose/goals, incentives, knowledge structure, and multiple channels for knowledge transfer.

Hung, Huang, Lin, and Tsai (2005) carried out a survey of Taiwan pharmaceutical companies to assess the success factors in adopting KMS. Exploratory factor analysis was used to identify factor structure in the data. For the resulting factors, correlations with KMS success were tested (with KMS success measured based on the respondents' perceptions of the contributions of KMS to their organisations). Based on 98 responses obtained in the survey, seven factors were identified: benchmarking strategy, knowledge structure, employee involvement, and employee training.

Benbya and Belbaly (2005) conducted a multiple case study of 20 multinational organisations to examine the success factors of KMS. Based on qualitative analysis of data obtained in semi-structured interviews and of company documents, they found that leadership, rewards, and culture affected the success of KMS.

A summary of the success factors suggested by these studies is presented in Table 2-5. The studies introduced in this section emphasized the organisational factors. Specifically, leadership, incentives, knowledge sharing culture, and knowledge structure were the factors suggested most consistently. The multiple case study by Davenport et al. (1998) supported all of these factors. In the quantitative study by Hung et al. (2005), only knowledge structure was statistically significant in correlating with KMS success. Knowledge sharing culture and leadership were considered in the Hung's study, but their

correlations with KMS success were not statistically significant. Incentives were not considered in the Hung's study.

Table 2-6 *Summary of KMS Success Factors Suggested by the Literature Covered in Section 2.4.3*

Source	Success factors ^a	Context	Methodology
Davenport et al. (1998)	Linkages to economic performance, knowledge sharing culture ^b , leadership ^b , technical and organisational infrastructure, clear purpose of KMS, incentives ^b , knowledge structure ^b , multiple channels for knowledge transfer	Large companies in the USA	Multiple case study
Benbya & Belbaly (2005)	Knowledge sharing culture ^b , leadership ^b , incentives ^b , support by system operators	Multinational organisations	Multiple case study
Hung et al. (2005)	A benchmarking strategy, knowledge structure ^b , employee involvement, employee training	Pharmaceutical firms in Taiwan	Survey

^a Statistically significant factors for surveys and factors judged important based on qualitative data analysis for multiple case studies. ^b Factors supported by at least two studies.

2.5 Kulkarni et al.'s (2007) KM Success Model

The model by Kulkarni et al. (2007) was the only model of KMS success that covered both system and organisational factors (see section 2.4.1 for a discussion of KMS success models). As the research questions of the present study suggest formulating a model involving both system and organisational factors, the model by Kulkarni et al. is of particular interest. Therefore, the study by Kulkarni, which was initially introduced in section 2.4.1, in Table 2-3, is discussed in detail in this section.

Kulkarni et al.'s (2007) KM success model (see Figure 2-5) was developed based on the IS success model of DeLone and McLean (2003). Kulkarni et al. followed Wu and Wang (2006) by interpreting net benefits as the use of knowledge. As discussed in section 2.4.1, although the consequences of knowledge use, such as knowledge worker productivity, are more interesting from the management practice perspective than the knowledge use behaviours per se, it is difficult to measure such consequences.

Kulkarni et al. (2007) followed Wu and Wang (2006) in replacing the system use construct in the DeLone and McLean IS success model by perceived usefulness of knowledge

sharing. As discussed section 2.5, this was motivated by the argument by Seddon (1997) that system use is a consequence of perceived KMS benefits, rather than an antecedent.

The model included organisational support factors of leadership, incentives, co-worker support, and supervisor support. The leadership concept represented the extent of support of KM by the management by means other than direct incentives. The incentives construct reflected the support via monetary rewards and promotion opportunities. Although Kulkarni et al. justified the inclusion of the leadership and incentives constructs by referring to the structuration theory from microeconomics, it seems to be much more straightforward to justify the inclusion of these constructs by considering the practice of knowledge management at organisations from the point of view of the transformational and transactional leadership theory by Burns (1978) and Bass (1985), which was introduced in section 2.3.3. The incentives construct corresponds to transactional leadership, and the leadership construct in the Kulkarni et al. model corresponds to transformational leadership.

The co-worker and supervisor concepts represented the support and encouragement of sharing knowledge by the respondents' co-workers and supervisors. Kulkarni et al. justified the inclusion of the co-worker and supervisor constructs based on the social exchange theory (which was introduced in section 2.3.5). Nonetheless, the items used to measure these constructs did not address interaction, which is an essential part of the social exchange theory. Arguably, these constructs could be justified by referring to subjective norm (see section 2.3.2) and to TAM2 (Venkatesh & Davis, 2000). The TAM2 model suggests that subjective norm affects perceived usefulness. This matches the hypotheses that co-worker and supervisor affect perceived usefulness of knowledge sharing in the Kulkarni et al.'s model.

In terms of content, the content of the co-worker construct in Kulkarni's study seems somewhat ambiguous. The WordNet entry for term *co-worker* is "colleague, co-worker, fellow worker, workfellow (an associate that one works with)". (WordNet is a lexical database at <http://wordnet.princeton.edu> maintained by Princeton University in the US.) Supervisors may be regarded as co-workers in cultures with low power distance—see, for example, the phenomenological study of supervision by Clarkson and Aviram (1995). Thus, in certain contexts the content of the co-supervisor concept can be seen as having a large overlap with the supervisor concept (even though in case of the data Kulkarni et al.

used to test the model there were no discriminant validity problems between supervisor and co-worker constructs).

The perceived usefulness of knowledge sharing concept represented the extent to which an employee believes that using knowledge sharing capabilities existing at her (or his) organisation can improve her (or his) performance. The items used for this concept did not mention the use of KMS for sharing and contributing, but referred to all possible knowledge sharing capabilities (e.g. sharing via informal face-to-face meetings, not involving KMS). With such a broad view of knowledge sharing, the hypothesis that KMS quality (which was measured by items explicitly suggesting an IT-based system) affects perceived usefulness of knowledge sharing appears to be not entirely justified. Having low opinion of the IT capabilities available does not prevent one from taking a view that informal face-to-face knowledge sharing is highly useful.

The model was tested using data collected in a cross-sectional survey. The survey was administered to a group of 150 midlevel managers enrolled in executive MBA and part-time professional MBA programs at a university in the United States. The respondents represented a broad range of industries. It appears that the questionnaire asked the respondents if they have a “KM program” at their organisation; 22 questionnaires were judged not usable because “the respondents had no KM program in their function” (the article does not explain how respondents that “had no KM program” were distinguished). The article states that the job responsibilities of the respondents showed that they would be routinely involved with knowledge work. Thus, it would appear that excluding these respondents was not necessarily justifiable, unless they had no access to IT enabling knowledge sharing (such as email). Of the 150 questionnaires returned, 111 were used in data analysis (17 questionnaires with uncompleted sections were also excluded).

In the analysis of convergent and discriminant validity, only one item (for the knowledge use construct) was dropped. The item referred to the use of a scheme for classifying knowledge, and dropping it somewhat changed the content of the measure, as a scheme for classifying knowledge was not covered by the remaining items. Dropping the item did not change the essential meaning of the construct.

Fitting the data by using a covariance based SEM technique (with LISREL software), Kulkarni et al. found that the model fit, as measured by RMSEA, NNFI, and CFI global fit

indices, was acceptable according to the criteria suggested by Hartwick and Barki (1994) and Segars and Grover (1993). On the other hand, the value of SRMR was considerably higher than the cut-off recommended by Hu and Bentler (1998), and the value of CFI did not pass the more stringent criterion suggested by Hu and Bentler. The problems with overall fit are not surprising, because the data set was smaller than recommended for analysis using co-variance based techniques (see section 5.4 for a discussion of data set sizes needed for different SEM analysis techniques).

Path coefficients obtained in an alternative analysis using multiple regression were overall consistent with the path coefficients obtained using covariance based SEM. Kulkarni et al. (2007) did not report the values of average variance explained (R^2) for dependent constructs.

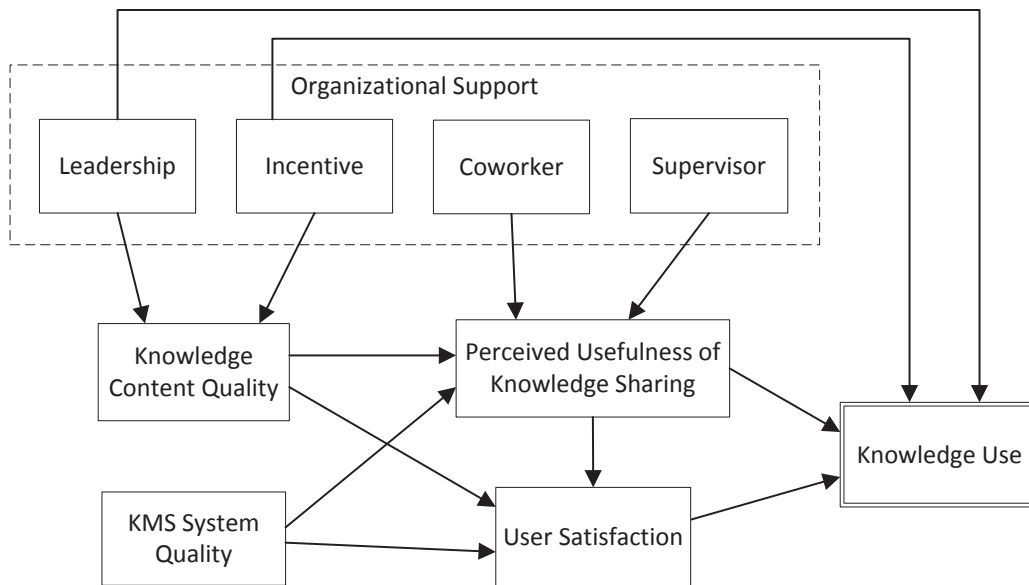


Figure 2-5. KM success model (Kulkarni et al., 2007).

Leadership and incentives had medium to large effects on knowledge use and knowledge content quality; co-worker had medium effect, but supervisor had weak effect. Knowledge content quality and system quality did not affect perceived usefulness of knowledge sharing, which was not surprising because perceived usefulness of knowledge sharing did not explicitly relate to using the system (as discussed earlier in this section).

The effects of both leadership and incentives on knowledge use were stronger than the effect of user satisfaction (perceived usefulness was not found to affect knowledge sharing).

The findings from Kulkarni et al.'s (2007) study suggest the importance of organisational factors in determining KMS success.

2.6 Research Gaps

The problem addressed in this study is the lack of understanding of the organisational and system factors of KMS success in the healthcare context (see section 1.3 for a statement of the research problem).

Only one empirical study of KMS success in healthcare was found in the literature—the study by Hwang et al. (2008) (discussed in section 2.4.1). The study by Hwang et al. was limited to testing the system factors—organisational factors were not considered.

The only KMS success model that addressed both system and organisational factors was that of Kulkarni et al. (2007). The model targeted generic KMS, and the study was conducted using a convenience sample representing multiple industries.

Although both knowledge sharing and knowledge retrieval have been identified as important and distinct dimensions of KMS success (see section 2.4.2), none of the existing KMS success models (reviewed in section 2.4.1) included knowledge sharing and knowledge retrieval as separate dimensions in the same model.

There is a need to formulate and test a model involving both organisational and system factors and taking into account the specifics of healthcare. It is desirable that such a model distinguishes knowledge sharing from knowledge seeking. The model should be tested in the context of healthcare, using a sample with known extent of generalizability, rather than a convenience sample.

2.7 Summary

Knowledge management is an important area of concern in the era of knowledge economy in which knowledge is valued as a critical intangible asset. Knowledge originates and is applied in the human mind, and in organisations can be captured in documents, routines, practices, and norms. It is common to distinguish between tacit knowledge that resides in

heads of individuals and is difficult to externalize and explicit knowledge that has been externalized and captured.

Knowledge management involves identifying, organising, and sharing knowledge assets belonging to an organisation. It is common to distinguish codification and personalization (person-to-person) approaches to knowledge management. A codification approach emphasizes knowledge capture (codification) and sharing of captured knowledge. A personalization approach emphasizes connecting employees to knowledgeable individual for direct sharing of tacit knowledge.

Knowledge management systems are information systems used to facilitate the management of knowledge. These systems may be implemented on purpose or may emerge from grassroots initiatives. It is common to distinguish network and repository models of knowledge management systems. The network model focuses on enabling employees to find knowledgeable individuals and on enabling communication, thus supporting the sharing of tacit knowledge and the personalization approach to knowledge management. The repository model emphasizes knowledge capture, as well as making captured knowledge available to employees, thus supporting the sharing of explicit knowledge and the codification approach to knowledge management.

Healthcare is a highly knowledge intensive field due to constantly evolving medical knowledge. KMS support healthcare professionals, as the healthcare professionals create optimal healthcare outcomes by using knowledge that they access, exchange, and share via the ICT infrastructure. Both knowledge management systems relying on specialized technology and knowledge management systems relying on commonly available IT are relevant to healthcare practice. Some recent developments in healthcare, including patient-centred care, clinical governance and evidence-based medicine, and the emergence of communities of practice involving healthcare professionals, result in a greater need for knowledge management and knowledge management systems.

The information systems success model by DeLone and McLean (2003), the concepts of organisational culture and of subjective norm, the theory of transformational and transactional management, and the distinction between environmental uncertainty and behavioural uncertainty as aspects of perceived security are relevant to understanding the knowledge management systems success model formulated in this thesis.

Of the existing four studies of knowledge management systems success based on the information systems success model by Delone and McLean (2003), only the study by Kulkarni et al. (2007) took into account both organisational and system factors of knowledge management systems success. A number of studies explored the success of knowledge management systems in terms of knowledge management system use for knowledge sharing or knowledge seeking (or both) focusing primarily on organisational factors and not taking into account system factors. There are very few studies of knowledge management systems success in healthcare, and the existing models do not account for both organisational and system factors of knowledge management systems success.

Three particular research gaps were identified: (1) lack of studies of knowledge management systems success studies in healthcare taking into account both organisational and system factors; (2) oversimplification in the existing studies of knowledge management systems success of the concept of knowledge management systems use, treating it as one-dimensional, and (3) a reliance on an artificial convenience sample rather than on collecting data at real organisations in the only study of knowledge management systems success taking into account both organisational and system factors (the study by Kulkarni et al., 2007).

CHAPTER 3. MODEL DEVELOPMENT

3.1 Introduction

The chapter starts by justifying the choice of the KMS success model used as the base for formulating a KMS success model for healthcare. This is followed by choosing the constructs to include in the KMS success model for healthcare—the outcome variables serving as proxy variables for KMS success in healthcare, as well as the factors affecting the outcome variables. This is followed by a discussion of the content of the constructs included in the model.

The chapter concludes by introducing the model of KMS success for healthcare. First, the model is justified from the point of view of how it enhances the base model (the KMS success model by Kulkarni et al., 2007) and adapts it to fit the healthcare context. Then, the individual hypotheses are justified one by one.

3.2 Choosing the Base Model and the Model Constructs

The model by Kulkarni et al. (2007) is the only KMS success model validated in prior research that included both organisational and system factors. It is based on the DeLone and McLean IS success model that has been validated in multiple contexts and found to be flexible and robust (see section 2.3.1 for an introduction of the DeLone and McLean IS success model).

Building on the basis of existing models results in the creation of well-developed research streams allowing the establishment of the nomological validity of constructs, as constructs and relationships between constructs are tested in a broad variety of settings (Gefen, Straub, & Boudreau, 2000). Therefore, reusing existing research models (when such models are available) results in a greater accumulation of knowledge within the research community than creating entirely new models. Even though some of the constructs of the model by Kulkarni et al. (2007) were operationalised in ways that are somewhat problematic (see the discussion in section 2.5), a model of KMS success in healthcare was

built on its base, adjusting it to fit the target context of healthcare and improving its overall structure.

The rest of this section briefly discusses the selection of constructs to include in the model. The individual constructs are then discussed in detail in sections 3.3 (covering the outcome variables) and in section 3.4 (covering organisational and system success factors).

Kulkarni et al. (2007) interpreted net benefits—the ultimate outcome of KMS success—as knowledge use. As highlighted in the section discussing knowledge gaps (section 2.6), it is desirable to distinguish knowledge seeking from knowledge sharing. Therefore, in the spirit of the KMS success model by Wu and Wang (2006), net benefits were interpreted as KMS use, but, unlike Wu and Wang, KMS use for sharing and KMS use for seeking were distinguished as separate dimensions.

To maintain research continuity and to benefit from the extensive validation of the DeLone and McLean IS success model (see section 2.3.1 and Figure 2-4) in prior research, all constructs were retained from the Kulkarni et al. (2007) model that matched the constructs of the DeLone and McLean IS success model. Kulkarni et al. was followed in replacing the system use construct in the DeLone and McLean IS success model with perceived usefulness, but interpreted perceived usefulness as perceived usefulness of KMS in particular, rather than of knowledge sharing in general, which was consistent with the model by Wu and Wang (2006). The problems associated with replacing the concept of system use in the DeLone and McLean IS success model by perceived usefulness of knowledge sharing in general are discussed in section 2.5.

The factors affecting knowledge sharing and knowledge seeking (or KMS success in general) consistently supported by prior research (listed in sections 2.4.2 and 2.4.3) were then considered, and compared them with the system and organisational factors suggested by the model by Kulkarni et al. (2007). When deciding whether or not to include a factor in the model, I took into account the results in Ryu et al. (2003)—an empirical study on knowledge sharing conducted in healthcare, as well as the opinions stated in three conceptual articles devoted to knowledge management in healthcare: Desouza (2002), Koumpouros, Nicolisi and Martinez-Selles (2006), and Wickramasinghe et al. (2007). These articles presented opinions of qualified individuals working in healthcare based on

their experience in the field and on their knowledge of KM and KMS literature but did not report collection or analysis of empirical data.

The factors considered were incentive / reward, leadership, subjective norm, culture of sharing, security, reciprocity, usefulness, and self-efficacy.

Incentive was included in Kulkarni et al.'s (2007) model and has been cited as an important factor in healthcare (Desouza, 2002). The incentive factor was retained and was judged to be equivalent to reward. Leadership was included in the Kulkarni et al.'s model and has been cited as an important factor in healthcare (Desouza, 2002). The leadership factor was included. As argued in section 2.5, leadership and incentive factors can be viewed as corresponding to transformational and transactional leadership introduced in section 2.3.3.

Subjective norm is similar in content to co-worker and supervisor constructs in the Kulkarni et al.'s (2007) model (as discussed in section 2.5), and it has been found to affect knowledge sharing among physicians (Ryu et al. 2003). As discussed in section 2.5, the constructs of co-worker and supervisor were found to be somewhat problematic. Therefore, subjective norm (a well-known construct with an established nomological validity) was included instead of co-worker and supervisor.

Culture of sharing has been cited as an important factor in healthcare (Desouza, 2002; Wickramasinghe et al., 2007). Culture of sharing is related to subjective norm, but is not the same (see section 2.3.2 for a discussion of these constructs from the theory perspective). Culture of sharing was included as a separate factor, distinct from subjective norm.

Trust is related to security and has been consistently cited as an important factor in healthcare (Desouza, 2002; Koumpouros et al., 2006; Wickramasinghe et al., 2007). Therefore, security was included as a separate factor. In this study, perceived security was viewed from the perspective of environmental and behavioural uncertainty (introduced in section 2.3.4).

Reciprocity is similar to subjective norm and thus was judged to fall under subjective norm and was not included as a separate factor. Usefulness is similar to knowledge content quality in Kulkarni et al.'s (2007) model, and therefore was not included as a separate

factor. Self-efficacy was not covered in the Kulkarni et al.'s (2007) model. Self-efficacy was not identified in the literature as a factor relevant to healthcare. Indeed, it is difficult to see why it would be more relevant in healthcare than in other contexts. Even though in terms of the success of KMS in generic contexts self-efficacy may be relevant, I did not include it in this study to keep the scope and the focus of the study under control.

Thus, the constructs included in the model are as follows. KMS use for sharing and KMS use for retrieval were used as the outcome variables of KMS success (representing net benefits in the DeLone and McLean IS success model). KMS use for sharing and KMS use for retrieval are discussed in detail in section 3.3. Knowledge content quality, KMS quality, perceived usefulness, user satisfaction, and perceived security were included as system factors (discussed in detail in section 3.4.1). Incentive, leadership, subjective norm, and culture of sharing were included as organisational factors (discussed in detail in section 3.4.2). In sections 3.4.1 and 3.4.2, devoted to system and organisational factors, respectively, I examine the factors one by one to reconfirm the need for their inclusion in the model. The cause-effect relationships between the constructs—the hypotheses tested in this study—are introduced and justified in section 3.5.

3.3 Outcome Variables of KMS Success

KMS that are not used cannot be seen as successful, and, in the long term, failed KMS would not be used. Thus, KMS success, by any reasonable measure, is associated with KMS use. While one can argue that KMS success is not necessarily the same as KMS use, KMS use is clearly a viable proxy variable for KMS success (Table 3-2 lists a number of studies that have adopted this point of view).

Based on the premise that KMS success is associated with employees using KMS this study focuses on the system use. More specifically, the study uses KMS use for knowledge sharing and KMS use for knowledge retrieval as the outcome variables in a model of KMS success.

3.3.1 System Use

The importance of system use as a measure of success has been recognized decades ago, with an argument that systems can only have value only when they are used (Lucas, 1978). In line with this view, Szajna (1993) suggested that the use of an information system is closely related to its success, effectiveness, or acceptance. Existing evidence suggests that employees' underutilisation of a system results in failure to obtain benefits from the investment made into the system (Jaspersen, Carter, & Zmud, 2005). System use is also believed to affect individual and organisational performance (DeLone & McLean, 2003; Ko & Dennis, 2011).

The importance of the system use construct is further underscored by its inclusion as a measure for IS success in a number of studies (Burton-Jones & Straub, 2006; DeLone & McLean, 1992; DeLone & McLean, 2003; Doll & Torkzadeh, 1998; Straub, Limayem, & Karahanna-Evaristo, 1995). System use is used as the dependent variable in technology acceptance models (Davis, 1989; Venkatesh, Morris, Gordon, & Davis, 2003).

Some of the existing measures of system use are presented in Table 3-1.

Table 3-1 *Measures of System Use*

Source	Type of IS/IT	Measures of Use
Thompson et al. (1991)	Personal computer	Intensity of job-related PC use (minutes per day at work) Frequency of PC use Diversity of software packages used for work (Number of packages)
Hartwick & Barki (1994)	Mini or mainframe computer	Frequency of use
Igbaria et al. (1996)	Microcomputer	Self-reported daily use of microcomputers
Iivari (2005)	Accounting system	Frequency of use

Table 3-2 *Measures of System Use in KMS Studies*

Source	Systems	Measure of use
Kankanhalli et al. (2005)	EKR	Frequency of use (contributing)
Wu & Wang (2007)	KMS	Extent of KMS use for knowledge sharing (contributing and seeking)
Lin & Huang (2008)	KMS	Frequency of use (contributing and seeking)
He, Qiao, & Wei (2009)	KMS	Frequency of use
Lin & Huang (2009)	EKR	Frequency of use

Note. EKR = Electronic knowledge repository. KMS = knowledge management system.

As mentioned at the outset of Section 3.3, KMS use is closely related to KMS success. Therefore, KMS use has been considered as representing KMS success in prior studies. One can distinguish two types of KMS use: use for knowledge sharing and use for knowledge retrieval (Watson & Hewett, 2006; Wu & Wang, 2006). Measures of KMS use utilised in prior studies are listed in Table 3-2.

All of the existing measures of KMS use are uni-dimensional; measures that cover both knowledge sharing and knowledge retrieval combine both aspects in a single construct of KMS use. Doll and Torkzadeh (1998) suggested that system use should be measured to reflect the variety of use. For example, instead of measuring system use in terms of frequency of use or number of hours of use of the system overall, system use should be measured as a multidimensional concept that identifies key performance-related use behaviours. They used three dimensions of system use: decision support, work integration, and customer service. They indicated that using a multidimensional concept of system use enables organisations to observe the extent of system use and sheds lights on how effectively organisations are using IT. Recently, consistent with Doll and Torkzadeh's work, Beaudry and Pinsonneault (2010) used a multi-dimensional measure of IT use, with four dimensions: informational, resources allocation, negotiation, and figure head (to represent the organisation to the outside world).

Previous studies have demonstrated that KMS failed due to the reluctance of employees to use KMS to share (Barth, 2000; Davenport et al., 1998; Malhotra, 2002; O'Dell & Grayson, 1998) and retrieve knowledge (Bock et al., 2006; Kankanhalli et al., 2005b; Markus, 2001; Watson & Hewett, 2006). KMS are successful when organisations are able

to successfully create the conditions in which knowledge is shared and then actively put to use.

Due to the view that KMS success is associated with (a) use of KMS for sharing (i.e. where a worker actively contributes knowledge to the knowledge-base and publishes their contact details) and (b) accessing KMS for retrieving (that is, seeking and reusing knowledge available in KMS or locating and contacting the experts) (Alavi & Leidner, 2001; Davenport et al., 1998; Desouza, Yukika, & Yun, 2006), I propose that two separate dimensions of KMS use are used to represent the two types of KMS use: KMS use for sharing and KMS use for retrieval. Both types of KMS use are explored simultaneously in the same model with the view that these behaviours may be affected by different factors. My study is the first to consider the two separate dimensions of KMS use in a single model.

A self-reported measure is used instead of actual use. Actual use was not feasible as a measure in this study due to confidentiality and resource issues.

3.3.2 KMS Use for Sharing

KMS are implemented to facilitate the sharing and integration of knowledge (Alavi & Leidner, 1999). In this study, knowledge sharing behaviour is viewed as the extent to which doctors share their knowledge (both tacit and explicit) with their colleagues via KMS. This includes sharing organisationally relevant information, ideas, suggestions, and expertise, as well as collaborating with others to solve problems, develop new ideas, or implement policies or procedures (Bartol & Srivastava, 2002; Cummings, 2004; T.-K. Yu et al., 2010).

In healthcare, doctors are expected to be able to respond to the ever-changing knowledge needs of an evolving clinical situation (Abidi, 2007; Ryu et al., 2003; Wickramasinghe et al., 2007). Local knowledge can only be obtained from co-workers; thus, knowledge sharing among doctors is critical. Doctors can contribute their ideas, insights, and experiences to KMS knowledge repositories. Knowledge that is contributed to repositories is called codified knowledge. Examples are clinical practice guidelines or clinical

documents (Abidi, 2007; Wyatt, 1991). By contributing to KMS repositories, doctors enable their colleagues to reuse their knowledge for solving problems.

Another way of using KMS to share knowledge is by direct interaction with the colleagues (personalization or person-to-person approach). This approach enables direct interaction between experts through KMS features such as a knowledge directory, also known as corporate yellow pages. It is also called a people finder, as it enables individuals to locate and identify the experts with specific expertise that is not available in KMS repositories. Doctors can publish their area of expertise and contact details for other employees to contact them via telephone, email, video conference, or electronic discussion forums (Abidi, 2007; Earl, 2001; Wickramasinghe, 2002).

The use of KMS for sharing knowledge either through KMS repositories or by enabling direct contacts through a knowledge map enables individuals to retrieve the knowledge of others.

3.3.3 KMS Use for Retrieval

Another crucial aspect of KMS use concerns the use of KMS to retrieve knowledge (Markus, 2001; Watson & Hewett, 2006). Studies have recently highlighted the use of KMS to retrieve knowledge as an important aspect of KMS success (Bock et al., 2006; Desouza et al., 2006; He & Wei, 2009; Kankanhalli, Lee, & Lim, 2011; King & Lekse, 2006). The repository model of KMS enables explicit knowledge that is retained to be accessed and disseminated for use by other organisation members.

One of the advantages offered by KMS is the ability to provide relevant, accurate, and timely knowledge that enables an organisation and its employees to use that knowledge for problem solving and decision making, thus enhancing the organisation's efficiency and increasing its competitiveness (Watson & Hewett, 2006). Using search capabilities offered by KMS, individuals can seek and retrieve diverse information and knowledge by accessing a knowledge repository such as a document management system, corporate internet, knowledge portals or expert systems (Earl, 2001; Garud & Kumaraswamy, 2005). In addition to explicit knowledge, tacit knowledge can also be retrieved based on the network model of KMS according to which KMS enable employees to request knowledge

from others through a people finder or knowledge map that serve as a connector between knowledge seeker and knowledge provider (Earl, 2001). Through knowledge maps, KMS provide a mechanism to manage the tacit knowledge carried in individuals' minds and not available from a repository.

Despite the availability of KMS providing capabilities for seeking, retrieving, and reusing knowledge, knowledge retrieval still often becomes an issue. Efforts in implementing KMS have been wasted due to employees not making use of the functionality available to retrieve knowledge (Kankanhalli et al., 2001). Using KMS for seeking knowledge requires extra efforts to identify the right search terms for the knowledge sought, or to locate the expertise that matches the knowledge required (Garud & Kumaraswamy, 2005). Furthermore, knowledge seekers may find it troublesome to seek advice and be connected to the experts whom they have never met or to expend effort to access knowledge in domains with which they are not familiar (Boh, 2008; Watson & Hewett, 2006). If KMS are not properly designed, for example, are lacking proper indexing and categorizing of knowledge, the knowledge seeker may get lost when searching for knowledge or end up accessing unnecessary knowledge (Bennett, Casebeer, Kristofco, & Strasser, 2004; Brauner & Becker, 2006; Markus, 2001).

3.4 Factors that Influence Knowledge Management Systems Success in Healthcare

This study is intended to provide a model that integrates system and organisational factors as the factors that influence KMS success in healthcare. As discussed in sections 2.4.2 and 2.4.3, organisational factors play important roles in determining KMS success. System factors, as demonstrated by IS success and KMS success research (see section 2.4.1), are also important.

3.4.1 System Factors

The system factors included in the model of KMS success in this study are knowledge content quality, KMS system quality, perceived usefulness, user satisfaction, and perceived security.

3.4.1.1 Knowledge Content Quality

Several empirical studies have been conducted to explore the issue of knowledge content quality (Rao & Osei-Bryson, 2007; Yoo, Vonderembse, & Ragu-Nathan, 2011).

Effective use of knowledge will depend on its quality (Durcikova & Gray, 2009; Rao & Osei-Bryson, 2007). Knowledge that is acquired from various sources of specialized knowledge will be used if the knowledge is perceived as having value and leading to benefits. Knowledge content that has problems such as outdated entries, inconsistent formats, incomplete descriptions, and duplicate entries may cause employees to stop using the repository (Yoon, Choi, & Sohn, 2008). At Siemens, a provider of integrated voice and data networks, the successful implementation of a knowledge management system known as ShareNet was partly attributed to the high quality of knowledge content (Nielsen & Ciabuschi, 2003). Its employees had to deal with associates and customers from various countries, which required the content of knowledge accessible in ShareNet to be of high quality. The management of Siemens considered that low quality of knowledge content would lead to a poor reputation for its knowledge base, and as a consequence, the knowledge base would lose its credibility and acceptance among Siemens employees, associates, and experts. In another study, the successful implementation of an intranet was partly attributed to its content (Stoddart, 2001). Effective intranets include up-to-date and relevant content, and are based on robust, reliable, and agile technology (Hall, 2001; Stoddart, 2001).

The importance of knowledge content quality has also been given emphasis in the implementation of KMS in healthcare (Desouza, 2002; Koumpouros et al., 2006). In healthcare, the quality of knowledge content can have serious implications, because the decisions made by doctors based on that content have implications for patients' lives. Wrong knowledge, such as wrong dosages of drugs prescribed to patients, may lead to wrong treatments. Knowledge content in this context includes treatments, various kinds of drugs for various kinds of diseases, procedures of surgery, or diagnoses for particular patients (Abidi, 2001). Furthermore, diversity in the vocabulary used by medical professionals may hinder knowledge sharing (Desouza, 2002). For example, a researcher in cardiology may use precise terminology from the field, whereas a general practitioner may not. Thus, to enable more medical practitioners to share knowledge, the issues of quality of knowledge content such as consistent and unified vocabulary should be addressed

(Desouza, 2002). Similarly to this view, in their study of KMS in cardiology, Koumpouros et al. (2006) mentioned that the quality of knowledge and the correct terminology are important for increasing doctors' use of KMS. Medical professionals have a broad range of knowledge needs and produce a great amount of knowledge; without high quality and up-to-date knowledge, doctors cannot practice high quality medicine (Heathfield & Louw, 1999).

Based on the discussions above, knowledge content quality was included as a factor that can influence the success of KMS.

3.4.1.2 KMS System Quality

Another important issue that has been a concern for KMS users is the quality of the knowledge management system. A knowledge management system is described as information technologies used to facilitate the flow of knowledge and sharing of knowledge (Alavi & Leidner, 1999, 2001) (a more detailed definition of a knowledge management system was given in section 2.2.1.3). The quality of KMS is important to those who would contribute their knowledge as well as those who would like to retrieve knowledge.

In previous studies of healthcare information systems, one of the barriers to successful healthcare IS implementation was identified as low quality or unsuitable technology (Eley, Fallon, Soar, Buikstra, & Hegney, 2009; Treister, 1998). It was found that user-friendliness and efficiency are attributes the users expect from systems. A system that is not user-friendly or efficient will not be used because doctors need to spend time with patients rather than overcoming the problems of the system (Bhattacharjee & Hikmet, 2007; Treister, 1998). Any systems used by doctors have to improve doctors' performance with respect to their patients (Davenport & Glaser, 2002). High quality systems, such as systems with user-friendly interfaces, good searching capabilities, and low response times, are more likely to be successful as KMS, particularly in the healthcare context (Koumpouros et al., 2006).

Based on the discussions above, KMS system quality was included as a factor that can influence the success of KMS.

3.4.1.3 User Satisfaction

Besides knowledge content quality and KMS system quality, user satisfaction is another frequently measured aspect of KMS success. User satisfaction is the aggregate of user's feelings of pleasure or displeasure with respect to KMS (Ives, Margrethe, & Jack, 1983). Such feeling corresponds to the extent to which KMS met, exceeded, or failed to meet user expectations. Previous studies of IS success have demonstrated the effect of user satisfaction on IS success (Leclercq, 2007; McKinney, Yoon, & Zahedi, 2002; Staples, Wong, & Seddon, 2002; Wang, 2003; Wixom & Todd, 2005; Zrivan, Pliskin, & Levin, 2005).

Prior research found that user satisfaction depends on the different contexts of use (Scheepers, Scheepers, & Ngwenyama, 2006). The varying social contexts of individual use (individual as an employee, professional, or private user) result in different social influences that may affect the user satisfaction with the use of technology.

In a study of doctors' experience with handheld computers in clinical practice (McAlearney, Schweikhart, & Medow, 2004), doctors' use of handheld computers was attributed to their satisfaction with handheld computers. Similarly, a study of the use of telemedicine demonstrated high satisfaction among general practitioners leading to the acceptance of telemedicine in their work (Al-Qirim, 2007). In another study, which was conducted at the emergency department of a hospital in the United States (Konradt, Christophersen, & Schaeffer-Kuelz, 2006), it was found that satisfaction contributed to the use of an electronic medical records system by physicians and nurses.

Based on the discussions above, user satisfaction was included as a factor that can influence the success of KMS.

3.4.1.4 Perceived Usefulness of KMS

The term 'perceived usefulness' has been adopted from the Davis's (1989) technology acceptance model (TAM). Perceived usefulness is defined as the extent to which a person believes that using a particular system improves her (or his) job performance (Davis, 1989, p. 320).

In the context of KMS, perceived usefulness has been used in a study of KMS user acceptance (Money, 2004) and in studies of KM success (Hwang et al., 2008; Kulkarni et al., 2007; Vitari, Moro, Ravarini, & Bourdon, 2007). In the context of healthcare, previous studies mentioned that most practitioners would only use a system if they can see the benefits of the system, in particular if they can see that the system is able to facilitate their treatment of patients (Al-Qirim, 2007; Bhattacharjee & Hikmet, 2007; Chau & Hu, 2002b). In line with the purpose of healthcare to provide effective care to patients, systems that can improve doctors' performance in treating their patients (and are perceived as such by the potential users) are likely to be used (Bower, 2005; Eley et al., 2009; Ward, Stevens, Brentnall, & Briddon, 2008).

Based on the discussions above, perceived usefulness of KMS was included as a factor that can influence the success of KMS.

3.4.1.5 *Perceived Security*

As knowledge is increasingly seen as a strategic resource, security of knowledge has become another important issue raising concerns of organisations, particularly those in healthcare. Gold et al. (2001) asserted that security of knowledge is an essential organisational capability for effective knowledge management. They further argued that organisational knowledge that is not protected would lose the qualities of being rare and inimitable. Similarly, Lindsey (2002) suggested that protection of knowledge must be given attention by organisations if they want to sustain their competitive advantage.

In healthcare, security of knowledge is a concern because knowledge may represent a matter of life and death. Like online purchasers who are uncomfortable with releasing personal information to websites (Salisbury, Pearson, Pearson, & Miller, 2001), doctors may feel at risk in contributing their knowledge because knowledge can be stolen or misused. (For example, knowledge obtained from KMS may be used out of context. If knowledge is used to treat patients with undesirable outcomes, the originator of the knowledge may be alleged to be responsible.) Real or perceived knowledge security problems may hinder the practice of knowledge sharing. Thus, it is vital for healthcare organisations to develop the sense of security among doctors with respect to their contributing their knowledge. Security can be viewed in terms of technology and in terms of organisational policies and procedures. Technology aspects of security are software and

hardware features such as authorisation and authentication of the users accessing the system. Security policies and procedures ensure that technological measures are in place and regulate who can access the system and how they are expected to use the system (Gold et al., 2001; Lindsey, 2002).

Based on the discussions above, perceived security was included as a factor that can influence the success of KMS.

3.4.2 Organisational Factors

As for organisational factors, leadership, incentive, culture of sharing, and subjective norm were included in the model.

3.4.2.1 Subjective Norm

Subjective norm is defined as the perceived social pressure to perform or not to perform a behaviour (Ajzen, 1991). Subjective norm refers to the influence of the immediate social environment. Previous studies found subjective norm to affect the use of IS (Davis, 1989; Taylor & Todd, 1995; Venkatesh & Davis, 2000). Much earlier, a study was conducted that indicated that an individual's decisions regarding when or how to use a system are strongly influenced by their social group, which forms their ideas about the use of technology (Robertson, 1989). The issues relevant to the influence of peers are discussed in a number of studies. Cross, Parker, Prusak, and Borgatti (2001) found that people are approximately five times more likely to use their friends or colleagues as a source of reference than a database or other repository. Their research with 40 managers in a consulting firm revealed that 85 percent claimed to use other people's knowledge in completing projects; they used the knowledge repository only to supplement what they heard from their contacts. In an ethnographic study of general practices in England conducted over two years, Gabbay and Le May (2004) found that doctors tended to rely on their own and their colleagues' experience, the opinions of their leaders, and interactions with each other. Although they may have unprecedented direct online access to the latest research findings, they would rather walk to the desk of a colleague to obtain information. In this situation, peers tend to create interpersonal communication networks and therefore, have high possibility to influence the behaviour of individuals.

Based on the discussions above, subjective norm was included as a factor that can influence the success of KMS.

3.4.2.2 *Culture of Sharing*

While employees' decisions to use KMS can be influenced by their immediate colleagues whom they perceive to be important to them (subjective norm), their decisions can also be influenced by their organisation's overall (culture). In the present study, subjective norm refers to the influence of colleagues interacting with the individual, while culture of sharing refers to the set of beliefs and values prevalent in the organisation. Culture has been cited as influencing KM practices in prior research (Gold et al., 2001; Milne, 2007; Nayir & Uzuncarsili, 2008; Palanisamy, 2007). Some authors claimed that in KM practice, employee acceptance of, or resistance to, knowledge sharing is a management and corporate culture issue rather than a technology issue (Alavi & Leidner, 1999; Ruppel & Harrington, 2001). That is, technology alone cannot make KMS successful and, therefore, effective KMS require a culture that supports and encourages knowledge sharing and, subsequently, knowledge use. It is argued that organisations with cultures that do not value and support information sharing will face difficulties in integrating KMS (Alavi et al., 2006).

According to Gurteen (1999), culture of sharing is about making knowledge sharing a common expectation and an organisational norm. He suggested that a knowledge-sharing culture can be created by encouraging people to work together more effectively, to collaborate and to share, with the aim of making organisational knowledge more productive. A strong knowledge-supporting culture must be nurtured in order to create an environment where knowledge workers feel comfortable, where they can learn, and where they are empowered and given the opportunity to be creative and innovative (Alavi et al., 2006). More specifically, openness, trust, innovation, and teamwork are among the culture attributes that may lead to positive KM behaviours (Al-Adaileh & Al-Atawi, 2011; Alavi et al., 2006).

The hypothesis that organisational culture affects KMS success has never been tested empirically, even though the qualitative analysis reported by Alavi et al., 2006 provided empirical evidence that the relationship does exist. Knowledge sharing in healthcare organisations has been claimed to be hindered by strong professional boundaries (Nicolini

et al., 2007). Thus, in the context of healthcare it is particularly important to gain a better understanding of the effect of culture of sharing on KM related behaviours.

Based on the discussions above, culture of sharing was included as a factor that can influence the success of KMS.

3.4.2.3 Leadership

Leaders have received consistent attention in the literature as one of the critical factors influencing the success of IS implementation (Armstrong & Sambamurthy, 1999; Neufeld, Dong, & Higgins, 2007; Prybutok, Zhang, & Ryan, 2008; Sabherwal, Jeyaraj, & Chowa, 2006). DeTienne, Dyer, Hoopes, and Harris (2004) describe a leader as everyone from the CEO and the board of directors down to an unofficial opinion leader. Kulkarni et al. (2007) describe leadership as the commitment of top levels of management to KM.

The available literature on leadership support provides abundant evidence that leadership behaviour is an important factor of KMS implementation success (DeTienne et al., 2004; Gold et al., 2001; Hackney, Desouza, & Irani, 2008; Kulkarni et al., 2007; Xue, Bradley, & Liang, 2011; Zhang & Faerman, 2007). Leaders can influence the behaviour of employees, and they have the ability to change employees' behaviour towards the implementation of KMS through their support, involvement, and commitment to KM activities. Furthermore, the commitment from the highest levels of management, such as CEOs, is critical because it is at these levels that the rules and the norms with respect to knowledge exchange and reuse are established.

Some empirical studies have found the positive effect of leadership on KMS success. In a survey of 431 US and European organisations, more than 67 percent of respondents suggested that leaders can overcome resistance to knowledge sharing (Ruggles, 1998). Similarly, Kulkarni et al. (2007) found from their empirical study that commitment from senior management encourages employees to participate in knowledge contribution and knowledge reuse. It has been posited that a lack of commitment of top leadership to sharing organisational knowledge and the absence of role models who exhibit the desired behaviour can impede knowledge sharing. Another empirical study provided evidence that an empowering leadership influences an individual to share knowledge (Xue et al., 2011).

In opinion articles devoted to knowledge management in healthcare, Booth (2001), Gray (1998), and Dwivedi, Bali, and Naguib (2005) argued that an organisation needs a chief knowledge officer to be responsible for managing knowledge and to ensure that employees are involved in KM initiatives. CEOs need to visibly demonstrate their commitment to KMS projects and lead by example in contributing and using knowledge.

Based on the discussions above, leadership was included as a factor that can influence the success of KMS.

The studies reviewed in this section focused on aspects of leadership other than incentive. The studies focusing on incentive—transactional leadership (in terms of the distinction between transformational and transactional leadership introduced in section 2.3.3)—are discussed in section 3.4.2.4.

3.4.2.4 Incentive

Incentive (an important aspect of transactional leadership), described equivalently as reward, has been found to promote the sharing of knowledge. One of the theories explaining the social interactions of people is the economic exchange theory, which suggests that an individual's behaviour is based on rational self-interest. Thus, knowledge sharing will occur when its rewards exceed its costs (Constant, Kiesler, & Sproull, 1994). Rewards are considered to influence KM behaviours (Quigley, Tesluk, Locke, & Bartol, 2007). Incentives can contribute to KM system success by promoting knowledge sharing via the system (Davenport & Prusak, 1998; Iyer & Ravindran, 2009; E. Z. Taylor, 2006).

A number of studies have suggested that a positive incentive system makes it more likely that employees will put forth efforts to share knowledge (Barth, 2000; Hansen et al., 1999; Kulkarni et al., 2007; Orlikowski, 1993). Other studies suggested that team-based rewards and financial incentives (e.g. profit sharing and employee stock options) can enhance knowledge sharing (Bartol & Srivastava, 2002). In view of this, Markus (2001) suggested that providing rewards and incentives and including support for KM as part of performance assessment will positively influence the desired behaviour of knowledge contributors, particularly when they are pressed for time or are competing with each other on the basis of performance.

In healthcare, both financial and non-financial incentives have long been mentioned as factors that influence the acceptance of IT by doctors (Hackbarth & Milgate, 2005; Marshall & Smith, 2003; Miller & Sim, 2004; Muller, Spiliopoulou, & Lenz, 2005; Schoen et al., 2009). Similarly, the use of incentives may encourage doctors to share their knowledge. Knowledge sharing has been a common practice in healthcare, though via traditional face-to-face communication (Abidi, 2007). Incentive can be a potential solution to compensate doctors' time and efforts in using KMS to share knowledge more widely (Taylor, 2006).

Based on the discussions above, incentive was included as a factor that can influence the success of KMS.

3.5 Knowledge Management Systems Success Model for Healthcare

This section introduces the model of KMS success in healthcare (see Figure 3-1) formulated to address the research questions of this study (formulated in section 1.3). First, the model is described in terms of its main differences from the Kulkarni et al.'s (2007) KMS success model (which was introduced in section 2.5, in Figure 2-5). Then, the hypotheses included in the model of KMS success in healthcare are justified one by one, with an emphasis on their relevance in the healthcare context.

As discussed in section 3.2, to develop the KMS success model for healthcare this study used Kulkarni et al.'s (2007) KM success model as a basis (see section 2.5 for a detailed review of the Kulkarni's study). Kulkarni et al.'s KM success model was modified to refine it and to tailor it to the healthcare context. The knowledge use construct in Kulkarni et al.'s KM success model was divided into two constructs representing more specific behaviours: KMS use for sharing and KMS use for retrieval. Knowledge use in Kulkarni et al.'s KM success model represented both knowledge contributing and knowledge seeking in the same construct. However, the success of KMS requires knowledge possessors to be willing to impart their knowledge and knowledge seekers be willing to reuse codified knowledge or tacit knowledge of others (Chen & Hung, 2010; He & Wei, 2009). Knowledge contributors and knowledge seekers have distinct needs and motivations and thus, they can be affected by different factors (He & Wei, 2009; Kankanhalli et al., 2011; Kankanhalli et al., 2005a, 2005b). Therefore, this study divided the use of KMS construct

into two constructs, corresponding to two different types of KMS use—use for knowledge contributing/sharing and use for knowledge seeking/retrieval; the two constructs have been examined simultaneously in one model. Including these constructs in the same model allowed me to identify the distinct sets of factors affecting these distinct behaviours and to compare the effect sizes for the factors that affect both of the behaviours. By better understanding the factors affecting these key knowledge management behaviours, organisations may be able to manage these behaviours more effectively.

As mentioned in section 3.2, co-worker and supervisor in the model by Kulkarni et al.'s model were replaced by subjective norm. In Kulkarni et al.'s KM success model, co-worker and supervisor refer to the influence of interactions of employees with their co-workers and immediate supervisors on the employee's attitudes towards knowledge sharing. Some problems associated with using co-worker and supervisor constructs at the same time (the content of the constructs appears to overlap) were discussed in section 2.5. Subjective norm has content similar to co-worker and supervisor as they were operationalized by Kulkarni et al. Moreover, the subjective norm construct is better established in MIS research and has strong nomological validity. In addition to subjective norm, the related concept of culture of sharing was added to reflect the influence of the overall organisational culture.

As discussed in section 3.2, the construct of perceived usefulness of knowledge sharing in the model by Kulkarni et al. was replaced by the concept of perceived usefulness of KMS. The problems associated with the use of perceived usefulness of knowledge sharing as a construct related to KMS quality were discussed in section 2.5.

Perceived security was added as a new construct; perceived security is not similar to any constructs in Kulkarni et al.'s (2007) model. As discussed in section 3.2, perceived security was added based on an analysis of literature reporting empirical studies of factors influencing knowledge sharing and seeking and of literature discussing KMS success in healthcare, followed by an in-depth consideration of the relevance of perceived security to KMS success in healthcare (in section 3.4.1.5). Following the existing empirical studies of the effect of perceived security on system success (in the context of e-commerce), it was hypothesised that perceived security directly affects KMS use for sharing (this hypothesis is considered and justified in detail later in this section, in subsection 3.5.1.5—as hypothesis H10).

In the rest of this section, I justify the hypotheses for the organisational factors (leadership, incentive, culture of sharing, and subjective norm) and the system factors (knowledge content quality, KMS system quality, perceived usefulness of KMS, user satisfaction, and perceived security).

3.5.1 System Factors' Effects

The hypotheses for the system factors were consistent with the Delone and McLean IS success model, with net benefits interpreted as KMS use for sharing and KMS use for retrieval, and with system use in the Delone and McLean IS success model replaced by perceived usefulness (following Hwang et al., 2008, Kulkarni et al, 2007, and Wu and Wang, 2006, who followed the suggestion from Seddon, 1997). The only exception was the new system factor introduced in this study, perceived security, which was hypothesised to affect KMS use for sharing following the work by Fang, Chan, Brzezinski and Xu (2006) on the acceptance of e-commerce systems. In the following subsections, I justify the individual hypotheses one by one.

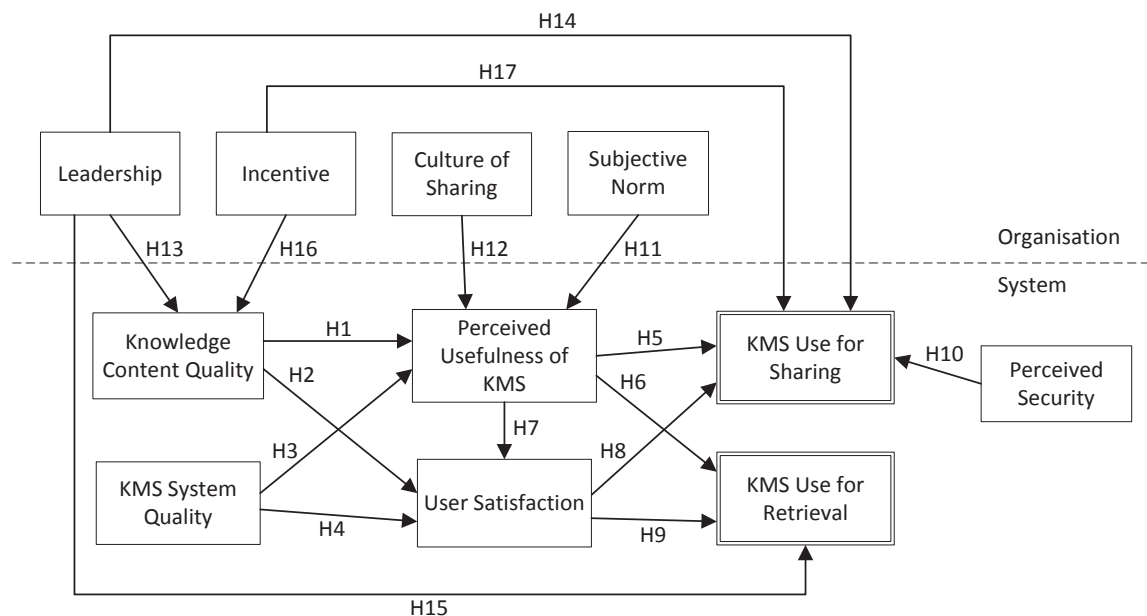


Figure 3-1. KMS success model for healthcare.

Replacing system use in the Delone and McLean IS success model by perceived usefulness and interpreting net benefits as system use made the model structure closer to the TAM model (see Figure G-3) than the basic Delone and McLean IS success model (the TAM

model is introduced in Appendix G.7). In TAM, perceived ease of use is hypothesised to affect intention to use, with intention to use affecting the actual use. In the model of the present study (as in the models by Hwang et al. 2008, Kulkarni et al. 2007, and Wu and Wang, 2006), the concept of intention to use is not included, judged to be not very interesting for management practice, and perceived usefulness is hypothesised to affect use directly. Moreover, KMS system quality in the research model can be seen as somewhat related to ease of use in TAM. In TAM, perceived ease of use is hypothesised to affect intention to use both directly and via perceived usefulness. In the research model, KMS system quality is hypothesised to affect perceived usefulness, but is not hypothesised to affect KMS use directly. This is consistent with the hypothesis that perceived ease of use affects intention to use not being confirmed in most of the TAM studies, as highlighted in the reviews of TAM research by Venkatesh, Morris, Davis, and Davis (2000) and Legris, Ingham, and Collette (2003).

3.5.1.1 H1, H2: Higher Knowledge Content Quality Leads to Higher Perceived Usefulness and Higher User Satisfaction

As discussed in section 3.4.1.1, the quality of knowledge content is crucial to the success of KMS, particularly in healthcare. Information quality was suggested to affect perceived usefulness by Seddon (1997) in his refinement of the DeLone and McLean IS success model. If the quality of knowledge content is high, then an employee is more likely to perceive that KMS contribute to enhanced job performance.

In the studies of KMS success, empirical evidence of the relationship between knowledge content quality and perceived usefulness was found (Hwang et al., 2008; Wu & Wang, 2006). Hwang et al. (2008), in their survey-based study at a hospital in Taiwan, found that information quality had a strong direct effect on perceived usefulness. Similarly, Wu and Wang (2006) found that an increase in knowledge content quality was likely to increase the perceptions that using the system would give benefits. However, in the study by Kulkarni et al. (2007) the effect of knowledge content quality on perceived usefulness of knowledge sharing was not statistically significant.

In this study, it is argued that high quality of knowledge content is critical in healthcare because it affects doctors' decisions that may have serious implications for their patients' wellbeing (Davenport & Glaser, 2002). High quality knowledge affects doctors'

perceptions of the usefulness of KMS and thus influences them to use KMS to improve their job performance. Therefore, high quality knowledge content is likely to increase the doctors' perceptions that using KMS would enhance their job performance.

A number of empirical studies confirmed the effect of knowledge content quality on user satisfaction, including the study by Hwang et al. (2008) conducted in the context of healthcare.

In view of the discussion above, the following hypotheses are justified:

Hypothesis 1. Higher knowledge content quality leads to higher perceived usefulness of KMS.

Hypothesis 2. Higher knowledge content quality leads to higher user satisfaction.

3.5.1.2 H3, H4: Higher KMS System Quality Leads to Higher Perceived Usefulness and Higher User Satisfaction

KMS system quality as a factor relevant to KMS success in the context of healthcare was introduced in section 3.4.1.2. Some examples of low KMS quality are difficult to use user interfaces and low reliability. A difficult to use user interface may cause a user to spend a lot of time when trying to reply to a discussion forum posting. Low bandwidth network connections may result in video conferencing sessions being interrupted. Such problems are likely to result in the system not meeting users' expectations, and thus, users feeling dissatisfied. Moreover, users are likely to form perceptions of the system not being useful.

Prior studies have confirmed the effect of system quality on perceived usefulness. Seddon (1997) found that system quality affected perceived usefulness. As to studies in the context of healthcare, in a survey-based KMS success study at a hospital in Taiwan Hwang et al. (2008) found that system quality affected perceived usefulness. However, studies by Wu and Wang (2006) and Kulkarni (2007) did not find a statistically significant relationship between these two constructs.

The effect of KMS system quality on user satisfaction was confirmed in three prior studies (Hwang et al., 2008; Kulkarni et al., 2007; Wu & Wang, 2006).

Doctors are working under strong time pressure, in changing and unpredictable environments. Therefore, any glitches in system design or operation adding to the uncertainty of the working environment are likely to have particularly strong effects in the context of healthcare.

In view of the discussion above, the following hypotheses are justified:

Hypothesis 3. Higher KMS system quality leads to perceived usefulness of KMS.

Hypothesis 4. Higher KMS system quality leads to higher user satisfaction.

3.5.1.3 H5, H6, H7: Higher Perceived Usefulness Leads to Higher KMS Use for Sharing, Higher KMS Use for Retrieval, and Higher User Satisfaction

Perceived usefulness as a factor relevant to KMS success in the context of healthcare was introduced in section 3.4.1.4. Employees, overall, care about their personal success and about the success of their organisation (which makes their personal success possible). Therefore, if a knowledge management system is perceived as useful in terms of promoting the goals of the employees and of their organisation, the employees are more likely to use the functionality it provides. Moreover, if a knowledge management system is perceived as useful, it is more likely that it satisfies employee expectations, and thus employees are more likely to be satisfied with the system.

Prior studies have confirmed the effect of perceived usefulness on use (Adams, Nelson, & Todd, 1992; Davis, 1989). In the KMS context, Wu and Wang (2006) found that perceived KMS benefits (a concept similar in content to perceived usefulness) affected KMS use. However, Kulkarni et al. (2007) found the relationship between perceived usefulness and knowledge use to be not statistically significant.

The relationship between perceived usefulness and IS use was shown to be statistically significant in a number of studies of acceptance of information technology among doctors (Bhattacharjee & Hikmet, 2007; Chau & Hu, 2001, 2002a; Hu, Chau, Sheng, & Tam, 1999). Similarly, for KMS in the healthcare context, perceived usefulness was found to be a determinant of KMS success in a survey based study of KMS application in classifying diseases at a hospital in Taiwan (Hwang et al., 2008).

Previous studies have confirmed the effect of perceived usefulness on user satisfaction (Hwang et al., 2008; Kulkarni et al., 2007; Wu & Wang, 2006). One of these studies (the study by Hwang et al.) was conducted in the context of healthcare.

Doctors are only likely to use KMS to share or retrieve knowledge if they have found that sharing and retrieving knowledge via KMS is useful and could improve their ability to do their jobs (e.g. reduce medical errors). Doctors, whose priority is to treat patients and who are often under time pressure, are reluctant to use IT systems as this takes extra time. However, as suggested in an opinion article by Davenport and Glaser (2002), they would use a system if they felt quite strongly that doing so would enhance their job performance. If knowledge management systems are perceived as useful, it is more likely that they will satisfy the expectations of the doctors, and thus doctors are more likely to be satisfied with the knowledge management systems. There is no reason why this argument would apply to doctors less (or more) than to any other professionals.

In view of the discussion above, the following hypotheses are justified:

Hypothesis 5. Higher perceived usefulness leads to higher KMS use for sharing.

Hypothesis 6. Higher perceived usefulness leads to higher KMS use for retrieval.

Hypothesis 7. Higher perceived usefulness leads to a higher user satisfaction.

3.5.1.4 H8, H9: Higher User Satisfaction Leads to Higher KMS Use for Sharing and Higher KMS Use for Retrieval

As discussed in section 3.4.1.3, satisfaction suggests that users feel that the system meets the requirements. If the system meets the requirements, users are more likely to use it compared to a situation when users feel that the system does not meet the requirements.

Prior studies have confirmed the effect of user satisfaction on use (Baroudi, 1986; Igbaria & Tan, 1997). Similarly, in the KMS context, Wu and Wang (2006) found that user satisfaction had a positive effect on KMS use while Kulkarni et al. (2007) found that user satisfaction affected knowledge use.

As any other professionals, if doctors are satisfied with the capabilities of a knowledge management system, they are more likely to use the system for sharing and retrieving knowledge.

In view of the discussion above, the following hypotheses are justified:

Hypothesis 8. Higher user satisfaction leads to higher KMS use for sharing.

Hypothesis 9. Higher user satisfaction leads to higher KMS use for retrieval.

3.5.1.5 H10: Better Perceived Security Leads to Higher KMS Use for Sharing

The construct perceived security was discussed as a factor relevant to KMS success in section 3.4.1.5. If the users perceive that the knowledge they share via KMS may be stolen or misused, they are less likely to use KMS to share knowledge. Correspondingly, if the users feel that KMS provide a high level of security, they are more likely to share knowledge.

Perceived security has been found to affect the use of e-commerce systems for purchasing (Fang et al., 2006; Salisbury et al., 2001; Suh & Han, 2003; Yenisey, Ozok, & Salvendy, 2005). In these studies, perceived security was interpreted as the extent to which one believes that using online transactions is secure, in terms of technology infrastructure and in terms of the behaviour of employees handling the security sensitive information.

In the healthcare context, some of the knowledge shared via KMS may be highly security sensitive. When the knowledge can be traced to specific patients, security breaches may lead to serious consequences for the patients, as well as to the hospital (in terms of reputation and, if legal action is taken, even in financial terms). At the same time, the considerations of intellectual property being a source of competitive advantage apply to healthcare as much as they apply in other highly knowledge intensive industries (as suggested in an opinion article by Desouza, 2002). Therefore, doctors are likely to care about the security of knowledge contributed via KMS even more than most other professionals.

Even though two aspects of perceived security can be distinguished (relating to behavioural and to environmental uncertainty—see section 2.3.4), I followed the studies of

the effects of perceived security in e-commerce cited earlier in this section and formulated a hypothesis for a single perceived security construct.

In view of the discussion above, the following hypothesis is justified:

Hypothesis 10. Better perceived security leads to higher KMS use for sharing.

3.5.2 Organisational Factors' Effects

The hypotheses for a culture of sharing and subjective norm were in the spirit of TAM2 (Venkatesh et al., 2000, introduced in section 2.3.2). TAM2 suggests that subjective norm affects perceived usefulness (the addition of the hypothesis for culture of sharing, a construct somewhat similar but distinct from subjective norm, is specific to this study).

The leadership and incentive factors were viewed from the perspective of Burns (1978) and Bass (1985) theory of transformational and transactional leadership, with the leadership factor corresponding to transformational leadership and incentive—to transactional leadership. The view was taken that leaders rely on transformational and transactional leadership to encourage KMS use and to assure the quality of knowledge available via KMS. Hence, the hypotheses were stated to suggest that the two aspects of leadership affect knowledge content quality, KMS use for sharing, and KMS use for retrieval. (With one exception—I did not hypothesise that incentive affects KMS use for retrieval, because use for retrieval is difficult to track formally making it difficult to implement an incentive mechanism. One can track physical accesses via KMS, but it is difficult to tell if the knowledge accessed was meaningfully used, or perhaps the user just was clicking on links to get the incentive.)

In the following subsections, I justify the individual hypotheses one by one.

3.5.2.1 H11: Higher Subjective Norm Leads to Higher Perceived Usefulness

As discussed in section 3.4.2.1, subjective norm plays an important role in influencing individuals' behaviour. Frequent interactions among employees create an environment that enables employees to influence each other's behaviour.

Subjective norm has also been referred to as social influence (Hsu & Lin, 2008) and social norms (Hsu & Lu, 2004). A number of empirical studies found that subjective norm affected an individual's behaviour (Bock et al., 2005; Davenport & Glaser, 2002; Hsu & Lin, 2008; Hsu & Lu, 2004; Schepers & Wetzels, 2007).

Venkatesh et al. (2000) proposed that subjective norm affects use in two ways: direct effect and indirect effect via perceived usefulness. For the direct effect of subjective norm on use, they argued that when people in an individual's environment think she (or he) should use the system, she (or he) tends to comply with these opinions and use it. This mechanism is called compliance, and is primarily relevant in mandatory settings. For the indirect effect, where subjective norm influences intention via perceived usefulness, the mechanism is called internalization. In the internalization mechanism, if the colleagues suggest that a particular technology might be useful, the suggestion affects the individual's perception of the usefulness of the technology (Yi, Jackson, Park, & Probst, 2006). Unlike compliance, internalization takes place regardless whether the setting is voluntary or mandatory. As knowledge sharing is a voluntary act that is impossible to impose (Ipe, 2003), the internalization mechanism is more appropriate (Venkatesh & Davis, 2000). Venkatesh and Davis's (2000) views were supported by van Raaij and Schepers (2008) in his cross-sectional study and by Schepers and Wetzels (2007) in their meta-analysis study.

In healthcare, subjective norm was found to influence doctors' behaviour in using a clinical decision support system in a survey of physicians at hospitals in China (Chang, Hwang, Hung, & Li, 2007), although the effect size was weak. Yi et al. (2006) found that subjective norm had an indirect effect on doctors' intention to accept personal digital assistants through perceived usefulness in a survey of physicians at hospitals in the USA. He proposed that the internalization mechanism is prevalent in a healthcare context.

Doctors interact frequently in their work. They specialize in different areas, and may be at work at different times. Yet, a patient needs care when she (or he) needs it and may need care in more than one specialist area. Thus, more than one doctor is likely to be involved in treating a given patient, and doctors need to communicate and to collaborate. Therefore, doctors are likely to be influenced by each other's opinions at least as much as other professionals, as suggested by the ethnographic study of medical staff at a general practice in the UK by Gabbay and Le May (2004).

In view of the discussion above, the following hypothesis is justified:

Hypothesis 11. Higher subjective norm leads to higher perceived usefulness of KMS.

3.5.2.2 H12: *Better Culture of Sharing Leads to Higher Perceived Usefulness of KMS*

As discussed in section 3.4.2.2, the culture of sharing is a factor relevant to KMS success (Alavi et al., 2006; Goh, 2002; McDermott & O'Dell, 2001). A culture that encourages knowledge sharing instead of knowledge hoarding may encourage employees to share knowledge via KMS.

The number of empirical studies on the influence of culture of sharing on KMS success is limited. This is due to the large number of attributes of culture that makes it a complex concept (Kappos & Rivard, 2008; Park et al., 2004). For example, Alavi et al. (2006) in their case study of a global information services company in the United States found that organisational values such as innovativeness, collaboration, autonomy, formalization, and expertise affected the use of KM tools.

Park et al. (2004), in a survey of employees at organisations in the US (using a convenience sample), found a statistically significant positive relationship between organisational culture and the successful implementation of KM technology. They concluded that the attributes of a knowledge sharing culture, such as team oriented work, working closely with others, and trust are important for the success of KMS. Al-Alawi, Al-Marzooqi, and Mohammed (2007), in a mixed methods study of public and private organisations in Bahrain (the study involved a survey and a series of interviews), found that culture attributes, such as levels of interpersonal communication and trust, influenced knowledge sharing.

Norms, beliefs, and values are particularly important in healthcare, because healthcare professionals' behaviour has a profound effect on the well-being of their patients. Therefore, to be successful, healthcare organisations need to have strong cultures, cultures that profoundly affect the behaviour of their members. Thus, in their behaviour with respect to knowledge management systems, healthcare professionals are likely to be strongly influenced by the aspects of culture of their organisations that are relevant to knowledge sharing.

While ultimately, the culture of sharing is expected to affect KMS use, similarly to the subjective norm (discussed in section 3.5.2.1), it is assumed that because KMS use is voluntary, the culture of sharing does not directly affect the behaviour, but rather affects the perceptions of KMS usefulness (and thus affects the behaviour via perceived usefulness of KMS).

In view of the discussion above, the following hypothesis is justified.

Hypothesis 12. Better culture of sharing leads to higher perceived usefulness of KMS.

3.5.2.3 H13, H14, H15: Leadership Results in Higher Knowledge Content Quality, Higher KMS Use for Sharing, and Higher KMS Use for Retrieval

As introduced in section 3.4.2.3, leaders profoundly influence KMS success. This section focuses on the effects of leadership not associated with administering rewards or punishments (not with transactional, but with transformational leadership in terms of the theory of transformational and transactional leadership introduced in section 2.3.3).

The studies by Schepers and Wetzels (2005) and Neufeld, Dong, and Higgins (2007), reviewed in section 2.3.3 suggest the relevance of transformational leadership to explaining technology acceptance and knowledge management behaviours.

Sabherwal et al. (2006) from their meta-analysis study concluded that top management commitment indirectly and directly affects system use. Kulkarni et al. (2007), in their study of KMS success at business organisations in the United States, found that leadership had an effect on knowledge use and knowledge content quality. They argued that the commitment from leaders, in particular, top management, to promote knowledge sharing might influence employees to contribute high quality knowledge and to use knowledge available via KMS. In a very recent simulation study using university students organised in groups to simulate organisations, Xue et al. (2011) found that supportive styles of leadership are effective at encouraging knowledge sharing behaviours.

In an experience report describing the implementation of a KMS at a cardiology department of a hospital, Koumpouros et al. (2006) suggested that support from leaders and their involvement are needed to motivate doctors to use KMS and to contribute high

quality knowledge. In healthcare organisations, the effect of leadership should be at least as high as in other professional organisations.

In view of the discussion above, the following hypotheses are justified:

Hypothesis 13. Leadership results in higher knowledge content quality.

Hypothesis 14. Leadership results in KMS use for sharing.

Hypothesis 15. Leadership results in KMS use for retrieval.

3.5.2.4 H16, H17: Incentives Result in Higher Content Quality and in KMS Use for Sharing

Incentive refers to transactional leadership (introduced in section 2.3.3)—to influencing behaviour by administering tangible rewards and punishments. The relevance of incentive as a factor of KMS success was argued in section 3.4.2.4.

The study by Politis (2001) reviewed in section 2.3.3 and the studies by Constant, Kiesler, & Sproull (1994) and Quigley, Tesluk, Locke, & Bartol (2007) reviewed in section 3.4.2.4 suggest the relevance of transactional leadership to explaining technology acceptance and knowledge management behaviours.

Overall, previous studies of the effect of incentive on knowledge sharing produced mixed results. A number of studies found incentive to affect positively knowledge sharing (Choi et al., 2008; Kankanhalli et al., 2005a; Koumpouros et al., 2006; Lai, 2009). However, others found that incentive had a negative effect on knowledge-sharing attitudes (Bock et al., 2005). He, Qiao, and Wei (2009) did not find incentive to have an effect. Lin (2007) found that organisational rewards, such as monetary rewards, did not affect knowledge sharing, and enjoyment of helping others was more important than extrinsic rewards for encouraging knowledge sharing.

Based on a meta-analysis of 25 years of research relating to rewards and performance, it was found that, generally, people enjoy activities or tasks more when they are rewarded (Cameron and Pierce, 1997 as cited in Milne, 2007). Consistent with that view, Kulkarni et al. (2007) found that incentive affected positively both knowledge use and knowledge

content quality, implying that if employees are given incentives, they are more likely to contribute knowledge, and the knowledge they contribute is likely to be of higher quality.

In an opinion article by Nicolini et al. (2007) it was suggested that in the context of healthcare, lack of transparent rewards is a barrier to KMS success (but no argument was provided in support of that view). Even though the evidence for incentive having an effect is inconclusive, and there is no reason why incentive should be particularly effective in the healthcare context, I opted to retain incentive as a factor in the model. By including incentive, I aimed to clarify whether incentives have effect.

In view of the discussion above, the following hypotheses are justified:

Hypothesis 16. Incentives result in higher knowledge content quality.

Hypothesis 17. Incentives result in KMS use for sharing.

3.6 Summary

To formulate a KMS success model for healthcare, the KMS success model by Kulkarni et al. (2007) was chosen as the base, as the only KMS success model available that covers both system and organisational factors. Two outcome variables were used: KMS use for sharing and KMS use for retrieval. KMS use for sharing and KMS use for retrieval were used based on the previous literature suggesting that KMS success is closely associated with KMS use for sharing and retrieval. The perceived usefulness of knowledge sharing construct in the Kulkarni et al.'s model was replaced by the perceived usefulness of KMS system factor. The new organisational factor, subjective norm, replaced co-worker and supervisor factors from the Kulkarni et al.'s KM success model. Other new factors included in the research model were culture of sharing as an organisational factor and perceived security as a system factor.

The system factors identified were KMS system quality, knowledge content quality, perceived usefulness of KMS, user satisfaction, and perceived security. The organisational factors identified were leadership, incentive, culture of sharing, and subjective norm.

Based on these factors, the KMS success model was proposed. For system factors, knowledge content quality was hypothesized to affect perceived usefulness of KMS and user satisfaction. KMS system quality was hypothesized to affect perceived usefulness of KMS and user satisfaction. Perceived usefulness was hypothesized to affect KMS use for sharing, KMS use for retrieval, and user satisfaction. User satisfaction was hypothesized to affect KMS use for sharing and KMS use for retrieval, and perceived security was hypothesized to affect KMS use for sharing.

For organisational factors, it was hypothesized that leadership affects knowledge content quality, KMS use for sharing, and KMS use for retrieval. Incentive was hypothesized to affect knowledge content quality and KMS use for sharing. Culture of sharing and subjective norm were hypothesized to affect perceived usefulness. The hypotheses for leadership and incentive were consistent with the hypotheses in the Kulkarni et al.'s (2007) model, and the hypotheses for subjective norm and culture of sharing were in the spirit of TAM2 (Venkatesh & Davis, 2000).

CHAPTER 4. RESEARCH METHODOLOGY

4.1 Introduction

This chapter justifies the overall approach to research and data collection adopted in this study, the measurement instrument development process, and the approaches to data collection and data analysis.

First, the chapter justifies the use in this study of the positivist paradigm and quantitative research as overall approaches to research, and of cross-sectional survey as a data collection method.

Then, the chapter describes the measurement instrument development process, the operationalization of constructs of the research model (the KMS success model for healthcare formulated in Chapter 3), a pre-test, a pilot study, and a formal content validity study with content experts.

This is followed by a description of the approach to data collection: the choice of the unit of analysis and of the survey sample, the associated ethical issues, and the steps involved in data collection.

The chapter concludes by presenting the details of the approach to data analysis adopted in this study: data screening, checking for bias in the data, instrument validation, and model and hypotheses testing.

4.2 Research Epistemologies

Epistemology refers to assumptions about knowledge and how it can be obtained (Becker & Niehaves, 2007). Two epistemologies that are commonly used in IS research are positivism and interpretivism. Positivism is more commonly used in IS research, while interpretivism is relatively less dominant (Goles & Hirschheim, 2000; Orlikowski & Baroudi, 1991). Mingers (2003) found that 75 percent of IS research employs a positivist approach, and 17 percent—interpretivist. Chen and Hirschheim (2004) found that 81 percent of studies in IS research were positivist.

4.2.1 Positivist Epistemology

IS research can be categorised as positivist based on the following criteria: evidence of formal propositions, quantifiable measures of variables, hypothesis testing, and inferences drawn from samples to populations (Orlikowski & Baroudi, 1991). Positivist research is based on the belief that objective data can be collected and that theories exist independently from their creators and can be tested by using objective data (Walsham, 1995).

The positivist perspective is concerned with the empirical testability of theories and with generalisable results (Chen & Hirschheim, 2004). A theory is considered acceptable only if it is repeatedly not falsified by empirical tests (Orlikowski & Baroudi, 1991). As such, a cause-effect relationship is usually presented, which enables explanation, prediction, and control of certain events and actions. Positivists believe that reality exists objectively and independently from human experiences. Positivists contend that researchers should take a value-free position and should employ objective measurement to collect research evidence.

Most commonly, a positivist approach is implemented by using quantitative research methods, such as surveys and laboratory experiments. Chen and Hirschheim (2004) reported that survey research and laboratory experiments were the dominant research designs in MIS research, accounting for 41 percent and 18 percent respectively of all MIS related studies. Surveys and laboratory experiments enable deductive, hypothetical reasoning and generalization of the results.

In brief, the positivist research usually involves relying on quantitative research designs that involve (1) formulation of hypotheses; (2) collection of quantitative data; (3) testing hypotheses against quantitative data; and (3) objective, value-free interpretation of the results of hypothesis testing. This should be contrasted with the interpretivist approach, which suggests that meanings are constructed, and thus are subjective and value-laden (Walsham, 2006). Researchers relying on interpretivism create subjective and context dependent (rather than generalisable) accounts of social reality. It is up to the readers of these interpretivist research studies to judge whether the research is relevant to the readers' contexts.

In summary, the positivist research approach is well-accepted and is in widespread use by IS researchers. Even though interpretivist research is gaining popularity, positivist research is more likely to be accepted as an objective account (Walsham, 1995).

4.2.2 Interpretivist Epistemology

A common research paradigm alternative to positivism is interpretivism. Interpretivists believe that social realities, such as organisations, groups, social networks, and information systems do not exist independently of people; they are produced and reinforced by humans through their actions and interactions (Orlikowski & Baroudi, 1991; Walsham, 2006). People exercise their agency in social contexts based on meanings that they attribute to social realities and situations. Therefore, it is assumed that scientific knowledge should be obtained through the understanding of subjective meanings and of lived experiences that lead to the construction of such meanings (Walsham, 2006). Research participants (the people under study) interpret their social worlds by constructing meanings, and at the same time, the researchers interpret the data they obtain (e.g., by interviewing or by observing the research participants). From the perspective of an interpretivist researcher, knowledge is constructed via interpretations that are inherently subjective and context bound, rather than by discovering an objective truth that is common to all.

Interpretivists attempt to attain a rich, in-depth understanding of the phenomenon examined (Orlikowski & Baroudi, 1991; Walsham, 2006). They value detail and richness in examining specific cases in their contexts over generalizability (discovering relationships that can be claimed to be true for all cases). The readers of qualitative research need to compare the context of a qualitative study with the context they are interested in to decide whether the findings of the study are likely to apply.

Interpretivist research relies on rich data obtained by observing and by interacting with the research participants. Therefore, in interpretivist research the most appropriate approach to data collection are field studies that engage researchers in the real social setting (Orlikowski & Baroudi, 1991). Moreover, the research participants in qualitative research can be seen as participating in the construction of meaning with the researcher. Participants' feedback on the research results is frequently sought and is considered as a way to improve the credibility of the research results. Using rich data, interacting with the

participants, and seeking participants' feedback allows researchers to understand the meaning embedded in human and social interaction and learn how the interaction takes place from the participant's perspective (Chen & Hirschheim, 2004).

Action research is interpretivist research that combines data collection and interpretation with action intended to address specific issues and solve problems (Stringer, 2007; Baskerville, 1999). Unlike in other types of interpretivist research, such as ethnography, where the researcher involved in a social setting aims to achieve an understanding without disturbing the setting, an action researcher is actively involved in promoting change. Because an action researcher is able to act on the setting, action research may be more effective than other interpretivist approaches (action research allows for a broader range of interactions with the participants). Action research has greater potential than other types of interpretivist research to result in benefits to participants (Stringer, 2007). At the same time, it also has a greater potential to result in harm, and therefore, an action researcher has to be particularly diligent in addressing ethical issues.

Interpretivist IS research involves researcher access to rich data about the specific organisational and IS settings investigated and analysis based on IS users, managers, or other stakeholders' viewpoints (Orlikowski & Baroudi, 1991; Walsham, 1995). According to bibliographic studies, interpretivist research is increasingly more common in Management Information Systems. In 1991, only 3.2 percent of studies employed interpretive epistemology (Orlikowski & Baroudi, 1991); however, the number of studies had increased to 17 percent by 2003 (Mingers, 2003) and to 19 percent by 2004 (Chen & Hirschheim, 2004).

One may assert that interpretivist research and positivist research rely on incommensurate paradigms and should be treated as alternatives, rather than as complementary approaches (Guba & Lincoln, 1994). Nonetheless, mixed research combining interpretivist and positivist approaches has become increasingly common (Creswell, 2012). In mixed studies, interpretivist approaches are used to explore the richness of a social setting and positivist approaches are used to obtain results that can be claimed to be generalizable to specific populations, with the two paradigms combined to complement each other.

Because interpretivist research relies on the researcher's interpretations (which are necessarily subjective), the researcher herself (or himself) is seen as a research instrument

(Corbin & Strauss, 2008). The ability of the researcher to notice patterns and issues in the data (the researcher's sensitivity) and the researcher's interpretations of such patterns depend on the researcher's background. In contrast, positivist research is designed to claim replicability—it is expected that the same results would be obtained by anyone following the research procedures correctly. Therefore, in interpretivist research accounts it is common to include information about the researcher's background. Nonetheless, even in positivist research there is an element of subjectivity (for example, the choice of the problem to study clearly is influenced by the background of the researcher). Therefore, even though the present study is positivist in its approach to research (as introduced in section 4.2.3), I have described my background as a researcher in section 1.8.

4.2.3 Choice of Epistemology

The problem addressed in this research is an insufficient understanding of the determinants of KMS' success, particularly in the healthcare field. For the results of this research to be of relevance to practice, it is desirable that they are seen as objective and as generalizable to a well-defined population, suggesting a positivist approach to research. Moreover, since most of the prior research on KMS success relied on a positivist paradigm, using a similar approach to research in this study enables a comparison of the determinants of KMS success in healthcare discovered in this study with the results of the prior studies, thus making sense of the results.

Nonetheless, one may also provide a strong argument for using an interpretivist approach. An in-depth study of several carefully selected organisations (a multiple case study, Yin, 2009) would also be of relevance to practice because the readers would compare the organisations covered by the study with the organisations they are interested in and decide themselves if the results are applicable. Further, an action research study involving the researcher actually participating in implementing a knowledge management system at a healthcare organisation could result in deep insights that cannot be obtained via simple observations or interviews of the participants, let alone via a self-administered survey questionnaire.

Ultimately, an important factor in choosing the positivist research paradigm for the present study was access to research participants and my background as a researcher (introduced in section 1.8).

If I were an actively employed health practitioner, I would have access to a suitable research context—my own organisation—and would have professional connections facilitating entry into other health organisations. Indeed, I would have opportunities to conduct action research as someone already actively involved in the target setting. I would have to address, however, the ethical issues around the possibility of a conflict of interest. I would also have to address the issues around analytical sensitivity (Corbin and Strauss, 2008)—as a member of the social setting I might be taking for granted aspects that are not obvious and are of interest to the readers of the research. Moreover, as a member of the social setting I would run the risk of emotionally overidentifying myself with the participants, a problem known as “going native” (Corbin and Strauss, 2008, loc 1261). Nonetheless, if I had the experience of working as a health practitioner, it would make it easier for me to establish rapport with the research participants and to access the research settings without disturbing the participants, and I would be able to rely on my knowledge of the domain to plan interviews and observations to get interesting and relevant data.

Not having any experience at all working as a health practitioner and not having any connections that could facilitate entry into health organisations, I concluded that adopting an interpretivist approach was not a real possibility and opted to use a positivist approach.

4.3 Choice of Data Collection Method

Most common research methods used in positivist research are experiment, positivist multiple case study, and survey. Experiments allow researchers to test cause-effect relationships by manipulating variables. In research involving KMS in real organisations, experiments are not feasible because of resource and ethical considerations.

In a positivist multiple case study, the researcher focuses on a small number of units of analysis, but studies each of them in greater detail, using multiple sources of data, both quantitative and qualitative. A multiple case study approach was not feasible for this research because the researcher did not have access to suitable organisations.

Survey research involves the systematic gathering of information from a number of individuals, groups, organisations, or communities, known as a sample, which reflects the characteristics of a larger population (Sekaran & Bougie, 2010). Surveys have several advantages (Newsted, Huff, & Munro, 1998). Responses can be generalized to other members of the population studied and often to other similar populations. Survey questionnaires can be reused easily and provide an objective way of comparing responses over different groups, times, and places. Survey data enables the objective testing of theoretical propositions by testing the hypothesised relationships between variables using statistical analysis. However, the limitation of survey research is that it lacks richness.

A survey was suitable as a data collection method for this research because the procedures involved in testing research models similar to the KMS success model for healthcare formulated in this study (see Figure 3-1) are well understood. The contact details of the potential respondents were easily available, and the ethical issues involved were well understood and did not present an obstacle for the study. The budget necessary for mailing the questionnaires was available. By using a survey, it was possible to collect data from a wide range of respondents selected from a well-defined population, thus ensuring the generalisability of the results.

Data collection for survey research can be either cross-sectional or longitudinal. Cross-sectional designs involve data collection at a single point of time. Longitudinal designs involve collecting data from the same participants more than once, over a period of time. Longitudinal designs allow more confidence regarding distinguishing causes from effects. For example, if data were collected for the factors in the research model in Figure 3-1 at one point in time and then data were collected for the outcome variables at a later point in time, there would be more certainty that the factors caused the outcomes, and not the other way round.

Longitudinal survey design has disadvantages that prevented its use in this study. Longitudinal design takes a longer time to complete, and there were tight deadlines for the completion of this research. Moreover, longitudinal research entails additional risks, because the respondents in the first round of data collection may not wish to participate in the second round. Thus, the researcher risks not getting sufficient responses to conduct statistical analysis. This risk was not acceptable in this research, because the deadlines meant there would be no time to repeat data collection in case of the failure of the initial

attempt. Finally, it is more expensive to contact the respondents more than once, particularly considering that the initial number of participants in longitudinal research has to be large enough to offset the attrition of the respondents in the second round.

Because of time constraints and limited resources, this research employed a cross-sectional survey.

4.4 Instrumentation

This section discusses the survey instrument development process. The instrument development processes in this study was based on the guidelines by Churchill (1979) and Lewis, Templeton and Byrd (2005). The process involved three steps: conceptualization, validation, and use (see Figure 4-1).

In the conceptualization step, construct definitions and initial items were formulated for the constructs in the model (see Figure 3-1). When acceptable quality measures were available in the literature, the items from the existing measures were reused. For KMS use for sharing, KMS use for retrieval, and for culture of sharing no existing measures were available. Therefore, for KMS use for sharing and KMS use for retrieval items were generated based on the understanding of the construct content gained from the literature. For culture of sharing, items were formulated based on the list of organisational culture attributes found to be particularly relevant to knowledge sharing and to KMS use in the study by Park et al. (2004).

For the rest of the constructs, items from measures used in prior studies were adopted with very few adaptations. To ensure content coverage and content fit to the domain of KMS success in healthcare, when formulating a measure of a construct the relevant items were combined from more than one prior study.

In the validation step, a pre-test was conducted with a group of PhD students. The purpose of the pre-test was to detect any problems with structure and readability of the questionnaire. The pre-test was followed by a pilot test with several health informatics experts to gather initial feedback on the appropriateness of the items included. Finally, a formal content validity survey was conducted on 30 health informatics and KM experts.

Churchill (1979) and Lewis et al. (2005) recommended that to reduce the risk of bias, before a measure is used for hypothesis testing, it should be pilot tested with a separate data set to confirm that its psychometric properties are sound (e.g., in terms of convergent and discriminant validity). Ideally, any adjustments to the measure should be limited to this pilot test with real data, and when the measure is used for hypothesis testing, it should not be modified (e.g., low loading items should not be dropped). In practice, MIS studies rarely involve pilot testing of measures with real data because of resource constraints. This study followed the common practice, and did not pilot test the instrument with real data in a separate step. Rather, minor adjustments to measures (such as dropping low loading items) were applied, based on the main data set that was also used for hypotheses testing. Thus, final adjustments to the measurement instrument were applied at the stage of using the instrument. As the adjustments were minor, it is believed that the risk of any bias was negligible.

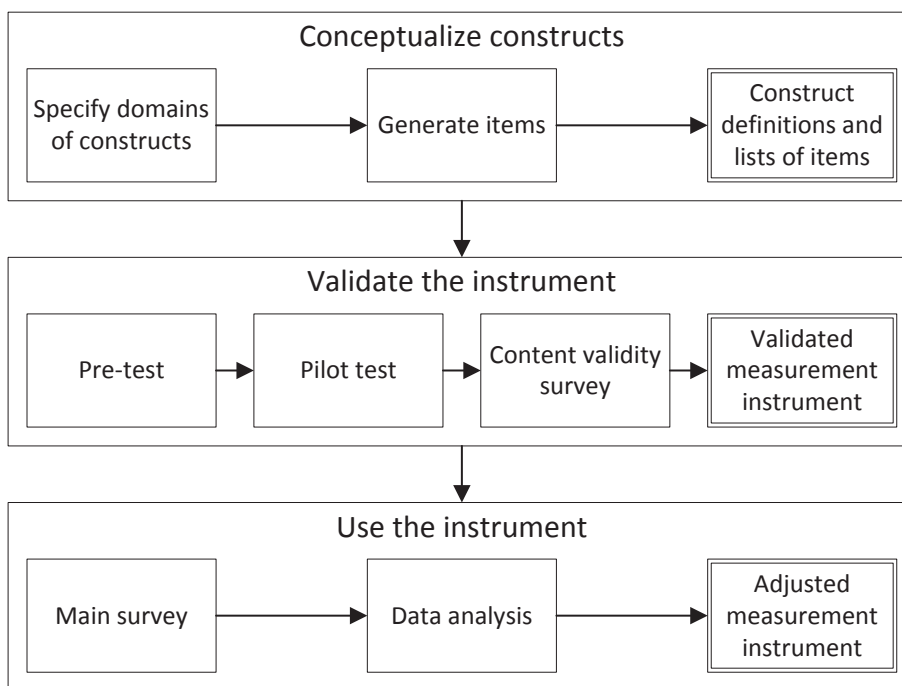


Figure 4-1. Instrument development, validation, and use.

The rest of this section is organised as follows. Subsection 4.4.1 discusses the operationalisation of constructs. The design of the survey questionnaire and the questions relating to demographic details of the respondents are covered in subsection 4.4.2. Validation of the questionnaire prior to data collection is presented in subsection 4.4.3.

4.4.1 Operationalization of Constructs

Outcome variables and factors introduced in sections 3.3 and 3.4, respectively, were operationalized by using items reflecting their content.

When existing measures were available, they were reused. For each measure, items were examined and, when needed, reworded to make them fit the context of the study. When more than one measure was available for a given construct, a measure with the best content fit was adopted as a base. The remaining measures were also reviewed, and items corresponding to relevant content that was not accounted for in the adopted base measure were added. The resulting adjusted measure was reviewed for items with nearly identical meaning, and, following the recommendation by Clark and Watson (1995), redundant items were eliminated to ensure that each item in a meaningful way contributed to the content of the measure.

The items for all of the measures, with references to the literature sources from which they were derived (when applicable), are listed in Appendix F. In the rest of this section, I discuss in detail the operationalizations of the KMS use for retrieval, KMS use for sharing, and culture of sharing constructs for which no suitable existing measures were available in the literature, and therefore, measures were constructed in this study.

4.4.1.1 Operationalization of KMS Use

This section discusses the operationalization of the KMS use for sharing and KMS use for retrieval constructs. The constructs were introduced in section 3.3.

Previous studies used a generic KMS use construct with items making no clear distinction between knowledge sharing and knowledge retrieval activities. The present study used separate constructs for KMS use for sharing and KMS use for retrieval. Because the existing instruments were not specific to either sharing or retrieval, the items specific for knowledge sharing and knowledge retrieval were generated based on the descriptions of the concepts of knowledge sharing and knowledge retrieval in the literature.

The activities involved in knowledge sharing and knowledge seeking were identified from the literature (as listed in Table 4-1), and used the list of activities as the basis for formulating the items. The wording of the items followed the pattern used by Doll and

Torkzadeh (1998) in developing a measure of system use and started all items with the expression “I use KMS to”. The resulting items are listed in Table 4-2.

Section 2.2.1.3 distinguished between repository and network models of KMS, which focus, respectively, on sharing explicit and tacit knowledge. (One can contribute knowledge to a repository, or communicate with experts available in a directory of experts, or one can retrieve knowledge from a repository, or access knowledge from the experts available in an expert directory). The measures of KMS use for sharing and KMS use for retrieval constructs presented in Table 4-2 account for both of the models.

Table 4-1 *Sharing and Retrieval Activities*

Activity	Sources
Sharing	
Communicate knowledge	Wu & Wang (2006)
Discuss/exchange ideas, experiences and expertise	Nielsen & Ciabuschi (2003), Kwan & Balasubramanian (2003)
Contribute ideas/feedback	Nielsen & Ciabuschi (2003)
Participate in discussion groups	Nielsen and Ciabuschi (2003), Pan & Leidner (2003)
Collaborate with colleagues	Alavi & Leidner (2001), Alavi & Tiwana (2002), Nielson & Ciabuschi (2003)
Retrieval	
Access knowledge for decision making	Kwan & Balasubramanian (2003)
Retrieve knowledge for problem solving	Davenport & Prusak (1998), Earl (2001), Kwan & Balasubramanian (2003)
Retrieve knowledge to improve the quality of work	Pan & Leidner (2003)
Connect to the experts (identify and locate the experts)	Earl (2001), Hansen (1999)
Retrieve knowledge to help employees be more innovative	Alavi & Leidner (2001)

Table 4-2 *Operationalization of KMS Use for Sharing and KMS Use for Retrieval*

Item code	Item wording
KMS Use for Sharing	
KMS_Sh1	I use KMS to communicate knowledge with colleagues
KMS_Sh2	I use KMS to contribute ideas and/or feedback
KMS_Sh3	I use KMS to participate in discussion groups
KMS_Sh4	I use KMS to discuss and/or exchange ideas/views/experiences with colleagues
KMS_Sh5	I use KMS to collaborate with colleagues (e.g. to be part of workflow process)
KMS_Sh6	I use KMS to distribute knowledge (e.g. news, memos, reports, presentation, or organisation policies)
KMS Use for Retrieval	
KMS_R1	I use KMS to retrieve knowledge for decision making
KMS_R2	I use KMS to retrieve knowledge to solve my job-related problems
KMS_R3	I use KMS to retrieve knowledge that can help me improve the quality of my work
KMS_R4	I use KMS to identify and locate people for knowledge and expertise
KMS_R5	I use KMS to retrieve knowledge that can help me to be innovative

4.4.1.2 Operationalization of Culture of Sharing

This section discusses the operationalization of the culture of sharing construct. The construct was introduced in section 3.4.2.2.

The measure for culture of sharing (see Table 4-4) was based on the study of attributes of organisational culture by Park et al. (2004). Park et al. conducted a survey to rank organisational culture attributes derived from the organisational culture profile framework (introduced in section 2.3.2) according to their relevance to promoting knowledge sharing and KMS success. Highly ranked attributes were consistent with the discussion of aspects of organisational culture relevant to KMS success by Alavi et al. (2006).

Table 4-3 *Attributes Contributing to Culture of Sharing*

Code	Attribute
C1	Team-oriented work
C2	Working closely with others
C3	Sharing information freely
C4	Trust
C5	Supportive of employees

The items for culture of sharing were formulated based on the five attributes of organisational culture ranked the highest in the study by Park et al. (2004) (listed in Table 4-3). The resulting measure is presented in Table 4-4.

Table 4-4 *Operationalization of Culture of Sharing*

Item code	Item wording
CS1	Our organisation supports a culture where team-oriented work is valued.
CS2	Our organisation supports a culture where sharing information freely is valued.
CS3	Our organisation supports a culture where being supportive of employees is valued.
CS4	Our organisation supports a culture where working closely with others is valued.
CS5	Our organisation supports a culture where trust is valued.

4.4.2 Questionnaire Development

4.4.2.1 *Presentation of the Items*

A seven-point Likert-type scale (1 “Strongly Disagree”, 2 “Disagree”, 3 “Slightly Disagree”, 4 “Neutral”, 5 “Slightly agree”, 6 “Agree”, 7 “Strongly Agree”) was used for all items operationalizing constructs. A similar scale was used by previous KMS success studies (Hwang et al., 2008; Wu & Wang, 2006).

The questionnaire contained only closed questions. The definition of KMS was included (as given in section 2.2.1.3) to ensure that the respondents correctly interpret the

questionnaire items. The questions were separated into eleven sections, with each construct given a separate section. The last section collected demographic information.

4.4.2 Demographic Information

Demographics questions were about age, gender, number of years of computer experience, number of years of working experience, number of years in the current organisation, and the respondent's department. Demographic information was used to test for non-response bias by comparing early and late respondents and to get the feel of the data.

4.4.3 Validation Process

4.4.3.1 Pre-test

The questionnaire was pretested with a group of information systems PhD students to collect feedback on the overall structure of the questionnaire. The pre-test respondents were asked to complete the instrument first and then provide feedback on matters such as format, content, understandability, terminology, and ease and speed of completion, as recommended by Lewis et al. (2005). Several minor mistakes were detected, spelling errors and duplication of items. The questionnaire was refined accordingly. Using the refined questionnaire, a pilot test was undertaken to further purify the instrument.

4.4.3.2 Pilot study

The pilot study was conducted with respondents similar to the target population. Three people with experience in health were asked to complete the questionnaire and to offer suggestions for improvement, such as adding items they felt were missing. The addition of one item relating to the role of leadership in providing the funding was suggested. This item was then added to the measure of the leadership construct. Overall responses suggested that the items adequately covered the content of their constructs.

4.4.3.3 Content Validation

Content validity of the measurement instruments was further tested in a formal content validity test, to ensure that measurement items reflect all of the important aspects of their constructs (Boudreau, Gefen, & Straub, 2001). This study used a quantitative approach

involving a content evaluation panel consisting of subject matter experts—individuals knowledgeable about healthcare and knowledge management. By using a quantitative approach (rather than a qualitative approach), I was able to include a large number of experts and could take into account their judgements objectively.

A quantitative approach developed by Lawshe (1975) was employed. Lawshe's approach uses the content validity ratio (CVR) to quantify the degree of consensus among experts to assess the content validity of items. Lawshe's quantitative approach has been successfully applied to validate content validity of information resource management instruments (Lewis, Snyder, & Rainer, 1995).

The content validity study involved preparing a content validity questionnaire, identifying subject matter experts, applying for ethical approval from Massey University Human Ethics Committee, and sending the questionnaire packet to the subject matter experts.

The content validity questionnaire included descriptions of constructs, with items listed under their constructs. The subject matter experts were asked to rate each item's relevance to the content domain of its construct using a scale from 1 to 3: (1) not relevant, (2) important (but not essential), and (3) essential. As additional information, the subject matter experts were asked to provide free-text feedback for the construct and for the items, or to suggest any new items in the space provided. The culture of sharing and the subjective norm constructs were not covered by the content validity study; the experts involved in the content validity study were not seen as experts in distinguishing between these two constructs (for a discussion of the content of these constructs refer to section 2.3.2).

The subject matter experts were chosen from both industry and academia. It is recommended to have at least three experts on the panel. However, a larger number is better as it allows access to a broader range of expertise and addresses the risk that some of the experts do not respond (Rubio, Berg-Weger, Tebb, Lee, & Rauch, 2003). The total number of subject matter experts in this study was thirty. Five were chosen based on their research in the area of KM, twenty were randomly chosen from the list of presenters at Health Informatics New Zealand Conference 2009 (HINZ2009), and five were researchers who have published papers in the areas of KMS in healthcare and KMS success in top ranking journals such as *Information and Management Journal* and *MIS Quarterly*, or at

peer-reviewed conferences. The subject matter experts were from New Zealand, USA, and Malaysia.

The questionnaire was sent by email to the potential respondents with known email addresses and to the rest by post. The questionnaire packet consisted of a cover letter with a web link to the online version of the questionnaire, information sheet, and the content validity questionnaire (as a hard copy or as a Word document). The respondents had a choice to use the on-line version of the questionnaire or the alternative.

Massey University ethics approval procedures were followed. Low risk notification was submitted to Massey University Human Ethics Committee.

Out of the thirty potential participants contacted, 17 responded. One respondent did not rate the items, but did provide comments on how to revise the measures. The response rate was 53 percent. Sixteen panellists responded and completed the form. A panel of sixteen experts is within the range recommended for content validity studies in methodological literature (Rubio et al., 2003). To determine whether an item has content validity, a content validity ratio (CVR) was computed for each item. The content validity ratio indicates the degree of consensus among the experts.

Although Lawshe (1975) utilized only the “essential” response category in computing the CVR, following the suggestion by Lewis et al. (1995), a less stringent criterion was employed to compute CVR in this study. This was because the categories of both “important (but not essential)” and “essential” mean that the items are considered to be relevant to the content of their constructs. Responses that did not provide a rating on a given item were not used in the calculation of the CVR for that item.

A content validity ratio (CVR) was computed for each item from the following formula:

$$\text{CVR} = \left(\frac{2N_e}{N} \right) - 1, \quad (1)$$

where CVR is the content validity ratio, N_e is the number of panellists rating the item as either “3 = essential” or “2 = important (but not essential)”, and N is the total number of subject matter experts who rated the item.

The total number of subject matter experts in this content validity study was 16. According to a table in Lawshe (1975, p. 568), the minimum CVR value required for an item to be acceptable when 16 subject matter experts are involved is 0.50. That means that if the number of subject matter experts in the panel is 16, for an item to be judged as having content validity at least 12 of the subject matter experts need to rate the item as acceptable.

A summary of the CVR values is provided in Table 4-5. Overall, 66 items out of the 71 included in the content validity study met the criterion for content validity.

Table 4-5 *Content Validity Ratios (CVRs)*

CVR	Number of items
0.90-1.00	17
0.80-0.89	20
0.70-0.79	16
0.60-0.69	12
0.50-0.59	1
0.40-0.49 ^a	2
0.30-0.39 ^a	1
0.20-0.29 ^a	1
0.10-0.19 ^a	0
0.00-0.09 ^a	1

^aDo not meet the criterion for content validity.

Five items, four from the incentive construct and one from the perceived security construct, did not meet the criterion for inclusion according to the CVR value. Table 4-6 presents the CVR value for each item in the constructs incentive and perceived security.

After considering item and construct content, I decided to drop the item that did not meet the formal criterion for inclusion from the perceived security construct. However, the items for incentive that did not meet the formal criteria for inclusion were retained because, based on the understanding of the incentive construct gained from the literature, it was concluded that they are important.

Table 4-6 *Original Items for Incentive and Perceived Security*

Construct	Item	CVR
Incentive	I will receive financial incentives (e.g. higher bonus, higher salary) in return for my knowledge sharing.	0.07 ^a
	I will receive increased promotion opportunities in return for my knowledge sharing	0.38 ^a
	I will received increased job security in return for my knowledge sharing	0.25 ^a
	Knowledge sharing is built into and monitored within the appraisal system.	0.43 ^a
	Generally, individuals are rewarded for teamwork.	0.62
Perceived Security	I believe that the knowledge I share will not be modified by inappropriate parties.	0.87
	I believe that the knowledge I share will only be accessed by authorized users.	0.88
	I believe that the knowledge I share will be available to the right people.	0.88
	I believe that people in my organisation do not use unauthorized knowledge.	0.73
	I believe that people in my organisation use other's knowledge appropriately.	1.00
	I believe that KMS have mechanisms to avoid the loss of critical knowledge.	0.88
	I believe that KMS have mechanisms to protect knowledge from being stolen.	0.47 ^a
	In my opinion, top management in my organisation is entirely committed to security.	0.87
Overall, I have confidence in knowledge sharing via KMS.	1.00	

^aItems that did not meet the formal criterion for inclusion.

4.5 Sampling Design and Unit of Analysis

The target participants were doctors practicing in Hamilton and Wellington (two mid-size cities in New Zealand). Contact details were obtained from the New Zealand Medical Council database. Doctors, who are the key members in healthcare organisations, are more suitable for this study than other healthcare workers because their jobs are particularly knowledge-intensive, and they are the principal professional group in hospitals (Habersam & Piber, 2003; Ryu et al., 2003). Furthermore, the contact details of doctors were accessible while other employees' contact details such as those of nurses and administrators were not available.

Based on Sekaran and Bougie (2010), a good sampling frame is a list of population members that is regularly updated, where the information is readily accessible and convenient to access. The New Zealand Medical Council database (accessible online) fulfilled these criteria. The information available from the database that was useful for this survey were the names of doctors, their addresses, and whether they have an annual practice certificate that enables them to practice. The New Zealand Medical Council database is updated every six months and therefore, the information available in the database was up-to-date.

To participate in the survey, the participants needed to have some experience in using KMS. To confirm whether the participants had experience in using KMS, a preliminary survey was conducted with Chief Information Officers (CIOs) of District Health Boards (DHBs) (see Appendix A). Based on the input from the CIOs, their organisations used information technologies such as electronic mail, document management systems, video conferencing, and electronic discussion forums to share knowledge. It was expected that doctors would use these technologies to share and to access knowledge.

From the list, the potential participants were chosen based on the following criteria:

- Only doctors who have an annual practice certificate and reside in New Zealand were included in the sample (the New Zealand Medical Council database includes contact details of doctors who are registered but no longer live in New Zealand).
- Due to the time constraints and limited budget of the researcher, the survey did not cover the whole population of doctors in New Zealand. The study focused on doctors in Hamilton and Wellington, two mid-size cities in New Zealand, with population of doctors (according to the database) of 525 and 639, respectively.

In choosing the number of potential respondents to include in the sample, a number of conditions were set. First, this was based on the minimum response rate of 20 percent acceptable for a survey (Yu & Cooper, 1983). Second, the sample size was based on the heuristics proposed by Chin (1998b). Chin suggested that for PLS analysis, which was used in this study, the overall number of responses should be 10 times the maximal number of independent variables for a dependent variable in the model. Based on this calculation, the minimum number of responses required for this study was 50 (and thus, assuming 20 percent response rate, the sample size should be 250). Third, the number of potential

respondents was chosen based on the previous studies of KMS success using models of similar size. In the study by Ryu et al. (2003), the sample size was 1000. Based on these criteria, the target sample size for this study was 1000 (which was considerably larger than the sample size of 250 implied by the Chin's heuristics). Thus, the total population of doctors at Hamilton and Wellington fulfilled this requirement and was sufficient for conducting the survey.

4.6 Ethics

To conduct this study, a number of ethical issues were considered. The information collected from the participants was kept confidential and only aggregated results were reported. The participation was voluntary. Data collected for this study was used solely for this research. These ethical issues were elaborated on in the information sheet given to the participants. To ensure that the standards of ethics are maintained, ethics approval was sought from the relevant committee.

The process of seeking ethics approval began by contacting Massey University Human Ethic Committee. Then, the steps summarized below were followed:

1. The researcher filled in a screening questionnaire. The answers suggested that this research required the ethics approval from New Zealand Health and Disability Ethics Committee.
2. The next step was to contact New Zealand Health and Disability Ethics Committee for advice on the types of application that were relevant to this research by providing information about this research including the objectives, the participants, and the methods used.
3. Based on the advice from New Zealand Health and Disability Ethics Committee, the researcher submitted an application under the category of expedited review, which takes two to three weeks to be processed. Together with the application, the researcher submitted an information sheet explaining the proposed research and the ethical procedures to be followed, the questionnaire to be used as a research instrument, cover letter, and a description of the study protocol. Two copies of the application were sent to New Zealand

Health and Disability Ethics Committee, and one copy was sent to Massey University Human Ethics Committee as a notification.

4. The process of obtaining approval took two weeks, and the researcher was informed via email that the research was approved.
5. The researcher received an official approval notification by New Zealand Health and Disability Ethics Committee, which included the approval reference number. This number was then included in the information sheet that was sent to the participants of the research.

4.7 Data Collection Procedures

Once the ethics approval was granted, the researcher proceeded with data collection. A mail survey (which included a link to a web-based version of the survey) was employed in this study as a data collection method. The details of the survey design and administration are described in the rest of this section.

4.7.1 Approach to Data Collection

The information provided in the New Zealand Medical Council database contained only names and addresses of doctors, and no telephone numbers or email addresses. Therefore, telephone and email surveys were not the appropriate methods for this study. Face-to-face interviews were not a viable option for this study because it is time consuming to collect large amounts of data using face-to-face interviews, and considerably more costly compared to a self-administered questionnaire (particularly, taking into account that the participants were at remote locations). Furthermore, due to the busy schedules of doctors, it is hard to arrange appointments with doctors to conduct face-to-face interviews. A self-administered questionnaire allows doctors to respond at a time that is convenient for them. The reading and writing skills among doctors are high, and therefore, are not a barrier to using a self-administered questionnaire. In terms of the question form, this research required answers to closed questions, which can easily be administered using a self-administered questionnaire. Therefore, mail survey was the most appropriate approach to for this study.

Although the response rate for mail surveys has been reported as low (Fowler, 2009), follow-up letters can be used to increase the response rate. Through the mail survey, the respondents were also given access to a web-based version of the survey as an alternative option for responding to the questionnaire, which was expected to further increase the response rate. A respondent who had access to the Internet could use the web-based survey as an alternative way of responding. Offering both mail and web-based survey as data collection methods enabled the respondents to respond to the questionnaire using their preferred approach (on paper or online).

4.7.2 Survey Administration Procedures

The survey administration started on 30 October 2010 and was completed on 15 December 2010. The questionnaire was sent by post. A questionnaire packet containing a cover letter, an information sheet explaining the details of the study and the ethics approval reference number, a hard copy of the questionnaire, and a self-addressed prepaid return envelope were sent to individual respondents.

The cover letter described the purpose of the study and promised confidentiality. The cover letter also emphasized the importance of doctors' participation in this study. Included in the cover letter was also a link to the web-based version of the survey and a unique token needed to access the web-based survey (used to track responses).

To track responses in the mail version of the survey, each questionnaire had an identifying code, which was put on the return envelope. All responses were treated as confidential.

4.7.3 Survey Follow-up Strategies

To increase the response rate, follow-ups were conducted (Fowler, 2009; Yu & Cooper, 1983). There were two follow-ups. The first was made ten working days after the first mail-out by sending a reminder letter. The second was made ten working days after the first follow-up by sending a second reminder letter and an extra copy of the questionnaire packet. Both follow-ups were sent using the postal service. As expected, the number of responses increased after each follow-up.

4.7.4 Response Rate

Out of 1,164 questionnaires distributed via mail to individual doctors, a total of 117 questionnaires were returned undelivered. A total of 293 responses were received by mail and online after two follow-ups. As expected, the response rate increased after each follow up. Out of the 293 questionnaires received, 30 questionnaires were returned blank, leaving only 263 usable questionnaires involving 100 respondents from Hamilton and 163 from Wellington. This yielded a response rate of 25 percent. A summary of the sample size and response rate is presented in Table 4-7.

Table 4-7 *Response Rate*

Results	Number of questionnaires	
	Mail	Online
Total sent	1164	
Undeliverable	117	
Responses after first mail out	104	18
Responses after first reminder	55	22
Responses after second reminder	63	31
Returned blank	9	21
Total usable returned questionnaires	263 (25%)	

In IS research, a response rate of 20 percent or better is desirable and considered to be acceptable (Cornford & Smithson, 1996; Yu & Cooper, 1983). Achieving a high response rate in a survey of doctors is often a challenge. Surveys of doctors reported in IS literature had response rates from 19 percent (Yi et al., 2006) to 74 percent (Yi et al., 2006). Due to the time constraints and pressures on people in such positions, the response rate of 25 percent obtained in this study was judged satisfactory and acceptable.

Of this 25 percent response rate, only 5 percent was from web-based survey. This result is consistent with a previous study, which reported that doctors do not respond as well to web-based surveys as they do to more traditional methods, such as paper-based surveys (Aitken, Power, & Dwyer, 2008).

4.8 Data Screening and Cleaning

Verifying the quality of empirical data is necessary before proceeding to the data analysis stage (Lewis et al., 2005). This section discusses data screening and cleaning.

4.8.1 Checking for Accuracy of Data Entry

Prior to the data analysis stage, data were examined for errors that may have occurred during data entry. By using PASW software, data were screened by checking each variable to see whether any values were out of range. No out of range values were discovered.

4.8.2 Checking for Missing Data

There were some missing data in the responses. Missing data were examined following the suggestion by Hair, Black, Babin, Anderson, and Tatham (2006). Hair et al. suggested that variables or cases with 50 percent or more missing data should be deleted. In the present study, the percentage of missing data was below 30 percent for all cases. As the percentage of missing data was below 50 percent, the missing data were treated as ignorable and all the cases (a total of 263) were kept for analysis. In the data analysis, mean replacement was used to deal with missing data.

4.8.3 Checking for Outliers

Outliers are values that are unusually higher or lower than other values in the data set. Tabachnick and Fidell (2007) define outliers as cases that have a standardized residual in the scatterplot of more than 3.3 or less than -3.3. Based on a scatterplot, there were six cases of extreme values. To check whether these cases were likely to influence the results for the model as a whole, the value for Cook's distance was checked. According to Tabachnick and Fidell (2007), cases with values larger than one are a potential problem. The maximum value for Cook's distance was 0.083, suggesting no major problems. Therefore, no cases were removed as outliers.

4.9 Potential Sources of Bias

This section discusses non-response bias, sample representativeness, and common method bias.

4.9.1 Non-response bias

The non-response bias occurs when people in the survey sample who do not respond have relevant characteristics that differ from those who do respond (Dillman, Smyth, & Christian, 2009). In this study, the non-response bias was assessed by comparing early and late respondents to verify if there are statistically significant differences between them (Igbaria & Tan, 1997). The rationale is that late respondents are likely to resemble non-respondents (Urbach & Ahlemann, 2010). To compare whether there were statistically significant differences between early and late respondents, the Mann-Whitney U test was used (Pallant, 2011). No statistically significant differences were discovered (the details of the analysis are presented in section 5.3.1).

4.9.2 Sample Representativeness

Another potential source of bias is a systematic difference between respondents and the full population because of the choice of the sample (or due to non-response bias). If doctors in Wellington and in Hamilton are very different from their counterparts in the rest of New Zealand, the results of this study cannot be generalized to the whole country. The age and gender data for all doctors in New Zealand were available in the literature (Medical Council of New Zealand, 2010). Age and gender of the respondents and in the total population were compared using chi-square and *t*-tests (Pallant, 2011). No evidence of bias was found (the details of the analysis are presented in section 5.3.2).

4.9.3 Common Method Bias

Common method variance is another common source of bias; it may occur when data for dependent and independent variables are obtained by using the same method, such as via

the same survey questionnaire (Podsakoff & Organ, 1986). The problem arises when data used to measure two or more variables are collected from the same respondent and an attempt is made to interpret correlations among them. The correlations may reflect the respondents' subjective opinions about the relationships rather than their objective reality. In this study, Harman's one-factor technique was used to test for bias due to common method variance (Podsakoff & Organ, 1986). No evidence of common method bias was discovered (the details of the analysis are presented in section 5.3.3)

4.10 Instrument Validation

After the evaluation of data quality, and prior to testing the hypotheses, it is highly recommended that instruments are validated to avoid problems with interpreting results and to obtain a good quality of research. Straub, Boudreau, and Gefen (2004) argued that the scientific basis of the MIS field is at risk without solid validation of measurement instruments. Therefore, this study employed both pre-data collection validation (via the content validity study discussed in Section 4.4.3) and post-data collection validation. Post-data collection validation involved reliability (item reliability and internal consistency) and construct validity (convergent and discriminant validity) checks (Straub et al., 2004).

This section introduces the reliability and validity checks. These checks in the context of PLS analysis are discussed in section 4.11.4. The results of the analysis are presented in Chapter 5.

4.10.1 Item Reliability

Item reliability describes the extent to which each item correlates with the estimate of the latent construct (Gefen, Straub, & Boudreau, 2003). Item reliability is assessed by examining the item's loading on its construct. There are several recommendations for the cut-off point values for item loadings. Hair et al. (2006) suggested the rule of thumb that item loadings greater than 0.30 should be considered as noticeable; loadings greater than 0.4—as important; and loadings of 0.50 or greater—as very important. However, Chin (1998a) suggested that when using the PLS technique, item loadings should be greater than 0.70 to be satisfactory.

4.10.2 Internal Consistency Reliability

Internal consistency refers to items in a measure changing consistently enough to be reflecting the same construct (Straub et al., 2004). The statistic most often used to evaluate internal consistency is Cronbach's alpha. Recently, this technique has been supplemented by composite reliability assessed in structural equation modelling (Chin, 1998b). While Cronbach's alpha assumes that all items are equally reliable, composite reliability (CR) takes into account that items have different loadings. In Partial Least Square (PLS) path models, it is recommended that CR is used to assess internal consistency reliability (Chin, 1998b).

4.10.3 Convergent Validity

Convergent validity refers to the extent to which a measure of a construct reflects agreement between different measures of the same construct (Straub et al., 2004). Major approaches used to assess convergent validity are multitrait-multimethod matrix (MTMM) (Churchill, 1979) and confirmatory factor analysis (CFA) (Straub et al., 2004). MTMM analysis requires that data is collected using more than one method (for example, interview and questionnaire) and involves using different methods to measure the construct (trait), which is often not feasible in practice. An alternative to MTMM is CFA, which is based on assessing the fit of measurement models with latent variables according to a range of criteria (Bagozzi, Yi, & Phillips, 1991).

As this study only used one method of data gathering, survey, CFA (using PLS) was used (Straub et al., 2004). The details are explained in Section 4.11.4.3.

4.10.4 Discriminant Validity

Discriminant validity refers to the extent to which items used to measure a given construct reflect this construct, rather than other constructs in the same model (Hulland, 1999; Urbach & Ahlemann, 2010). Similar to convergent validity, MTMM can be used for assessing discriminant validity (Churchill, 1979). However, as mentioned earlier, in most

studies it is not feasible for IS researchers to use MTMM in practice. Therefore, CFA was the alternative technique used to test discriminant validity in this study.

4.11 Analysis Techniques

This section introduces the approaches used for data analysis. The results of the analysis are presented in Chapter 5.

4.11.1 Exploratory Factor Analysis

An exploratory factor analysis was conducted to examine the factorial structure of multi-dimensional constructs (Churchill, 1979). Steps involved in conducting exploratory factor analysis were assessment of the suitability of the data for exploratory factor analysis, factor extraction, and factor rotation using oblimin (Pallant, 2011). The suitability of the data for factor analysis was assessed using the Kaiser-Meyer-Olkin measure of sampling adequacy (KMO) and the Bartlett's test of sphericity. The minimum recommended value for KMO is 0.60 ($KMO > 0.60$) (Pallant, 2011). The Bartlett's test of sphericity should be statistically significant at $p < 0.05$, suggesting a sufficient sample size. For factor extraction, principal components analysis (PCA) was used to extract (identify) the factors underlying the constructs under study. The rotated solution was used to interpret the components that had been extracted, based on the pattern of loadings.

4.11.2 Structural Equation Modelling

For the purposes of testing the measurement and the structural model suggested by the research model (as introduced in section 3.5, see Figure 3-1) and by the operationalizations of constructs (introduced in section 4.4.1), Structural Equation Modelling (SEM), Partial Least Square (PLS) approach, was employed in this study. PLS SEM is used extensively in IS research (Gefen et al., 2003).

SEM supports the testing of models involving latent variables (also referred to as latent constructs). Latent variables are used to represent theoretical constructs that are relevant to

understanding a domain of interest but that cannot be measured directly (Bentler, 1980). Latent variables are measured by using indicators—observable variables that reflect their values.

A SEM model consists of two sub-models: (1) the structural model (or inner model); and (2) the measurement model (or outer model) (Chin, 1998b). The structural model consists of the relationships between latent variables, which are derived from theoretical considerations. For each of the latent variables in the structural model, a measurement model has to be defined. The measurement model shows the relationships between a latent variable and its items. Measurement models for all latent variables taken together compose the overall measurement model. The combination of the structural model and the overall measurement model is a complete structural equation model.

Variance-based SEM (PLS) or covariance-based SEM can be used to test measurement and structural models. Covariance-based SEM (used by the well-known LISREL software package), offers a number of measures of overall model fit. Variance-based SEM does not offer a measure of overall fit, and the model fit is judged by the amount of variance explained in dependent variables (R^2) and by statistical significance and magnitudes of path coefficients describing the strengths of the hypothesised cause-effect relationships between latent variables.

Covariance-based SEM uses an estimation approach called maximum likelihood (ML), which assumes data to be multivariate normal and requires large numbers of cases (Barclay, Higgins, & Thompson, 1995; Geffen et al., 2003). On the other hand, PLS is a distribution-free approach to parameter estimation and thus, multivariate normality is not necessary for PLS (Chin, Marceline, & Nsted, 2003). Another advantage PLS has over covariance-based SEM is that it can handle complex models (many constructs and many paths, or constructs with large numbers of indicators) (Barclay et al., 1995).

As this study involves multiple constructs and items, PLS was judged most appropriate approach for assessing the research model. The next section provides a more detailed discussion of PLS.

4.11.3 PLS Approach

In PLS the measurement model and the structural model are tested simultaneously, using the same algorithm (Chin, 1998b). However, in practice, the models are usually analysed and interpreted sequentially in two stages: (1) the assessment of the reliability and validity of the measurement model that often involves restructuring the measurement model (e.g., dropping indicators found unreliable); followed by (2) the assessment of the structural model. The researcher has to ensure that the reliability and the validity of measures of the model constructs are adequate before drawing conclusions about the nature of the relationships between constructs (Hulland, 1999).

4.11.4 Assessment of the Measurement Model

The measurement model in PLS is assessed in terms of item reliability, internal consistency reliability, and construct validity (i.e. convergent and discriminant validities) (Lewis et al., 2005; Straub et al., 2004). See section 4.10 for an introduction of these terms; the rest of this section discusses how these reliabilities and validities are addressed in the context of PLS.

4.11.4.1 Item Reliability

Item reliability (introduced in section 4.10.1) was assessed by examining the loadings of the items on their constructs (Henseler, Ringle, & Sinkovics, 2009). According to Chin (1998b), the loadings that have values close to 0.5 or 0.6 or higher are acceptable for early stages of scale development. For a satisfactory level, it is recommended that the threshold value for item loadings should be at the minimum of 0.70 (Chin, 1998b; Hair et al., 2011); the cut-off value of 0.70 was used in this study.

4.11.4.2 Internal Consistency Reliability

Internal consistency of the measures (introduced in section 4.10.2) was assessed using composite reliability (CR) (Chin, 1998b). This study used the threshold value of 0.8 for internal consistency (Nunnally & Bernstein, 1994).

4.11.4.3 Convergent Validity

When an individual construct is measured by multiple indicators (as all constructs in this study), convergent validity has to be examined. Convergent validity (introduced in section 4.10.3) was judged by using the average variance extracted (AVE) score for each construct, with the cut-off value of 0.5 (Fornell & Larcker, 1981). AVE is the average variance in the indicators accounted for by variation of their latent variable relative to measurement error.

4.11.4.4 Discriminant Validity

In PLS analysis, constructs are considered as having adequate discriminant validity (introduced in section 4.10.4) if each construct shares more variance with its measures than it shares with other constructs in the model (Chin, 1998b). This is verified by comparing the square root of AVE for each construct to correlations of the construct with other constructs in the model. Square roots of AVE should be greater than the correlations. In addition, discriminant validity can also be assessed by looking at the matrix of cross-loadings; each item should load on its own construct more than on other constructs (Chin, 1998b).

4.11.5 Assessment of the Structural Model

After the measurement model has been validated, the structural model is analysed. The structural model consists of the latent variables and the theoretical relationships among them (the paths). By evaluating the structural model, one evaluates the explanatory power of the model and the statistical significance of paths, which represent hypotheses to be tested. The explanatory power of the research model can be assessed by observing the R^2 of the dependent variables, while the strengths, the signs, and the statistical significance of the relationships between independent and dependent variables are assessed via path coefficients.

4.11.5.1 Hypothesis Testing

The hypothesized relationships were accepted or rejected, and characterized as weak or strong based on the algebraic signs, magnitudes, and statistical significance of the

corresponding path coefficients. A path coefficient's magnitude indicates the strength of the relationship between the variables. Chin (1998a) suggested that the magnitude of 0.2 should be considered meaningful (corresponding to strong enough effect size for the relationship to be considered practically significant). The statistical significance of structural paths was evaluated by using a bootstrapping procedure, with 500 resamples (Goodhue, Lewis, & Thompson, 2007). The resulting p values were interpreted as follows: $p < 0.05$ indicates a statistically significant relationship, $p < 0.01$ indicates highly statistically significant relationship, and $p < 0.001$ indicates very highly statistically significant relationship.

It should be noted though that once a path was found to be statistically significant, its magnitude is more important in establishing the strengths of the effect than the p value. This is because p values reflect the size of the sample as well as the strengths of the relationships, but magnitudes of standardized coefficients are not affected by sample size. In this study, along with the Chin's (1998a) recommendation noted earlier in this section, the effect size suggested by path coefficient values was interpreted as follows (following Kline, 2011). Path coefficient values close to 0.5 or greater were interpreted as corresponding to large effect size, values around 0.3 were interpreted as corresponding to medium effect size, and values close to 0.1 and below as corresponding to small effect size.

4.11.5.2 Variance Explained

R^2 value is a measure of the explanatory power of the model for a given dependent variable (Gefen et al., 2003). The R^2 values represent the amount of variance in dependent variables explained by the independent variables. Chin (1998b) suggested that values close to 0.67 or greater should be considered as corresponding to substantial explanatory power, values around 0.33— to average, and values close to 0.19 and lower—to weak explanatory power. On the other hand, Falk and Miller (1992) suggested that R^2 must be at least 0.10 for an acceptable explanatory power of the model, thus imposing a less stringent requirement.

4.12 Summary

The choice of positivist methodology, quantitative research, and cross-sectional survey as an approach to data collection was justified by considering the alternatives available in view of the research problem and research questions, taking into account time and other constraints faced by the researcher.

Instrument development process involved the generation of items, instrument validation, and adjustments in the measurement model test step of data analysis. The implications of using the same data set for both measurement and structural model testing were discussed. Items were generated based on the literature; items from existing validated instruments were reused whenever possible. Instrument validation involved a pre-test with non-experts, a pilot test with a convenience sample of local experts, and a formal content validity study with a systematically selected broad panel of experts. Some items were deleted as the result of measurement model testing, to ensure convergent and discriminant validity.

The unit of analysis was an individual doctor. The sample comprised the doctors practicing in Wellington and in Hamilton, both mid-sized cities in New Zealand. The study covered only doctors (and not other healthcare employees) because doctors play a key role in healthcare, because their jobs are highly knowledge intensive, and because of feasibility considerations (the contact details of doctors were easily available). The sample size required was estimated based on expected response rate and on the required size for statistical analysis. The data collection procedure involved a mail-based survey with an option for the respondents to use an online version of the survey. The response rate obtained after two reminders was 25 percent.

Mean replacement was used to deal with missing data. Scatterplots and Cook's distance were used to detect outliers. Checks for bias included comparing early and late respondents to check for non-response bias, comparing demographic data for the respondents with statistics for the population to check for sample representativeness, and using Harman's one-factor technique to check for common method bias.

PLS structural equation modelling was used for measurement and structural model testing. Measurement model testing involved tests of item reliability, internal consistency, convergent validity, and discriminant validity. In structural model testing, bootstrapping

was used to assess the statistical significance of path coefficients. The overall model fit was judged based on the statistical significance and magnitudes of path coefficients, and based on the amount of variance explained in dependent variables.

CHAPTER 5. DATA ANALYSIS AND RESULTS

5.1 Introduction

This chapter presents the results of data analysis including the demographic characteristics of the respondents, bias checks, testing the measurement model, and testing the structural model.

Summaries of respondent characteristics for gender, age, work and computer experience, and area of specialization are presented. This is followed by discussing the outcomes of data bias checks, including checking for response bias by comparing early and late respondents, checking for sample representativeness by comparing characteristics of the respondents with known characteristics of the population, and checking for common method bias by using Harman's one-factor technique.

The measurement model testing is based on the output of the PLS algorithm applied to the survey data. The analysis involves checking item reliability, checking internal consistency reliability of the construct measures, and checking convergent and discriminant validity.

The structural model analysis is also based on the output of the PLS algorithm. The statistical significance of path coefficients is estimated by using bootstrapping. The results for individual hypotheses in the model are presented and interpreted in view of the literature. This is followed by considering indirect effects. The chapter concludes by discussing the amount of variance explained in the dependent variables, which is used to judge the overall fit of the model.

5.2 Sample Respondent Characteristics

The characteristics of the respondents are reported in terms of frequencies, percentages, means, and standard deviations (*SD*).

Table 5-1 *Gender Profile of the Respondents*

Demographic attribute	Category	Frequency	Percent (%)
Gender	Female	110	41.8
	Male	152	57.8
	Not reported	1	0.4
Age (years)	18-30	35	13.3
	31-40	72	27.4
	41-50	75	28.5
	51-60	58	22.1
	> 60	23	8.7

Table 5-2 *Experience Profile of the Respondents*

Demographic attribute	Category	Frequency	Percent (%)
Years in current organisation	≤ 5	141	53.6
	6-10	54	20.5
	11-15	25	9.5
	16-20	21	8.0
	21-25	11	4.2
	> 25	11	4.2
Years of computer experience	≤ 5	18	6.9
	6-10	37	14.1
	11-15	69	26.2
	16-20	75	28.5
	21-25	34	12.9
	> 25	29	11.0
	Not reported	1	
Years of work experience	≤ 5	33	12.5
	6-10	34	12.9
	11-15	40	15.2
	16-20	48	18.3
	21-25	33	12.5
	> 25	75	28.5

Table 5-1 presents respondent characteristics in terms of age and gender. The majority of the respondents were male (57.8%). Respondents had a mean age of 45 years. The range of 41-50 years old had the largest number of respondents.

Table 5-2 shows the number of years in the current organisation and computer and work experience of respondents. Respondents had a mean of 8.3 years in their current organisation ($SD = 8.4$ years), mean number of years of computer experience of 17.3 years

($SD = 6.8$ years), and mean work experience in the medical profession of 19.9 years ($SD = 11.4$ years).

As shown in Table 5-3, respondents were doctors from a broad range of departments: anaesthesia, surgery, radiology, medicine, oncology, pathology, urology, paediatrics, psychiatry, gynaecology, and emergency care. The highest number of the respondents came from a department of medicine. In Table 5-3, “Others” represents public health, general practice, rheumatology, student health, population health, sport physicians, and palliative care. There were 40 respondents who did not respond to the question regarding the department they were working in.

Table 5-3 *Departments of the Respondents*

Department	Frequency	Percent (%)
Anaesthesiology	30	13.5
Surgery	21	9.4
Radiology	6	2.7
Medicine	48	21.5
Oncology, pathology, urology	11	4.9
Paediatrics	9	4.0
Psychiatry	11	4.9
Obstetrics/gynaecology	7	3.1
Emergency care	8	3.6
Dermatology	1	0.4
Palliative care	1	0.4
Others	70	31.4
Not reported	40	

5.3 Potential Sources of Bias

This section describes the analyses of potential sources of bias, including non-response, sample representativeness, and common method variance. The approaches used to check for potential sources of bias were introduced and justified in Chapter 4, in sections 4.9.1, 4.9.2, and 4.9.3, respectively.

5.3.1 Testing for Non-response Bias

To check for non-response bias, the respondents were divided into two groups, early and late respondents, with 120 and 143 members, respectively. Late respondents were those who returned the questionnaire after a reminder was sent, and early respondents were those who answered and returned the questionnaire before any reminders were sent (an approach suggested by Korkeila, Suominen, Ahvenainen, Ojanlatva, Rautava, Helenius, and Koskenvuo, 2001). The two groups were compared according to demographic characteristics: age, gender, years in the current organisation, work experience, and computer experience. To test the difference between early and late respondents, Mann-Whitney U test was used (Bhattacharjee & Hikmet, 2007; Wu & Wang, 2006).

The results are summarized in Table 5-4. There were no statistically significant differences between the early respondents and the late respondents in terms of years in current organisation, computer experience, work experience, department, gender, or age at the 0.05 significance level. Late respondents were similar to early respondents, suggesting that non-response bias was not a problem in this study.

Table 5-4 *Results of Nonresponse Bias Analysis Based on Demographics*

Test	Years in organisation	Computer experience	Working experience	Department	Gender	Age
Mann-Whitney U	6369.000	6710.000	7319.500	5183.500	7618.500	7403.000
Wilcoxon W	9609.000	21075.000	11147.500	7958.500	11713.500	22281.000
Z	-0.811	-0.095	-0.435	-0.904	-0.154	-0.596
<i>p</i>	0.418	0.924	0.664	0.366	0.877	0.551

5.3.2 Sample Representativeness

The chi-square goodness-of-fit test was used to test whether the respondents represented the population of all doctors in New Zealand.

Respondents' demographics were compared with the population demographics for all 13,269 doctors in New Zealand (as of 2010) obtained from the list of New Zealand

Medical Workforce (Medical Council of New Zealand, 2010). The descriptive statistics for the quantities compared are presented in Table 5-5.

Table 5-5 *Comparing the Respondents to the Population*

	Respondents		Population	
Mean Age	45.5 years		45 years	
Female	110 individuals	41.8%	— ^a	40%
Male	152 individuals	57.8%	— ^a	60%

^aFor gender, percentage was available for the population, but count was not available.

For gender, the results of a chi-square goodness-of-fit test indicated that there was no statistically significant difference between the respondents and the population ($\chi^2 = 0.84, p = 0.37$).

Similarly, for age, the results of a *t*-test indicated that the respondents did not differ from the overall doctor population age ($t = 0.56, p = 0.58$).

Thus, the results of both of the tests conducted suggested that there was no non-response bias in the data sample.

5.3.3 Checking for Common Method Bias

Another common source of bias in single-respondent cross-sectional surveys is common method variance (Podsakoff & Organ, 1986). To test for common method bias, a statistical procedure, Harman's single-factor test, was used. In this test, all the items are entered into a factor analysis, and the results of the unrotated factor solution were examined. If substantial common method variance is present, either a single factor would emerge, or one general factor would account for most of the covariance (more than 50%) in the independent and dependent variables (Podsakoff & Organ, 1986). In this study, all the 71 items were included in a principal components analysis. This analysis produced eleven factors with eigenvalues greater than one, with the factor corresponding to the largest eigenvalue explaining 32 percent of the variance (less than 50%). This suggested that common method variance was not an issue in this study.

5.4 Assessment of the Research Model

As discussed in Chapter 4 (section 4.11), SEM model assessment involved the assessment of the measurement model and the assessment of the structural model.

To carry out model assessment, the response rate and the sample size should be adequate. The response rate obtained for this study was 25 percent (reported in Chapter 4, section 4.7.4), which fulfilled the minimum response rate requirement of 20 percent (Yu & Cooper, 1983).

The number of respondents in this study was more than the number required by PLS. As discussed in section 4.5, the number of respondents required suggested for the research model of this study by the heuristic by Chin (1998b) was 50. The actual number of responses obtained was 263, clearly much larger than the size suggested by Chin's heuristics. Furthermore, the number of respondents was larger than the numbers of respondents in previous studies using similar sized research models (about 6-9 constructs) in similar contexts (Kulkarni et al., 2007; Wu & Wang, 2006). Nonetheless, the sample size was not adequate to use covariance-based structural equation modelling, which requires 10 times the total number of items in a model (Bhattacharjee & Hikmet, 2007; Chin, 1998b) (for the model used in this research, it would be $10 \times 71 = 710$ responses).

Therefore, PLS was used as the data analysis technique to assess the KMS success model formulated in this study. SmartPLS (version 2.0) was used to conduct the analysis (see Ringle, Wende, and Will, 2005 for an introduction of SmartPLS).

The following sections present two stages of the analysis of the KMS success model: (1) the assessment of the measurement model (presented in section 5.4.1); followed by (2) the assessment of the structural model (presented in section 5.4.2).

5.4.1 Assessment of the Measurement Model

The adequacy of the measurement model is determined by examining item reliability, internal consistency reliability, convergent validity, and discriminant validity (Hulland, 1999). The techniques used in the analysis presented in this section were introduced in the

following sections: for item reliability refer to sections 4.10.1 and 4.11.4.1; for internal consistency reliability refer to sections 4.10.2 and 4.11.4.2; for convergent validity refer to sections 4.10.3 and 4.11.4.3; and for discriminant validity refer to sections 4.10.4 and 4.11.4.4.

The analysis of item reliability reported in subsection 5.4.1.1 resulted in a number of items found to be unreliable. Correspondingly, measures were updated by dropping the unreliable items. The analyses in the remaining subsections of this section (following the subsection 5.4.1.1) were conducted for the updated measures.

5.4.1.1 *Item Reliability*

As mentioned in Chapter 4 (sections 4.10.1 and 4.11.4.1), for an item to be judged as reliable, its factor loading had to be higher than the threshold value of 0.70 (the study used the criterion by Chin, 1998b). Items judged unreliable were removed, and the resulting updated model was re-evaluated. The scales were revised repeatedly, until acceptable psychometric properties were obtained. The factor loadings of items on their own constructs for all steps of the process are given in tables D-1, D-2, and D-3 in Appendix D.

As the result of the process, thirteen items were removed. The items removed are presented in Table 5-6. The content of the items was scrutinized to identify the reasons why they did not work and the consequences for the content coverage of their constructs.

Item INC5 was dropped from incentive (for a list of items used to measure the incentive construct, refer to Table F-3 in Appendix F). This was the only item in the measure not directly related to knowledge sharing, clearly standing out. It was not clear whether the “teamwork” in the item is necessarily relevant to knowledge sharing. It appears that the item was somewhat remote from the construct it was intended to measure, and I believe that the content of the construct changed very little.

Items KCQ1, KCQ7, KCQ8, and KCQ9 were dropped from knowledge content quality (for a list of items used to measure the knowledge content quality construct, refer to Table F-2 in Appendix F). These items related to the aspects of knowledge and KMS that, it was highly likely, were not relevant to the respondents’ organisations. Expert directories (in KCQ7 and KCQ8) were found to be in little use in the preliminary study (see Appendix A). Contextual knowledge (in KCQ9) is a difficult to comprehend concept, and

it was very likely that the issue of contextual knowledge was never explicitly mentioned or explicitly addressed at respondents' organisations. The detailed content of "words and phrases" (in KCQ1) is, arguably, a data-related rather than knowledge related issue. A document may develop an idea using counterexamples, but still have a clear direction. As it appears that the items dropped were not relevant to the respondents' organisations, I believe that for the context of the study, the content of the construct did not change much.

Item KMS_R4 was dropped from KMS use for retrieval (for a list of items used to measure the KMS use for retrieval construct, refer to Table F-1 in Appendix F). The item related to expertise directories, which, as found in the preliminary study (see Appendix A), were in little use. The same explanation applies as for the items related to expert directories discussed in the previous paragraph.

Items PS1, PS2, PS3, and PS6 were dropped from perceived security (for a list of items used to measure the perceived security construct, refer to Table F-2 in Appendix F). The items that were dropped were the items related to environmental uncertainty, and the items that were retained related to the behaviour of people in the organisation. It appears that the items relating to environmental uncertainty (the uncertainty relating to IT infrastructure) were not relevant to some of the respondents. As it appears that the items dropped were not relevant to the respondents' organisations, I believe that for the context of the study, the content of the construct did not change much. In studies where the aspects covered by the items are relevant, their inclusion should be considered.

Items SQ7, SQ8, and SQ9 were dropped from KMS system quality (for a list of items used to measure the KMS system quality construct, refer to Table F-2 in Appendix F). Item SQ7 related to "authorised user", and it may be a matter not within the respondents' knowledge because the issue of authorised users would be handled by the technical support personnel in charge of the system. For item SQ8, it is not clear what is documented. It is likely that the respondents used generic tools to share knowledge (see the results of the preliminary study in Appendix A), so that documentation was not needed. For item SQ9 it was not immediately clear why it did not work, because it appeared to be relevant. The content of the item SQ8, most likely, was not relevant to the respondents, so dropping the item, most likely, did not matter for this study. Dropping items SQ7 and SQ9, most likely, did change the content of the construct. The corresponding relevant areas of functionality were no longer covered.

Table 5-6 Deleted Items

Construct	Item code	Item wording
Incentive	INC5	Generally, individuals are rewarded for teamwork.
Knowledge content quality	KCQ1	The words and phrases in content provided by KMS are consistent.
	KCQ7	KMS provide a helpful expert directory (e.g. expert locator) for my specific work.
	KCQ8	The link to the expert directory where I can locate newly hired or newly acquired expertise is always updated.
	KCQ9	KMS provide contextual knowledge so that I can truly understand how that knowledge can be applied.
KMS use for retrieval	KMR_4	I use KMS to identify and locate people for knowledge and expertise.
Perceived security	PS1	I believe that knowledge I share will not be modified by inappropriate parties.
	PS2	I believe that knowledge I share will only be accessed by authorised users.
	PS3	I believe that knowledge I share will be available to the right people.
	PS6	I believe that people in my organisation do not use the KMS.
KMS system quality	SQ7	KMS are accessible from anywhere by the authorised users.
	SQ8	KMS are adequately documented (e.g. in user manuals).
	SQ9	KMS allow me to contribute knowledge that may be useful to other people in the organisation.

Factor loadings and internal consistency (composite reliability values) of measures improved with the deletion of these items, indicating better convergent validity. After the deletions, 58 items remained for further analysis. Item loadings ranged from 0.708 to 0.931 (see Figure 5-1) and were all statistically significant at 0.01 level.

5.4.1.2 Internal Consistency Reliability

To assess internal consistency reliability, the values of composite reliability (CR) were examined. The CR values for the constructs of the model ranged from 0.89 to 0.96 exceeding the required minimum of 0.80 (refer to Table 5-7), suggesting that the measures of all the constructs had internal consistency reliability.

5.4.1.3 Convergent Validity

Convergent validity of the measures was assessed using three criteria suggested by Fornell and Larcker (1981): (1) all item factor loadings should exceed 0.70 (item reliability); (2) composite reliability (CR) for each construct should exceed 0.80 (internal consistency reliability); and (3) average variance extracted (AVE) for each construct should exceed 0.50.

As discussed in sections 5.4.1.1 and 5.4.1.2, all item factor loadings were above 0.70 and all composite reliability values were above 0.80. As for AVE, the values were between 0.66 and 0.82, as shown in Table 5-7. All AVE values were well above the recommended threshold value of 0.50, suggesting acceptable convergent validity.

Table 5-7 Results of PLS Analysis: Measurement Model

Construct	Composite reliability	Average variance extracted (AVE)
Culture of sharing	0.96	0.82
Incentive	0.93	0.76
KMS system quality	0.92	0.67
KMS use for retrieval	0.93	0.76
KMS use for sharing	0.94	0.71
Knowledge content quality	0.92	0.69
Leadership	0.96	0.73
Perceived security	0.89	0.66
Perceived usefulness	0.95	0.72
Subjective norm	0.95	0.82
User satisfaction	0.92	0.71

5.4.1.4 Discriminant Validity

Discriminant validity was assessed following Fornell and Larcker's (1981) recommendation that the square root of AVE for each construct (on diagonal in Table 5-8) should exceed the correlations between the construct and other constructs in the model (off diagonal in Table 5-8) (Fornell & Larcker, 1981). As seen in Table 5-8, all constructs had good discriminant validity.

Table 5-8 *Correlations Between Constructs Compared to Square Roots of AVE*

	1	2	3	4	5	6	7	8	9	10	11
1 Culture of sharing	0.91										
2 Incentive	0.33	0.87									
3 KMS system quality	0.40	0.28	0.82								
4 KMS use for retrieval	0.14	0.18	0.47	0.87							
5 KMS use for sharing	0.20	0.27	0.42	0.54	0.84						
6 Knowledge content quality	0.26	0.18	0.66	0.67	0.45	0.83					
7 Leadership	0.66	0.47	0.54	0.31	0.34	0.41	0.85				
8 Perceived security	0.50	0.29	0.46	0.23	0.28	0.37	0.59	0.81			
9 Perceived usefulness	0.20	0.18	0.56	0.75	0.52	0.71	0.40	0.36	0.85		
10 Subjective norm	0.32	0.16	0.30	0.25	0.32	0.31	0.29	0.45	0.33	0.9	
11 User satisfaction	0.24	0.23	0.72	0.63	0.42	0.79	0.44	0.33	0.70	0.22	0.84

Other way of assessing discriminant validity is by observing the matrix of loadings. The items should load more strongly on their own construct than on other constructs in the research model (Chin, 1998b). The loadings of the items on all constructs in the model are shown in tables E-1, E-2, and E-3 in Appendix E. All of the items fulfilled the requirement.

5.4.2 Assessment of the Structural Model

The techniques used to assess the structural model were introduced in section 4.11.5.1 (which discussed path coefficients' statistical significance and magnitude, as well as the related issue of effect size) and in section 4.11.5.2 (which discussed R^2 as the measure of the amount of variance explained in dependent variables).

The structural model and the hypotheses were tested by examining the path coefficients' statistical significance and magnitudes. The bootstrapping procedure was used to assess the path coefficients' statistical significance. The SmartPLS bootstrap procedure was used in this study, with 500 resamples. In addition to the individual path tests, the amount of variance explained by the independent variables, measured by the R^2 values for the dependent variables, was assessed as an indication of the overall explanatory power of the model. The results for the structural model are presented in Figure 5-2.

In interpreting results of fitting a structural equation model, both direct and total effects can be considered (Bollen, 1989). An indirect effect represents the effect of a particular variable on another variable through its effects on other, mediating variables. The total effect is the sum of direct and indirect effects. The magnitude of a path coefficient represents the strength of the direct effect. The magnitude of a path coefficient carries meaning only if the path coefficient is statistically significant. As mentioned in section 4.11.5.1, in this study (following Kline, 2011) path coefficient values close to 0.5 or greater were interpreted as corresponding to large effect sizes, values around 0.3 were interpreted as corresponding to medium effect sizes, and values near and below 0.1 as corresponding to small effect sizes. As an alternative expression of effect size, a relationship was described as having practical significance if the corresponding path coefficient was greater than 0.2 (Chin, 1998a).

The following sections present the results of hypotheses testing, hypothesis by hypothesis, the indirect effects, and the values of variance explained (R^2). When introducing the results of hypothesis testing for individual hypotheses, an initial interpretation of the result in view of the existing literature is provided. More detailed interpretations and comparisons are given in Chapter 6.

5.4.2.1 H1: Higher Knowledge Content Quality Leads to Higher Perceived Usefulness

The results for hypothesis H1 are summarized in Table 5-9. Knowledge content quality was found to have a positive direct effect on perceived usefulness, with a large effect size. The relationship was practically significant. The results suggest that when knowledge content quality is high, doctors are more likely to perceive that KMS are useful.

Table 5-9 Effect of Knowledge Content Quality on Perceived Usefulness of KMS

	Hypothesis	β	p	Support
H1	Knowledge content quality \rightarrow Perceived usefulness of KMS	0.581	< 0.001	Yes

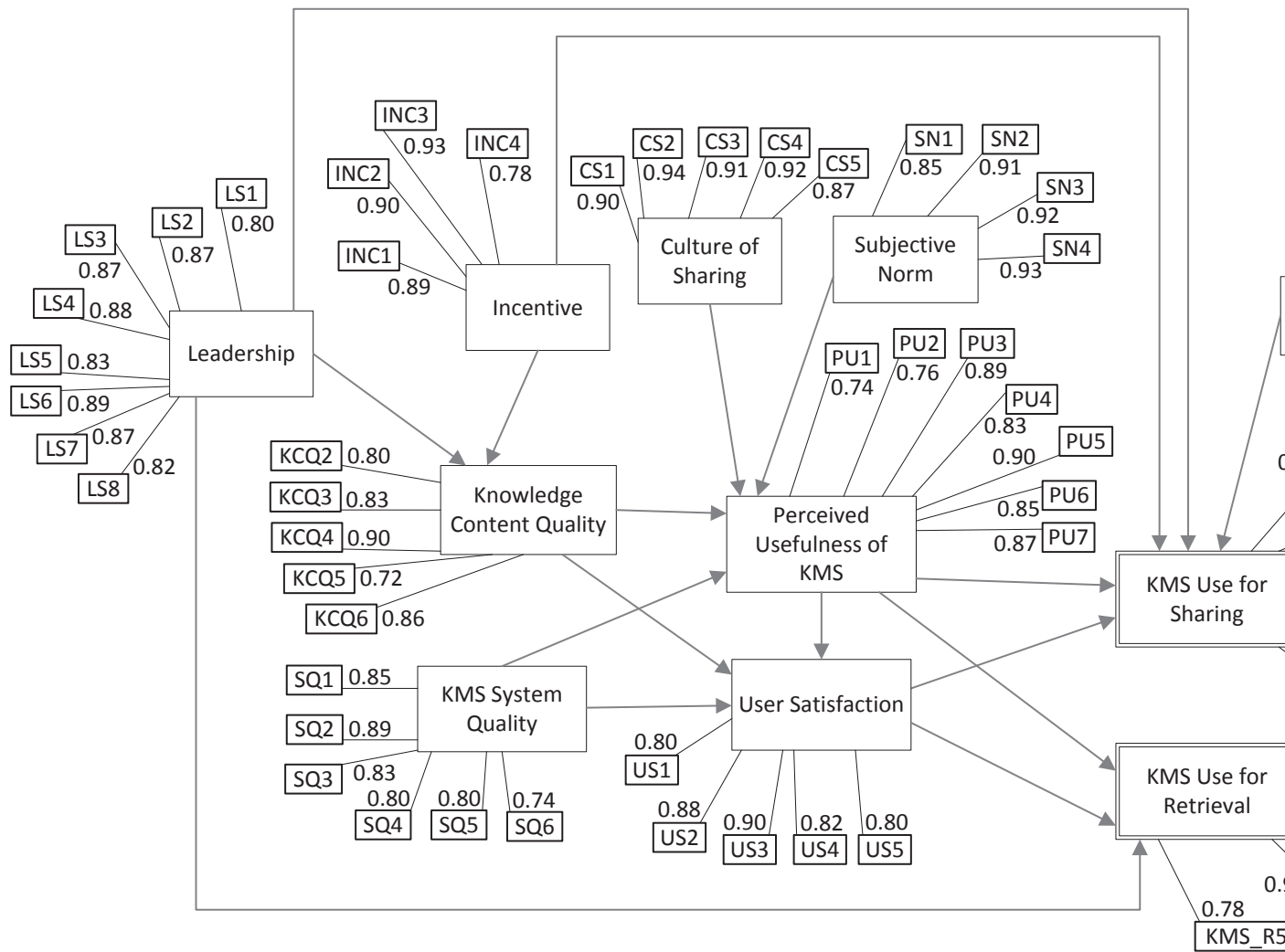


Figure 5-1. Factor loadings after the measures were updated by removing unreliable items.

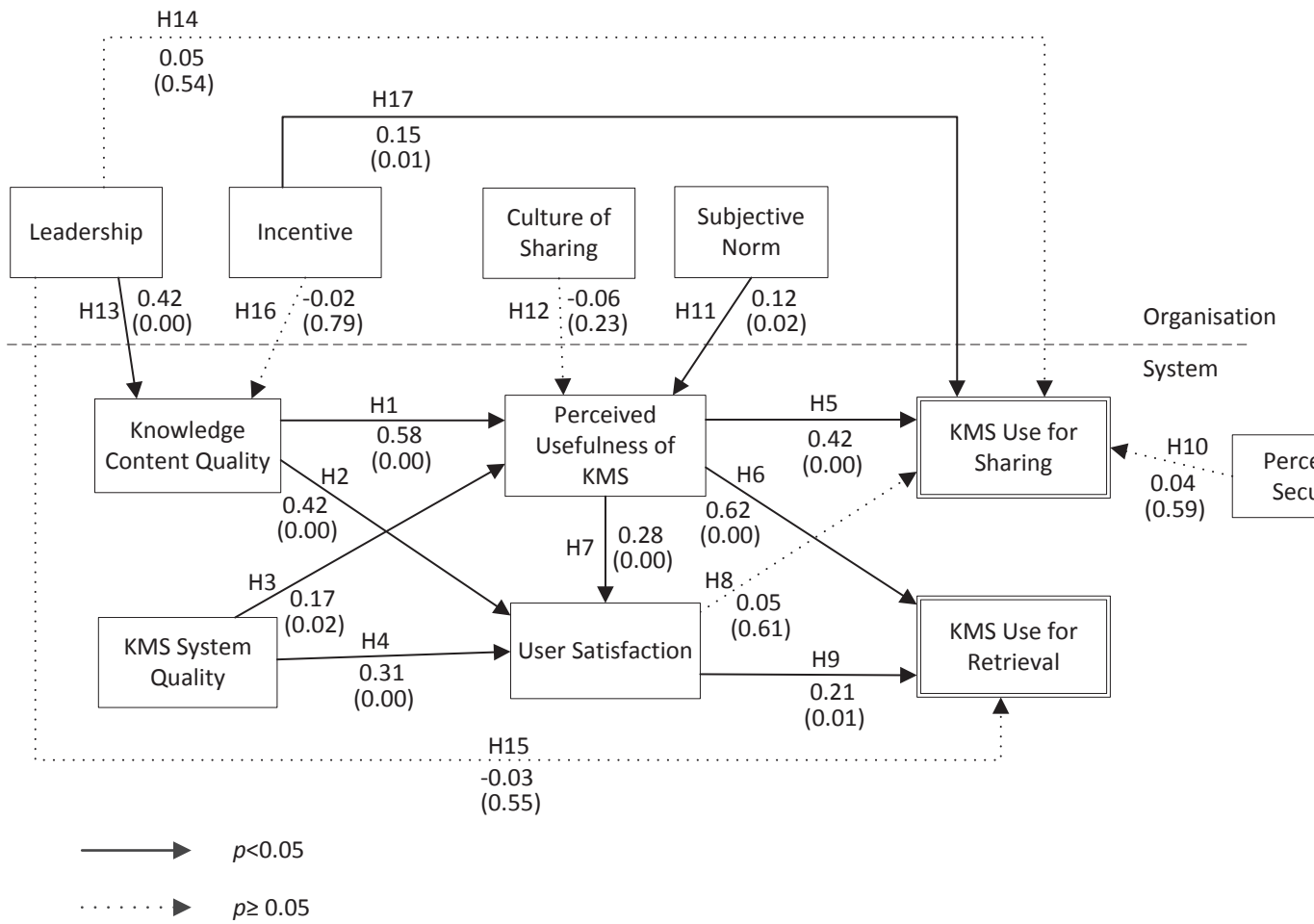


Figure 5-2. KMS success model for healthcare: results of model testing.

This finding is consistent with previous research on KMS. Wu and Wang (2006) found a similar relationship with large effect size ($\beta = 0.99$), and Hwang et al. (2008) found a similar relationship with medium effect size ($\beta = 0.29$).

5.4.2.2 H2: Higher Knowledge Content Quality Leads to Higher User Satisfaction

The results for hypothesis H2 are summarized in Table 5-10. Knowledge content quality was found to have a positive direct effect on user satisfaction with a medium to large effect size. The effect was practically significant. The results suggest that when knowledge content quality is high, doctors are more likely to perceive KMS as useful.

Table 5-10 *Effect of Knowledge Content Quality on User Satisfaction*

	Hypothesis	β	p	Support
H2	Knowledge content Quality \rightarrow User satisfaction	0.416	< 0.001	Yes

This finding is overall consistent with previous research on KMS success. Kulkarni et al. (2007) found a similar relationship with a medium effect size ($\beta = 0.38$), and Wu and Wang (2006) found a similar relationship with a medium effect size ($\beta = 0.28$). However, Hwang et al. (2008) found a similar relationship with a small effect size ($\beta = 0.12$).

5.4.2.3 H3: Higher KMS System Quality Leads to Higher Perceived Usefulness

The results for hypothesis H3 are summarized in Table 5-11. KMS system quality was found to have a positive direct effect on perceived usefulness with a small effect size. The effect was not practically significant.

Table 5-11 *Effect of KMS System Quality on Perceived Usefulness*

	Hypothesis	β	p	Support
H3	KMS system quality \rightarrow Perceived usefulness of KMS	0.168	0.02	Yes

This finding is consistent with previous research on KMS success. Hwang et al. (2008) found a similar relationship with a small effect size ($\beta = 0.12$). Kulkarni et al. (2007) and Wu and Wang (2006) did not find the relationship statistically significant, which is consistent with the small effect size found in this study.

5.4.2.4 H4: Higher KMS System Quality Leads to Higher User Satisfaction

The results for hypothesis H4 are summarized in Table 5-12. KMS system quality was found to have a positive direct effect on user satisfaction with a medium effect size. The effect was practically significant. The results suggest that when KMS system quality is high, doctors are more likely to be satisfied with the KMS.

Table 5-12 *Effect of KMS System Quality on User Satisfaction*

	Hypothesis	β	p	Support
H4	KMS system quality \rightarrow User satisfaction	0.307	< 0.001	Yes

This finding is consistent with previous research on KMS success. Hwang et al. (2008) found a similar relationship with a small effect size ($\beta = 0.12$); Wu and Wang (2006) found a similar relationship with a medium effect size ($\beta = 0.26$); and Kulkarni et al. (2007) found a similar relationship with a medium to large effect size ($\beta = 0.38$).

5.4.2.5 H5, H6: Higher Perceived Usefulness Leads to Higher KMS Use for Sharing and Higher KMS Use for Retrieval

The results for hypotheses H5 and H6 are summarized in Table 5-13.

Table 5-13 *Effects of Perceived Usefulness on KMS Use for Sharing and KMS Use for Retrieval*

	Hypothesis	β	p	Support
H5	Perceived usefulness of KMS \rightarrow KMS use for sharing	0.423	< 0.001	Yes
H6	Perceived usefulness of KMS \rightarrow KMS use for retrieval	0.615	< 0.001	Yes

Perceived usefulness was found to have a positive direct effect on KMS use for sharing with a medium to large effect size ($\beta = 0.42$). The effect was practically significant. The results suggest that when doctors perceive KMS as useful, they are more likely to use KMS to share knowledge.

Perceived usefulness was found to have a positive direct effect on KMS use for retrieval with a large effect size. The effect was practically significant. The results suggest that when doctors perceive KMS as useful, they are more likely to use KMS to retrieve knowledge.

These findings are consistent with some of the previous research on KMS success. Wu and Wang (2006) found a statistically significant relationship between perceived usefulness and KMS use with a large effect size ($\beta = 0.64$). However, these findings are not consistent with the study by Kulkarni et al. (2007) who did not find the relationship between perceived usefulness and knowledge use to be statistically significant. In the study by Kulkarni et al., the concept of perceived usefulness did not relate to using a KMS (see the discussion in section 2.5), which may be the reason behind the discrepancy.

5.4.2.6 H7: Higher Perceived Usefulness Leads to Higher User Satisfaction

The results for hypothesis H7 are summarized in Table 5-14.

Table 5-14 Effect of Perceived Usefulness of KMS on User Satisfaction

	Hypothesis	β	p	Support
H7	Perceived usefulness of KMS \rightarrow User satisfaction	0.284	< 0.001	Yes

Perceived usefulness was found to have a positive direct effect on user satisfaction with a medium effect size. The effect was practically significant. The results suggest that doctors are likely to be satisfied with KMS when they perceive that KMS are useful.

This finding is consistent with previous research on KMS success. Wu and Wang (2006) found a similar relationship with a large effect size ($\beta = 0.57$); Hwang et al. (1999) found a similar relationship with a medium to large effect size ($\beta = 0.38$); and Kulkarni et al. (2007) found a similar relationship with a medium to large effect size ($\beta = 0.40$).

5.4.2.7 H8, H9: Higher User Satisfaction Leads to Higher KMS Use for Sharing and Higher KMS Use for Retrieval

The results for hypotheses H8 and H9 are summarized in Table 5-15.

Table 5-15 Effect of User Satisfaction on KMS Use for Sharing and KMS Use for Retrieval

	Hypothesis	β	p	Support
H8	User satisfaction \rightarrow KMS use for sharing	0.054	0.61	No
H9	User satisfaction \rightarrow KMS use for retrieval	0.208	0.01	Yes

Contrary to expectations, the present study did not find a statistically significant relationship between user satisfaction and KMS use for sharing.

User satisfaction was found to have a positive direct effect on KMS use for retrieval with a small to medium effect size. The effect was practically significant (but very close to the 0.2 cut-off value for practical significance used in this study). The results suggest that when doctors are satisfied with KMS, they are more likely to use KMS to retrieve knowledge. Further, the results are consistent with a view that doctors share (or do not share) knowledge, irrespective of whether they are satisfied with KMS.

This finding is consistent with previous research on KMS success. Wu and Wang (2006) found a relationship between user satisfaction and KMS use with a small to medium effect size ($\beta = 0.24$).

5.4.2.8 H10: Higher Perceived Security Leads to Higher KMS Use for Sharing

The results for hypothesis H10 are summarized in Table 5-16.

Table 5-16 *Effect of Perceived Security on KMS Use for Sharing*

	Hypothesis	β	p	Support
H10	Perceived security \rightarrow KMS use for sharing	0.036	0.59	No

Contrary to expectations, perceived security was not found to have an effect on KMS use for sharing. The results are consistent with a view that doctors do not care about security when deciding to share knowledge.

This finding is not consistent with the findings by Fang et al. (2006) who found that perceived security affects intention to transact on wireless handheld devices. Findings by Fang were in a context very different from KMS in healthcare, which may be the reason for the discrepancy.

5.4.2.9 H11: Higher Subjective Norm Leads to Higher Perceived Usefulness

The results for hypothesis H11 are summarized in Table 5-17. Subjective norm was found to have a positive direct effect on perceived usefulness of KMS with a small effect size. The effect was not practically significant.

Table 5-17 *Effect of Subjective Norm on Perceived Usefulness of KMS*

	Hypothesis	β	p	Support
H11	Subjective norm \rightarrow Perceived usefulness of KMS	0.121	0.02	Yes

This finding is consistent with previous research. Yi (2006) found an effect of subjective norm on perceived usefulness with a small effect size ($\beta = 0.15$).

5.4.2.10 H12: Better Culture of Sharing Leads to Higher Perceived Usefulness of KMS

The results for hypothesis H12 are summarized in Table 5-18.

Table 5-18 *Effect of Culture of Sharing on Perceived Usefulness*

	Hypothesis	β	p	Support
H12	Culture of sharing \rightarrow Perceived usefulness of KMS	-0.062	0.23	No

Contrary to expectations, culture of sharing was not found to affect perceived usefulness of KMS. The result suggests that even though doctors may be influenced by their immediate colleagues (via subjective norm—see the outcome for hypothesis H11 in section 5.4.2.10), they are not directly influenced by the culture of sharing in the organisation overall.

5.4.2.11 H13, H14, H15: Leadership Results in Higher Knowledge Content Quality, Higher KMS Use for Sharing, and Higher KMS Use for Retrieval

The results for hypotheses H13, H14, and H15 are summarized in Table 5-19.

Table 5-19 *Effects of Leadership on Knowledge Content Quality, KMS Use for Sharing, and KMS Use for Retrieval*

	Hypothesis	β	p	Support
H13	Leadership \rightarrow Knowledge content quality	0.422	< 0.001	Yes
H14	Leadership \rightarrow KMS use for sharing	0.053	0.54	No
H15	Leadership \rightarrow KMS use for retrieval	-0.030	0.55	No

Leadership was found to have a positive effect on knowledge content quality, with a medium to large effect size. The effect was practically significant. The result suggests that when leadership is strong, doctors are more likely to contribute high quality knowledge.

This finding is consistent with previous research. Kulkarni et al. (2007) found a similar relationship with a large effect size ($\beta = 0.45$).

Contrary to expectations, the effects of leadership on KMS use for sharing and on KMS use for retrieval were not statistically significant. The results are consistent with a view

that even though strong leadership directly affects content quality, the levels of KMS use are determined by other factors.

5.4.2.12 H16, H17: Higher Incentives Lead to Higher Knowledge Content Quality and Higher KMS Use for Sharing

The results for hypotheses H16 and H17 are summarized in Table 5-20.

Table 5-20 *Effects of Incentive on Knowledge Content Quality and KMS Use for Sharing*

	Hypothesis	β	p	Support
H16	Incentive \rightarrow Knowledge content quality	-0.015	0.79	No
H17	Incentive \rightarrow KMS use for sharing	0.149	0.01	Yes

Incentive was found to have a positive direct effect on KMS use for sharing with a small effect size. The effect was not practically significant.

This finding is consistent with previous research. Choi et al. (2008) found that extrinsic reward affects intention to share knowledge with a small effect size ($\beta = 0.16$). Bock et al. (2005) found the effect of reward to be not statistically significant, which is consistent with the small effect found in this study.

Contrary to expectations, the effect of incentive on knowledge content quality was not statistically significant. This finding is inconsistent with Kulkarni et al. (2007) who found that incentive had a medium size effect on knowledge content quality. The results of this study suggest that even though incentive may result in somewhat more knowledge contributions, unlike leadership, it will not motivate doctors to improve the quality of knowledge contributions.

5.4.2.13 Direct, Indirect, and Total Effects on KMS Use for Sharing and KMS Use for Retrieval

In this study, KMS use for sharing and KMS use for retrieval played the role of outcome variables—proxy variables for KMS success. To better understand the effects of various factors on the outcome variables, total effects were estimated (see Table 5-21).

As shown in Table 5-21, perceived usefulness had the strongest total effect on KMS use for sharing and KMS use for retrieval compared to other factors. Perceived usefulness had

a stronger total effect on KMS use for retrieval than on KMS use for sharing. Knowledge content quality was the second most important determinant of KMS use for sharing and KMS use for retrieval. Knowledge content quality and KMS system quality had stronger total effects on KMS use for retrieval (via perceived usefulness and user satisfaction) than on KMS use for sharing (via perceived usefulness).

Table 5-21 *Direct and Indirect Effects on KMS Use for Sharing and for Retrieval*

Factor	KMS use for sharing		KMS use for retrieval	
	Direct	Total	Direct	Total
Organisational				
Leadership	0.053	0.169*	-0.030	0.169*
Incentive	0.149*	0.145*		-0.007
Culture of sharing		-0.038		-0.058
Subjective norm		0.052		0.080
System				
Knowledge content quality		0.275**		0.471***
KMS system quality		0.094*		0.175**
Perceived usefulness	0.422***	0.435***	0.615	0.664***
User satisfaction	0.053	0.054	0.208	0.208**
Perceived security	0.036	0.036		

Note. Indirect effects can be obtained by subtracting direct effects from total effects.

*Statistically significant at $p < 0.05$. **Significant at $p < 0.01$. ***Significant at $p < 0.001$.

Leadership had a total effect on KMS use for sharing (via knowledge content quality and perceived usefulness) and KMS use for retrieval (via knowledge content quality, perceived usefulness, and user satisfaction), even though its direct effect on KMS use for sharing was not statistically significant. Subjective norm had a stronger total effect on KMS use for retrieval than on KMS use for sharing (although the effect size for both was very weak).

Incentive was not found to affect KMS use for sharing indirectly (both direct and indirect effect of incentive on KMS use for sharing was possible in the model, but the difference between the direct effect and the total effect was negligible, suggesting no support for an indirect effect). As to the effect of incentive on KMS use for retrieval, direct effect was not hypothesised in the model; indirect effect was possible, but was not statistically significant.

5.4.2.14 Variance Explained

The variance explained (R^2) for dependent variables was calculated to assess the explanatory power of the structural model. The amount of variance explained in each dependent variable in the model is shown in Table 5-22.

Table 5-22 Variance Explained in Dependent Variables

Construct	R^2
KMS use for retrieval	0.58
KMS use for sharing	0.31
Knowledge content quality	0.17
Perceived usefulness	0.54
User satisfaction	0.71

As discussed in section 5.4.2.13, perceived usefulness and incentive directly affected KMS use for sharing, and they together explained 31 percent of variance in KMS use for sharing ($R^2 = 0.31$). Perceived usefulness and user satisfaction directly affected KMS use for retrieval, and they accounted for 58 percent of variance in KMS use for retrieval ($R^2 = 0.58$).

The amount of variance explained in both KMS use for sharing and KMS use for retrieval was comparable with variance explained in KMS use in previous studies: 51 percent in Lin and Huang (2008) and 60 percent in Wu and Wang (2006). In previous studies, KMS use for sharing and KMS use for retrieval were never considered together, as separate dependent variables in the same model. The model introduced in this study was the first to include both of these variables, and, according to the R^2 values, the model explained KMS use for retrieval better than for KMS use for sharing.

The amount of variance explained in perceived usefulness of KMS was 54 percent ($R^2 = 0.54$). Perceived usefulness of KMS was directly affected by knowledge content quality, KMS system quality, and subjective norm. The result for R^2 was within the range of the results from previous studies: 38 percent and 54 percent in Hwang et al. (2008) and Wu and Wang, (2006), respectively.

The amount of variance explained in user satisfaction was 71 percent ($R^2 = 0.71$). User satisfaction was directly affected by knowledge content quality, KMS system quality, and

perceived usefulness. This result was comparable to previous studies, in which the range of variance explained for user satisfaction ranged from 31 to 69 percent (31% in Halawi et al., 2007; 52% in Hwang et al., 2008; and 69% in Wu and Wang, 2006).

The amount of variance explained in knowledge content quality was 17 percent ($R^2 = 0.17$). Knowledge content quality was affected by leadership. The low R^2 value for knowledge content quality suggests that other factors not included in the research model also affect the quality of knowledge content.

The amount of variance explained in all dependent variables was above the 10 percent cut-off for good explanatory power suggested by Falk and Miller (1992) and, with the exception of knowledge content quality (with 17% of variance explained), above the 19 percent cut-off suggested by Chin (1998b). The amounts of variance explained for dependent variables in the model demonstrated that the overall model fit was good.

5.5 Summary

Demographic characteristics for gender, age, work and computer experience, and area of specialization were presented. Respondents had a mean of 8.3 years in their current organisation, and represented a broad range of medical specializations. In non-response bias, sample representativeness bias, and common method bias tests no evidence of bias was detected.

In measurement model analysis, out of 71 items, 58 were above the cut-off value of 0.7 for factor loadings and thus were used for further analysis. The implications of dropping the items for the content of the construct measures were considered; it was concluded that the content of the measures changed very little. Internal consistency reliability, measured by composite reliability, for all construct measures was above the cut-off value of 0.8. Moreover, all construct measures had acceptable convergent and discriminant validity.

In structural model analysis, knowledge content quality was found to affect perceived usefulness with a large effect size ($\beta = 0.581, p < 0.001$). Knowledge content quality was found to affect user satisfaction with a medium to large effect size ($\beta = 0.416, p < 0.001$). KMS system quality was found to affect user satisfaction with a medium effect size ($\beta = 0.307, p < 0.001$) and perceived usefulness with a small effect size ($\beta = 0.168, p = 0.02$).

Perceived usefulness was found to affect KMS use for sharing with a medium to large effect size ($\beta = 0.423, p < 0.001$), KMS use for retrieval with a large effect size ($\beta = 0.615, p < 0.001$), and user satisfaction with a small to medium effect size ($\beta = 0.284, p < 0.001$). User satisfaction was not found to affect KMS use for sharing ($p = 0.61$). User satisfaction was found to affect KMS use for retrieval with a small to medium effect size ($\beta = 0.208, p < 0.01$). Perceived security was not found to affect KMS use for sharing ($p = 0.59$).

Subjective norm was found to affect perceived usefulness with a small effect size ($\beta = 0.121, p = 0.02$). Culture of sharing was not found to affect perceived usefulness ($p = 0.23$). Leadership was found to affect knowledge content quality with a medium to large effect size ($\beta = 0.422, p < 0.001$). Leadership was not found to affect KMS use for sharing ($p = 0.54$) or KMS use for retrieval ($p = 0.55$). Incentive was not found to affect knowledge content quality ($p = 0.79$). Incentive was found to affect KMS use for sharing with a small to medium effect size ($\beta = 0.149, p = 0.01$).

Indirect effects were also reported. Even though leadership was not found to affect KMS use for sharing and KMS use for retrieval directly, the indirect effects were statistically significant.

The amounts of variance explained for dependent variables in the model demonstrated that the overall model fit was good.

CHAPTER 6. DISCUSSION AND CONCLUSIONS

6.1 Introduction

This chapter discusses the results of the study in view of the literature, highlights the contributions of the study to theory and practice, considers the limitations of the study, and makes suggestions for future research. The chapter concludes by stating conclusions for the whole thesis.

6.2 Findings for the Determinants of KMS Success

Discussion of the findings for the effects of factors included in the research model is organised by distinguishing between the two types of determinants of KMS success: the system and the organisational factors.

6.2.1 System Factors

This section interprets the findings for the effects of system factors. Factors relating to specific aspects of the system (knowledge content quality, system quality, and perceived security) are discussed first, followed by the factors reflecting the user perceptions of the system overall (perceived usefulness of KMS and user satisfaction).

Among the factors relating to specific aspects of the system, knowledge content quality had the strongest overall effect, while for perceived security no effect was discovered. Among the factors reflecting the user perceptions of the system overall, perceived usefulness had the strongest effect. Thus, the results of this study suggest that the system factors that matter most to KMS success are knowledge content quality and perceived usefulness of KMS. These factors are related, as knowledge content quality positively affects perceived usefulness.

6.2.1.1 Knowledge Content Quality

Knowledge content quality was the strongest predictor of both perceived usefulness of KMS and user satisfaction. Via perceived usefulness of KMS and user satisfaction, knowledge content quality indirectly affected both KMS use for sharing and KMS use for retrieval. The effect of knowledge content quality on KMS use for retrieval was stronger than on KMS use for sharing. Still, the medium size effect of knowledge content quality on KMS use for sharing is worth highlighting as it is not obvious that high quality knowledge in a KMS is likely to result not only in more use of the system for retrieval (to access the high quality knowledge) but also in more knowledge being shared—employees share knowledge when they perceive that the system is useful (so that their efforts have effect), and the strongest predictor of perceived usefulness is knowledge content quality.

These findings are consistent with Hwang et al. (2008) and Wu and Wang (2006), who suggested that user perception of quality of knowledge influences user perceptions of the usefulness of KMS and, therefore, encourages them to use KMS. In the healthcare context, this finding is in agreement with the studies by Koumpouros et al. (2006) and Desouza (2002) who found that the quality of knowledge content, in aspects such as unified and consistent terminology, plays an important role in the success of KMS in healthcare.

The high quality of knowledge content that is provided by repositories or experts may increase individuals' willingness to access the knowledge. This is consistent with prior literature (Kankanhalli et al., 2005b) reporting the positive effect of output quality on the use of KMS by knowledge seekers. The primary purpose of individuals using KMS to retrieve knowledge is to reuse knowledge generated by other organisational members as a way to avoid reinventing solutions (Akgün, Byrne, Keskin, Lynn, & Imamoglu, 2005). The outcomes of knowledge retrieval for knowledge reuse are a faster, better, and less costly service (Kankanhalli et al., 2011). Higher knowledge reuse results in better individual performance (Ko & Dennis, 2011). In particular, doctors depend on reusing high quality contextualized knowledge to perform their jobs (Dawes & Sampson, 2003).

Overall, the results suggest that the quality of knowledge affects the overall success of KMS.

6.2.1.2 KMS System Quality

KMS system quality affected both perceived usefulness and user satisfaction, although for both of them it was a weaker predictor than knowledge content quality. The effect of KMS system quality on perceived usefulness of KMS was considerably weaker than on user satisfaction. Thus, low quality KMS (in terms of ease of use, reliability etc.) might make the users feel less satisfied, but the users may still perceive the system as useful for as long as the quality of the knowledge it provides is high.

Via perceived usefulness of KMS and via user satisfaction, KMS system quality affected both KMS use for sharing and KMS use for retrieval, but both of the effects were weak, considerably weaker than the correspondent effects of knowledge content quality

These findings are consistent with the results from many previous studies that examined the effect of the quality of the system on the usefulness of the system in both IS success (Almutairi & Subramanian, 2005; DeLone & McLean, 1992; 2003; 2004) and KMS success (H.-G. Hwang et al., 2008) contexts. The relatively weak effect of the KMS system quality observed in the present study may be explained, in part, by the computer experience of doctors in the sample. As seen in Table 5-2, the overwhelming majority of the participants had at least five years of computer experience. Thus, they were capable of dealing with IT related problems.

The effect of KMS system quality on KMS use for retrieval was somewhat larger than the effect on KMS use for sharing. A prior study found that system quality had a larger effect on knowledge seeking than on knowledge contribution in online communities (Phang, Kankanhalli, & Sabherwal, 2009). Good system quality is very important during retrieval, as the process of retrieving knowledge requires cognitive effort and time associated with operating the system, and poor system performance may be a barrier for doctors using KMS to retrieve knowledge (Koutsantonis & Panayiotopoulos, 2011).

Overall, the results suggest that system quality matters, but not as much as knowledge quality.

6.2.1.3 Perceived Security

Perceived security was not found to have a statistically significant effect on KMS use for sharing. This finding is not in agreement with prior studies that, in fact, emphasized the importance of the role of security in the success of KMS (Desouza, 2003; Gold et al., 2001; Lindsey, 2002). This finding can be explained in two ways. The first explanation is that security may be generally well managed in healthcare. Research on security in healthcare information systems (Katsikas, 2000; Lorence & Churchill, 2005; Smith & Eloff, 1999) suggests that various security measures are given priority in the implementation of information systems in healthcare organisations. If security is overall at a high level, and is perceived as such, variations in perceived security leading to variation in KMS use for sharing should not be observed in the data.

Another plausible explanation is that breaches of security of KMS may not be seen by the users as having consequences as serious as those for financial transactions, contrary to the argument earlier in this thesis that the knowledge exchanged by the doctors may be highly sensitive. Information in formal clinical records is clearly highly sensitive, but it is not in the scope of KMS, and information exchanged between doctors when they share knowledge may be considered not as sensitive as information in clinical records. In prior research, perceived security was found to be a concern for online purchasing (Salisbury et al., 2001). Fang et al., 2006 found that perceived security affected tasks involving transactions using wireless technology, such as purchasing movie tickets or banking online, but it did not affect general tasks such as sending and receiving email or accessing information. Consistent with this finding, using KMS to share knowledge may be considered by doctors to be a general, not security sensitive task, and therefore perceived security does not affect their use of KMS for sharing knowledge. Thus, it is likely that the levels of security in healthcare organisations are high enough for knowledge sharing to be considered a general, not security sensitive task, so that perceived security is not an issue for knowledge sharing.

6.2.1.4 Perceived Usefulness

Perceived usefulness of KMS affected both KMS use for sharing and KMS use for retrieval. The effect of perceived usefulness on KMS use for sharing was particularly strong; it was the strongest effect in the model.

These findings are consistent with prior studies using TAM and the Delone and McLean IS success model (Adams et al., 1992; Baroudi, 1986; Davis, 1989; Fang et al., 2006; Halawi et al., 2007; Saadé & Bahli, 2005; Seddon, 1997), including the study by Wu and Wang (2006) conducted with a knowledge management system.

The finding is also consistent with claims of some opinion articles that doctors are likely to use systems that can improve their performance in treating patients (Bower, 2005; Eley et al., 2009; Ward et al., 2008). Moreover, a number of empirical studies confirmed the effect of perceived usefulness on IS use in the context of healthcare (Bhattacharjee & Hikmet, 2007; Chau & Hu, 2001, 2002a; Hu et al., 1999), including one study of KMS success (Hwang et al., 2008).

Overall, the effect of perceived usefulness on system use is well established in the literature, and it was not surprising that it was also found in this study.

6.2.1.5 User Satisfaction

User satisfaction was found to affect KMS use for retrieval, but was not found to affect KMS use for sharing. The effect of user satisfaction on KMS use for retrieval was weak, and considerably weaker than the effect of perceived usefulness. It is quite possible that there was an effect of user satisfaction on KMS use for sharing, but it was too weak to be discovered in the analysis because of low statistical power. As the effect of user satisfaction on KMS use for retrieval was weak, the difference between the effects of user satisfaction on KMS use for retrieval and on KMS use for sharing may be quite small.

Overall, these findings can be seen as consistent with prior studies that found that user satisfaction affected KMS use (Wu & Wang, 2006) and was a determinant of KMS success (Hwang et al., 2008). The results suggested that perceived usefulness of KMS is more important for KMS success than user satisfaction. It does not matter so much whether the system meets user expectations, as long as the users perceive the system to be useful.

6.2.2 Organisational Factors

This section interprets the findings for the effects of organisational factors. Factors relating to transformational and transactional leadership (leadership and incentive) are discussed

first, followed by the factors relating to the organisational culture (culture of sharing and subjective norm).

Among the organisational factors, leadership had the strongest overall effect, but the factors relating to the organisational culture affected the KMS success very little, if at all. Thus, the results of the study suggest that of organisational factors relevant to KMS success leadership involvement and support matters most.

6.2.2.1 Leadership

Leadership affected knowledge content quality with a relatively strong effect size, but it was not found to affect directly KMS use for sharing or KMS use for retrieval. Leadership did affect KMS use for sharing and KMS use for retrieval indirectly, via knowledge content quality, perceived usefulness of KMS, and user satisfaction.

These findings suggest that leadership commitment and support can influence doctors to share better quality knowledge (for example, taking more care to externalize their knowledge to make the resulting artefacts easier to comprehend and free from errors). This finding is in agreement with prior research that suggests that employees are more likely to contribute high quality of knowledge if there are champions drawn from senior leaders who promote knowledge contribution (Kulkarni et al., 2007).

The effect of leadership on both KMS use for sharing and KMS use for retrieval discovered in this study is in agreement with previous KM studies reporting that leaders play an important role in influencing employee knowledge sharing behaviour (Davenport et al., 1998; Xue et al., 2011; Zhang & Faerman, 2007). Previous studies found that leaders can influence employees to contribute high quality knowledge by showing their commitment to KMS and by leading by example (DeTienne et al., 2004; Goh, 2002; Hackney et al., 2008; Kulkarni et al., 2007; Poon et al., 2004). In relation to KMS in healthcare, this finding agrees with opinions of experts in opinion articles (Desouza, 2002; Koumpouros et al., 2006) suggesting that it is important that leaders show commitment to KM activities, thus contributing to KMS success.

6.2.2.2 *Incentive*

Incentive affected KMS use for sharing but was not found to affect knowledge content quality. This was in contrast to the findings for leadership, which was also hypothesised to directly affect knowledge content quality and KMS use for sharing—only the effect of leadership on knowledge content quality was found to be statistically significant. Incentive was not found to affect KMS use for sharing or KMS use for retrieval indirectly.

These results suggest that while leadership commitment and support can drive the quality of knowledge, incentive primarily drives the quantity of knowledge contributions. This is consistent with the finding by Garud and Kumaraswamy (2005) that incentive can ultimately undermine KMS success as it may result in a very large number of low quality knowledge contributions, thus undermining knowledge content quality, which is a major factor of KMS success.

While some of the prior studies found the effect of incentive on knowledge sharing not statistically significant (Bock et al., 2005; Lin, 2007), others, similarly to this study, confirmed the effect with a weak effect size (Choi et al., 2008; Lai, 2009). As it is quite likely that in studies that did not discover the effect, the effect was, in fact, present but not discovered due to low effect size, it might be argued that all of these studies were, overall, in agreement with each other.

In the context of healthcare, the finding that incentive affects KMS use for sharing agrees with the opinions voiced by experts in opinion articles that both financial and non-financial incentives are likely to influence doctors' decisions to use IS (Hackbarth & Milgate, 2005; Marshall & Smith, 2003; Miller & Sim, 2004; Muller et al., 2005; Schoen et al., 2009).

A possible explanation of the relatively weak effect of incentive on knowledge sharing is that incentive may undermine the intrinsic motivation to perform behaviour, and thus may be ultimately counterproductive (Kelman, 1961).

Finding no effect of incentive on knowledge content quality was not in agreement with the finding of Kulkarni et al.'s (2007) study, which suggested that this effect exists (with a medium effect size). The difference may be due to a different context. Kulkarni et al. studied business managers, while this study was in the context of healthcare. Contributing low quality knowledge may be less acceptable to doctors than to managers because doctors

have to follow particularly high ethical standards: the knowledge contributed by doctors may affect the lives of their patients (Desouza, 2002; Koumpouros et al., 2006). Therefore, doctors contribute high quality knowledge regardless of the use of incentives.

6.2.2.3 Culture of Sharing

A culture of sharing was not found to affect KMS use for sharing or KMS use for retrieval. There are a few ways to explain this finding. One possibility is that the culture of sharing was largely uniform in the sample, and thus variations in behaviour due to variations in culture of sharing were not observed. Another possibility is that in healthcare the culture of the organisation as a whole does not influence the behaviour of the employees as much as the opinions of their immediate colleagues (the aspect captured in the subjective norm construct).

6.2.2.4 Subjective Norm

Subjective norm affected perceived usefulness. In the healthcare context, Yi (2006) found an effect of subjective norm on perceived usefulness in a study of PDA acceptance by physicians (using a model based on TAM2). Ryu et al. (2003) found that subjective norm affected knowledge sharing behaviour among doctors with a small to medium effect size. These findings are, overall, consistent with the finding of the present study.

The strong collegial relationships between doctors make them value each other's opinions (Clarke & Wilcockson, 2001; Gabbay & Le May, 2004; Nicolini et al., 2007), and thus they influence each other's beliefs about the usefulness of KMS for sharing and retrieving knowledge, suggesting that a subjective norm should have an effect. The weak effect size may be attributable, in part, to the characteristics of the job of a medical practitioner, who is autonomous. Although doctors rely on information from their colleagues in making decisions (Gabbay & Le May, 2004), they still develop their independent evaluations; this means subjective norm has only a limited effect.

6.2.3 Contrasting the effects on KMS use for sharing with the effects on KMS use for retrieval

This section summarises the results discussed in sections 6.2.1 and 6.2.2 and the results presented in section 5.4.2.13 from the perspective of comparing and contrasting the effects of organisational and system factors on KMS use for sharing and KMS use for retrieval. First, this section discusses the effects of organisational factors, the effects of system factors relating to specific aspects of the system, and finally, the effects of the system factors reflecting the user perceptions of the system overall.

Among organisational factors, leadership was found to have the strongest effects on both KMS use for sharing and KMS use for retrieval. Leadership was hypothesized to directly affect both KMS use for sharing and KMS use for retrieval. However, the direct effects were not confirmed, and the effects were via knowledge content quality, perceived usefulness of KMS, and user satisfaction. The magnitudes of the indirect effects of leadership on KMS use for sharing and KMS use for retrieval was approximately the same, indicating that the leaders' commitment and support contributes to both of the essential behaviours. Incentive had a direct effect only on KMS use for sharing (the indirect effect was negligible); incentive was not found to affect knowledge content quality. The remaining organisational factors included in the model, culture of sharing and subjective norm, were not found to affect KMS use for sharing or KMS use for retrieval.

Among the system factors relating to specific aspects of the system (knowledge content quality, system quality, and perceived security), knowledge content quality was found to have the strongest effects on both KMS use for knowledge sharing and KMS use for retrieval. In the model, knowledge content quality and KMS system quality were hypothesised to affect KMS use for knowledge sharing and KMS use for retrieval only indirectly. The effect of knowledge content quality on KMS use for retrieval was stronger (large) than the effect on KMS use for sharing (medium). The effect of KMS system quality on KMS use for retrieval was also stronger than the effect on KMS use for sharing; however, both of these effects were weak, considerably smaller than the corresponding effects of knowledge content quality. The effect of perceived security was not found to be statistically significant.

Among the system factors reflecting the user perceptions of the system overall (perceived usefulness and user satisfaction), perceived usefulness of KMS was found to have the strongest effects on both KMS use for knowledge sharing and KMS use for retrieval. The effect of perceived usefulness of KMS on KMS use for retrieval was stronger than the effect on KMS use for sharing (both of the effects were strong). For user satisfaction, only the effect on KMS use for retrieval was statistically significant, but weak in size.

Overall, most factors explained KMS use for retrieval better than KMS use for sharing, with the exception of incentive, which was not hypothesised to affect KMS use for retrieval directly (on the assumption that incentives are provided only for knowledge sharing). In terms of the amount of variance explained, KMS use for retrieval was explained better than KMS use for sharing, even though five factors were hypothesised to affect KMS use for sharing in the model, and only three factors were hypothesized to affect KMS use for retrieval.

6.3 Contributions to Theory

This study was the first to develop a KMS success model for the healthcare context accounting for both system and organisational factors and the first to test such a model in the context of healthcare. The study contributes to the existing work on KMS success by taking into account the factors that are particularly relevant to the healthcare context, such as subjective norm and perceived security. In this way, this study contributed to better understanding of KMS success in healthcare.

This study was the first to develop and to test a KMS success model that includes KMS use for sharing and KMS use for retrieval in the same model as distinct constructs. Model testing confirmed the validity and the importance of distinguishing KMS use for sharing from KMS use for retrieval. In this way, this study contributed to better understanding of KMS success in general contexts.

In the rest of this section, I present the contributions of this study in terms of the support for the theories on which the study was based. Unlike in section 6.2, where the focus is on the effects of individual factors, this section focuses on sets of factors suggested by the theories on which the model was based.

The section is organised to make explicit the contributions of this study in terms of addressing the research questions formulated in section 1.3, the expected contributions suggested in section 1.6, and the knowledge gaps outlined in section 2.6. The section also discusses unanticipated contributions not directly implied by the research questions or research gaps identified at the outset of the study.

6.3.1 The KMS Success Model in Healthcare

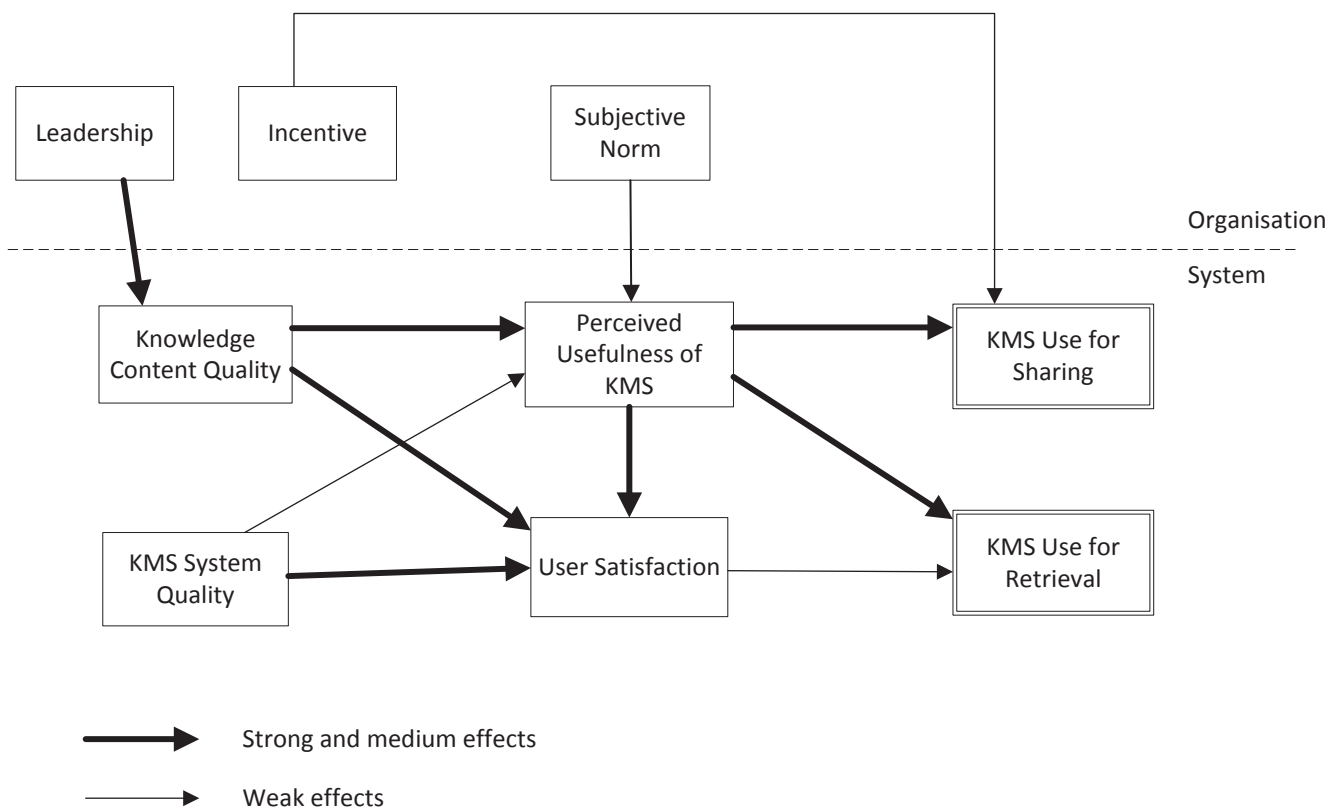


Figure 6-1. KMS success model for healthcare.

The KMS success model for healthcare developed in the present thesis is given in Figure 6-1. The model in Figure 6-1 includes only the relationships confirmed in structural model testing (see section 5.4.2). Taking into account the content of the constructs (see section 4.4) after the adjustments taken in measurement model testing (see section 5.4.1), the

model in Figure 6-1 suggests that KMS use behaviours at health organisations could be formed via the following mechanism.

Senior management is visibly committed to KM at the organisation and periodically reviews KM at the organisation. This both encourages doctors to contribute knowledge of higher quality and results in funds being available to integrate high quality knowledge from external sources (e.g., by offering online access to medical journals).

Higher-quality knowledge—up-to-date, relevant, meaningful, and complete (the latest medical information is available, presented in such a way that it is meaningful in the context of the healthcare organization)—contributes to greater user satisfaction with the system. Moreover, system quality—reliability, user friendliness, and the availability of tools—also contributes to user satisfaction. Satisfied doctors feel that KMS is instrumental in giving access to knowledge relevant to the organization’s functioning and that knowledge provided via KMS meets their needs.

Knowledge content quality and system quality also contribute to perceived usefulness of KMS—KMS is perceived as enhancing doctors’ performance and quality of work life. Subjective norm—the belief that knowledge sharing is encouraged and practiced by important others—also results in KMS being perceived as useful (because KMS enable knowledge sharing).

Perception of KMS as useful drives doctors to use KMS for knowledge retrieval, to retrieve knowledge relevant to decision making, to problem resolution, and to support innovative practices. Moreover, satisfaction with KMS also drives KMS use for retrieval. Finally, doctors who perceive KMS as useful are more likely to share knowledge, because they view KMS as an effective way to convey knowledge to their colleagues. Direct incentives—financial, promotion, and job tenure—also contribute to KMS use for sharing, but not as much as perceived usefulness.

Table 6-1 summarizes the total effects of organisational and system factors on KMS use for sharing and for retrieval (it is based on Table 5-21). Clearly, the effects of system factors are, overall, stronger, than the effects of organisational factors. A higher level of summarization is attempted in Table 6-2, which retains only medium and strong effects (all of them are of system factors). As seen from Table 6-2, the factors that matter most are

knowledge content quality, perceived usefulness, and (for KMS use for retrieval only) user satisfaction (of course, according to the model in Figure 6-1, these factors are not independent, but knowledge content quality affects KMS use for sharing and retrieval via perceived usefulness and user satisfaction). Table 6-2 suggests that managers wishing to promote KMS use should focus on knowledge content quality, perceived usefulness of KMS, and user satisfaction (this aspect is discussed in greater detail in section 6.2.1).

Table 6-1 *Total Effects on KMS Use for Sharing and for Retrieval—Full Model*

Factor	KMS use for sharing	KMS use for retrieval
	Organisational	
Leadership	Weak	Weak
Incentive	Weak	
System		
Knowledge content quality	Medium	Strong
KMS system quality	Weak	Weak
Perceived usefulness	Medium	Strong
User satisfaction		Medium

Table 6-2 *Total Effects on KMS Use for Sharing and for Retrieval—Simplified Model Retaining Only the Most Important Factors*

Factor	KMS use for sharing	KMS use for retrieval
Knowledge content quality	●	●
Perceived usefulness	●	●
User satisfaction		●

Note. In the simplified model, only strong and medium effects are taken into account; the symbol ● indicates the existence of a strong or medium effect.

To demonstrate the contribution of the present study to theory, the KMS success model developed in the present study is compared to prior studies of KMS success relying on extending the DeLone and McLean IS success model in Table 6-3 and in Figure 6-2. Table 6-3 compares the contexts in which the studies were conducted, and Figure 6-2 compares the models.

The present study and the study by Hwang et al. (2008) have been the only studies conducted in the context of healthcare. Nonetheless, the study by Hwang et al. was conducted with a different type of a knowledge management system, a purpose-built KMS

system (and the present study focused on the use of common IT tools for knowledge management).

The study by Hwang et al. (2008) interpreted net benefits in the DeLone and McLean IS success model as users' belief that KMS has the potential to improve their efficiency and reduce costs (e.g., one of the items stated "using KMS could improve knowledge worker efficiency", p. 732). Even though such beliefs are likely to accompany successful KMS implementation, ingraining such beliefs per se is hardly a benefit sought by the organisation. Indeed, some users may believe in KMS potential even when the benefits are yet to be realized. Even though the approach of the present study—using KMS use as proxy for KMS success—is also indirect, one may argue that actual KMS use is a better indicator of KMS success than the mere belief in KMS potential.

Finally, the study by Hwang et al. (2008) used convenience sampling and used gifts and service privileges to incite participation. The participants were "mostly doctors" (p. 729), but the exact composition was not reported. This may have resulted in bias (e.g., with participants receiving gifts more likely to rate KMS positively). The present study used a systematic approach to sampling (as described in section 4.5), and did not use participation enticements.

Even with all these differences, as seen in Figure 6-2, in the part of the model that was common between the two studies (for relationships involving the constructs matching the constructs of the DeLone and McLean IS success model, which are shown as grey boxes in the figure), the results were consistent. In fact, the results were consistent overall for all the studies, with the exception of the study by Kulkarni et al. (which was, very likely, because perceived use in the study by Kulkarni et al. was conceptualised as perceived use of knowledge sharing, with no mention of the system, as discussed in section 2.5).

System quality affected perceived usefulness in the present study and in the study by Hwang et al. (2008) (the studies conducted in healthcare) and did not affect perceived usefulness in the studies by Wu and Wang (2006) and Kulkarni et al. (2007) conducted in general business contexts. One may conclude that system quality is more important in healthcare, where knowledge workers are working under more pressure, so that even small glitches in the system operation matter.

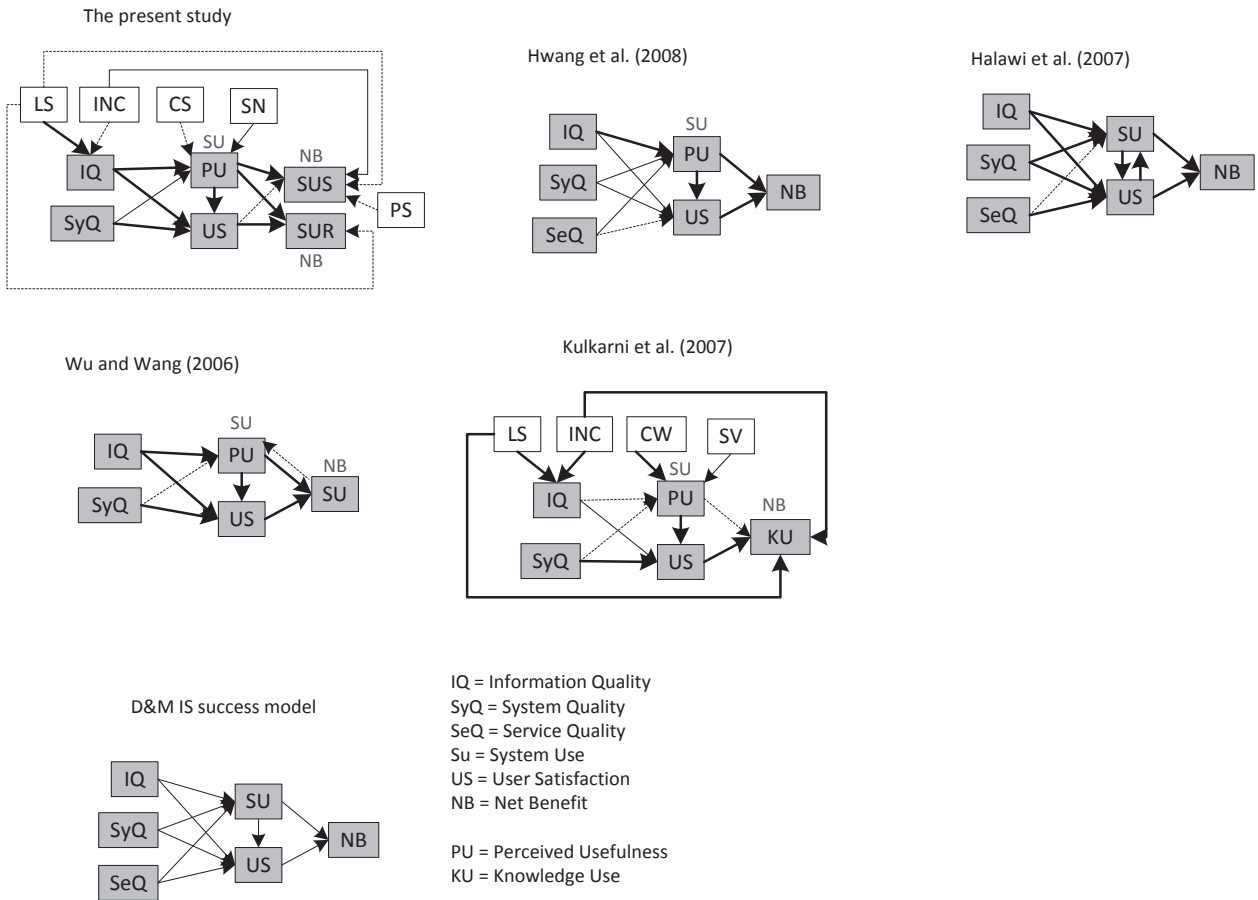
The present study differed from the study by Hwang et al. (2008), and from the rest of the studies covered in Figure 6-2, except the study by Kulkarni et al. (2007), by including organisational factors along with system factors. The organisational factors in the present study differed from the system factors in the Kulkarni et al. (2007) study. As argued in section 2.5, the content of the co-worker and supervisor constructs in the Kulkarni et al. study (representing aspects of subjective norm) appears to be overlapping. The present study included a single subjective norm factor and added the construct of organisational culture of sharing (to distinguish organisational expectations not associated with the direct influence of individuals). Thus, the present study was the first to include culture of sharing in a KMS success model; however, the construct had no effects. For subjective norm, the result of the present study was similar to the Kulkarni et al. result (one has to keep in mind, though, that the content of the perceived usefulness construct differed somewhat between the studies; in the present study it emphasized the use of the system, and in the Kulkarni et al. study, it did not).

Even though the content of the leadership construct in the present study and in the Kulkarni et al. (2007) study was similar (emphasizing KM, rather than KMS), the system use for sharing and the system use for retrieval constructs in the present study explicitly focused on the use of KMS. Knowledge use, the corresponding construct in the Kulkarni et al. study, focused on KM in general (on using knowledge without explicitly stating that the knowledge is from KMS). This difference may explain the different results. In the present study, leadership did not affect system use directly, but in the Kulkarni et al. study leadership had a strong effect on knowledge use.

As to incentive, the content of the construct was similar in the present study and in the Kulkarni et al. (2007) study. In the Kulkarni et al. study, however, incentive had a direct effect on information quality, but not in the present study. Because the content of the information quality construct was similar in the two studies, the difference may be because of study contexts. As discussed in section 3.4.1.1, it is possible that in healthcare doctors, realising that the quality of knowledge may affect patients' lives, contribute the best quality knowledge they can regardless of incentives.

Table 6-3 *The Present Study Versus Prior Studies of KMS Success—Study Settings*

Study	Country	Industry	Organisation(s)	Unit of analysis	Respondent	Type of KMS	N
The present study (2013)	New Zealand	Healthcare	District Health Board (DHB)	Individual	Doctor	General IT tools used for knowledge management	2
Hwang et al. (2008)	Taiwan	Healthcare	Hospital	Individual	Doctor	Purpose built disease classification and treatment KMS	1
Wu and Wang (2006)	Taiwan	Multiple industries	50 Top-500 firms	Individual	Employee	Purpose built KMS	2
Kulkarni et al. (2007)	USA	Multiple industries	Multiple businesses	Individual	Midlevel managers doing Executive MBA	Unspecified	1
Halawi et al (2007)	USA	Multiple industries	Multiple businesses	Individual	Employee	Purpose built KMS	1



Constructs related to constructs in the DeLone and McLean (2003) model are given as grey rectangles. The spatial arrangement for such constructs is held as close as possible to the geometrical arrangement used by DeLone and McLean. Constructs related to constructs by DeLone and McLean, but named differently, are labelled to make the correspondence explicit. Thick solid lines indicate strong and medium effects; thin solid lines indicate weak effects.

Figure 6-2. The model of the present study versus other models of KMS success.

6.3.2 KMS Use for Sharing and KMS Use for Retrieval as Separate Constructs

The study distinguished KMS use for sharing and KMS use for retrieval as separate constructs and empirically compared and contrasted the effects of organisational and system factors on KMS use for sharing and KMS use for retrieval. KMS use for retrieval was explained better than KMS use for sharing, suggesting the need to consider further constructs as immediate predictors of KMS use for sharing. Among the factors relating to specific aspects of the system (knowledge content quality and KMS system quality), knowledge content quality had the strongest effect on both KMS use for sharing and KMS use for retrieval (in both cases, stronger than the effect of the strongest organisational factor, leadership). For a further discussion of these results, see section 6.2.3.

Even though the present study was the first to formulate and to test a KMS success model based on the DeLone and McLean IS success model with KMS use conceptualized as a two-dimensional construct comprising KMS use for sharing and KMS use for retrieval, the study by Chen and Hung (2010) also tested a model including KMS use for sharing and KMS use for retrieval as separate constructs (but their model was not based on the DeLone and McLean IS success model). Chen and Hung (2010) studied knowledge sharing in online communities involving members interested in particular technical issues, rather belonging to a single organization or profession. The outcomes of the study by Chen and Hung (2010) are compared to the outcomes of the present study in Table 6-4.

As shown in the table, the factors found to affect KMS use for sharing and KMS use for retrieval were quite different, which, most likely, was the consequence of the different contexts and of the different theoretical frameworks used in the two studies. The study by Chen and Hung (2010) used the social exchange theory as the theoretical foundation for their model, which led them to include constructs such as norms of reciprocity and personal trust. This was appropriate for the context of their study—the participants in the virtual community had very little in common beyond interest in particular technical issues and, most likely, belonged to very broad range of organizations and professions, with very different cultures. Moreover, most of them never met face to face. Thus, reciprocity (expectation that if they help others, eventually something will help them) and trust (there

was no basis for trust stemming from sharing physical or organisational space) were particularly relevant.

Perceived usefulness in the present study was similar in content to perceived relative advantage in the study by Chen and Hung (2010), and the results for these factors were consistent.

Even though most of the factors included in the present study and in the study by Chen and Hung (2010) were different, the studies displayed a similar pattern: the effects on KMS use for sharing and on KMS use for retrieval were quite different even for factors that were hypothesised to directly affect both. Therefore, both of the studies supported the view that KMS use should be treated as a multidimensional construct.

Table 6-4 *Total Effects on KMS Use for Sharing and KMS Use for Retrieval—Comparison With the Study by Chen and Hung (2010)*

Factor	KMS use for sharing	KMS use for retrieval
	Present study	
Leadership	Weak	Weak
Incentive	Weak	
Knowledge content quality	Medium	Strong
KMS system quality	Weak	Weak
Perceived usefulness ^a	Medium	Strong
User satisfaction		Medium
	Chen & Hung (2010)	
Norm of reciprocity		Weak
Interpersonal trust	Weak	Strong
Knowledge sharing self-efficacy	Strong	Weak
Perceived relative advantage ^a	Strong	Strong
Perceived compatibility	Weak	

^aConstructs similar in content.

6.3.3 Culture of Sharing and Subjective Norm

The study considered the effects on KMS success of a culture of sharing and a subjective norm (representing values and beliefs with respect to knowledge sharing in the organisation overall and at the local level). These organisational factors had never been considered in the context of a KMS success model involving system factors. Both culture of sharing and subjective norm were hypothesised to affect perceived usefulness of KMS. Subjective norm had a weak effect, but culture of sharing had no effect, suggesting that in the context of healthcare organisations the influence of immediate colleagues on the perceptions of a doctor regarding KMS usefulness is stronger than the influence of the overall organisational culture. Neither culture of sharing nor subjective norm were found to have a statistically significant effect on doctors' behaviour with respect to KMS. For a detailed discussion of these results, see sections 6.2.2.3 and 6.2.2.4.

Even though the present study did not discover any effects of culture of sharing, constructs similar to culture of sharing in the present study have been demonstrated to have effect on KM related behaviours in prior studies. The studies by Alavi et al. (2006) (who found that organisational values affected the use of KM tools), by Al-Alawi et al. (2007) (who found that cultural values affected knowledge sharing), and by Park et al. (who found that organisational culture affected KM technology) are introduced in section 3.5.2.2. In addition, Yu, Lu, and Liu (2010), who conducted a survey of members of three professional virtual communities using weblogs, found that knowledge sharing culture attributes such as openness, enjoyment of helping, and fairness, affected knowledge sharing.

Therefore, even though no effects were discovered for knowledge sharing culture in the present study, in future research it makes sense to consider different ways to incorporate culture of sharing into a model of KMS success in healthcare. For example, a hypothesis that culture of sharing affects the subjective norm (namely, individuals influence each other to comply with the norms of the organisation overall) could be considered.

6.3.4 Transactional and Transformational Leadership and Other Theories of Leadership

In the present study, the content of the concept leadership was based on the conceptualisation used by Kulkarni et al. (2007), broadened based on the conceptualisations by Ash (1997) and by Guimaraes, Igbaria, and Lu (1992), and covered the perception of doctors of leadership's commitment to knowledge management, supportive approach to leadership, and management's understanding of the role of KM. The dichotomy between leadership and incentive was presented in terms of transformational and transactional leadership.

As discussed in sections 6.2.2.1 and 6.2.2.2, both leadership (transformational leadership) and incentive (transactional leadership) affected the respondents' behaviour; however, the effects of transformational leadership were stronger. This result should be compared to the result by Crawford (2005), who tested a model including both transformational and transactional leadership and found that only transformational leadership affected knowledge management behaviours. The study by Crawford was conducted with students as the respondents. The difference between the results of the present study and the result by Crawford is likely because of the difference in context—the incentives such as salary and promotion potentially available to professionals, such as healthcare professionals, are more immediate (and, therefore, stronger) than the incentives available to students at universities.

The remaining subsections of this section explore the implications of the results of the present study for leadership in a broadest possible sense, not limited to the dichotomy between transformational and transactional leadership. The discussion draws from the theories of distributed (Spillane, 2006) and instrumental (Bryman, Bresnen, Beardsworth, & Keil, 1988) leadership, as well from other relevant theories, such as the theory of social capital (Nahapiet & Ghoshal, 1998) and the theory of weak ties (Granovetter, 1973).

6.3.4.1 Distributed Leadership and Social Capital

The meaning of the finding that subjective norm affected perceived usefulness of KMS, but the culture of sharing had no effect can be explored from the perspective of the distributed leadership theory.

Distributed leadership is an emergent organisational process, rather than a role (Spillane, 2006). In distributed leadership, organizational members with different skills and expertise both work jointly and regularize each other's conduct relating to work (Gronn, 2002; Currie & Lockett, 2011). Distributed leadership primarily relies on implicit mutual understanding, although it may result in supporting formal structures, such as committees, established in the organisation. In distributed leadership, the influence is reciprocal: the direction of influence depends on the situation (Gronn 2002; Currie & Lockett, 2011).

Studies by Cronn (2002) and Currie and Lockett (2011) have claimed that distributed leadership is highly relevant to describing leadership in healthcare, because the complexity and interdependencies in the health domain (Gronn gives an example of interactions between psychotherapeutic and pharmacological treatments in psychiatry) and the constant changes at all levels (such as changes in patients' conditions, changes in medical knowledge, and changes in government regulations) make it difficult for a small number of people in leadership positions to lead effectively; therefore, because of cognitive limitations of individuals, leadership in healthcare has to be distributed to be effective.

In the context of the use of KMS in healthcare, one would expect that the use of KMS by doctors involved in distributed leadership processes ("leadership actors", following Currie & Lockett, 2011) would be influenced by other leadership actors, with whom they directly collaborate in accomplishing tasks. This view is consistent with the result of the present study that subjective norm affects perceived usefulness. Rather than being directly influenced by their perception of the culture of their organisation (culture of sharing in the present study), they are influenced by their colleagues.

In an article exploring the ways to improve leadership in New Zealand healthcare, Perkins (2004) asserted the need to involve rank and file health practitioners in leadership by noting that "those at the apex in health organisations seldom really understand the business of the operating core", so that effective leadership in a system "characterised by chaos and change" (p. 3) cannot be achieved without such involvement. In a similar vein, Glasgow and Day (2010) emphasized the need to place physicians in leadership roles to ensure the success of clinical information systems. The finding of the present study that subjective norm (but not the culture of sharing) affects perceived KMS usefulness is consistent with the Perkins's and Glasgow and Day's argument—rank and file health service professionals are capable of influencing each other.

Knowledge can be seen as a way to exercise influence as an aspect of expert power in the five bases of the power framework by French and Raven (1959). The framework distinguishes coercive power, reward power, which is related to coercive because a reward can be withdrawn, legitimate power, which relies on the acceptance of formal roles, referent power, which relies on charisma, and expert power, which relies on the possession of superior knowledge. Viewing knowledge as a way to exercise influence, once KMS use has been established, one would expect KMS to become a part of the distributed leadership processes, with leadership actors relying on KMS in their work and influencing each other via KMS. Therefore, it is likely that eventually, KMS use would influence distributed leadership, for example, by enabling effective distributed leadership over time (via codification/capturing explicit knowledge, see section 2.2.1) and over distance (via personalization/transmission of tacit knowledge). The possible feedback effects, however, are a topic for further research. The results of the present study did not provide direct evidence that such feedback effects exist; nonetheless, the evidence in the literature (Glasgow & Day, 2010) that IS implementations in healthcare involve complex dynamics (which, in part, could be caused by feedback effects) suggests extending the research model of the present study to explore such feedback effects as being an interesting topic for further research.

The possible feedback effect of KMS on leadership can be described in terms of the development of weak ties between leaders and followers and between leadership agents in distributed leadership; weak ties (connections between people who are not normally in direct contact) may be developed via communication functionality of KMS (see section 2.2.1). Such weak ties are particularly potent as empowering opportunity structures (Balkundi & Kilduff, 2006; Granovetter, 1973) because they give individuals access to information and knowledge that are not available in their immediate environment. Moreover, ties developed via KMS may change the circle of important others who form the doctor's subjective norm, which was found to positively affect the perceptions of KMS usefulness in the present study. It would be natural to assume that new connections established via KMS are likely to value KMS, and thus are likely to shift the subjective norm in the direction favouring more positive perceptions of KMS.

The value of relationships created via the personalization aspect of KMS can be considered from the perspective of the social capital theory (Nahapiet & Ghoshal, 1998). Social capital is a network of interpersonal relationships enabling trust, cooperation, and

collective action. Social capital is believed to contribute strongly to organisational effectiveness (Nahapiet & Ghoshal, 1998). The structural dimension of social capital refers to the overall pattern of connections, the relational embeddedness dimension refers to the types of relationships people have developed (such as trust, norms, and obligations), and the cognitive dimension refers to shared representations, interpretations, and systems of meaning constructed via interactions between people (Cicourel, 1973; Nahapiet & Ghoshal, 1998). Clearly, at organisations such shared representations, interpretations, and systems of meaning constitute organisational knowledge. Edmonstone (2011), in his discussion of leadership in the National Health Service in the UK, emphasized the importance of social capital for improving healthcare quality, as well as the role of leadership in developing social capital.

As discussed in section 2.2.1.3, KMS have a potential to both facilitate relationship building, and to facilitate the capture of knowledge. Therefore, one may expect that KMS promote the creation of social capital at organisation. Thus (congruent with the views expressed by Edmonstone, 2011), the results of the present study suggest that transformational leadership, KMS system quality, and knowledge quality promote activities (KMS use) that are, as just argued, likely to result in enhanced social capital at the organisation.

6.3.4.2 Full Range of Leadership

The research model of the present study included leadership and incentive organisational factors, which were conceptualised to maintain consistency with prior research of knowledge management success at organisations. As noted in section 2.3.3, leadership and incentive, as conceptualized in the present study, can be seen as corresponding to, respectively, transformational and transactional leadership in the full range of leadership (FRL) framework by Bass (1985), who aimed to cover all the important aspects of the leadership phenomenon. Even though the framework does not cover aspects such as distributed and instrumental leadership, it remains in use, as demonstrated, for example, by the recent publication by Peus, Braun and Frey (2013), which introduced a new set of measures of leadership constructs. The present study found that of the organisational factors considered, leadership (transformational leadership in terms of the FRL framework) is the strongest predictor of KMS use for both sharing and retrieval. The finding is consistent with the multiple studies of the effects of transformational leadership on various

aspects of organisational success reviewed by Lowe, Kroeck, and Sivasubramaniam (1996) and Bass (1999). The finding can also be presented in terms of the distinction between soft power (persuasion) and hard power (compulsion) (Nye, 2010). Incentives can be seen as representing hard power (because they can be withdrawn or not given). The relatively weak effects of incentives in the present study are consistent with the view that soft power is preferable to hard power, as far as leadership is concerned (Nye, 2010). Moreover, the result can also be seen through the prism of the distinction between communal relationships (relationships in which benefits are given without expecting reciprocity) and exchange relationships (relationships in which reciprocity is expected) (Clark, 1993). For a leader wishing to promote KMS use, communal relationships with rank and file health practitioners, relationships based on their shared destiny that is determined by the success of the organisation are more important than exchange relationships.

Perkins (2004), in his discussion of leadership in New Zealand healthcare, emphasized the importance of transformational leadership, in which leaders “focus on their people rather than the tasks they perform” (p. 3), contrasting transactional leadership with an approach solely relying on issuing rewards and enforcing rules. Perkins’s emphasis on transformational leadership in healthcare is supported by the finding of the present study that transformational leadership had stronger effect on KMS use in healthcare than transactional leadership. Edmonstone (2011), along with advocating distributed leadership, also emphasized the importance of more traditional leadership. The results of the present study are consistent with this view; leadership (transformational leadership) and incentive (transactional leadership) had stronger effects on KMS use than subjective norm, which incorporated the influence of the peers (and hence, aspects of distributed leadership). The results of the present study support the emphasis on both traditional and collective leadership in the New Zealand Ministerial Review Group document exploring ways to improve healthcare quality (Ministerial Review Group, 2009), which states that “the challenges we face require collective leadership from both clinicians and managers to help find the appropriate answers” (p. 19). Nonetheless, the results suggest that any distribution of leadership should be exercised with caution. The document emphasizes the need to collect timely performance data (which can be used to provide incentives). The effect of incentive on KMS use for sharing demonstrated in the present study supports the use of incentives; nonetheless, because transformational leadership had stronger effects, the use of incentives should not be overemphasized.

The effect of transformational leadership on KMS use discovered in the present study may be self-magnifying in the long term because of the possibility of a feedback effect of KMS use on transformational leadership. Once (and if) leaders discover that their efforts have resulted in an increased use of KMS, and if the leaders attribute increased organisational performance (such as better outcomes for patients) to such increased use, they are likely to redouble their transformational leadership efforts. On the other hand, if the leaders find that KMS use results in unexpected undesirable consequences (such as in the case study of KMS use at INFOSYS corporation reported by Garud and Kumaraswamy, 2005, where KMS was overused, resulting in productivity losses), they may discourage KMS use. Thus, the feedback effects may result in complex, nonlinear dynamics, contributing to the complex adaptive systems dynamics of leadership at knowledge oriented organisations (for a conceptualization of leadership at knowledge oriented organisations in terms of complex adaptive dynamics, refer to Uhl-Bien, Marion, & McKelvey, 2007).

Day and Norris (2006) relied on representing healthcare organisations as a complex system in their action research study of health IT projects. They found that the complexity of IT implementation can be seen as a “crucible of leadership” (p. 6) and thus, IT implementation, affected by leadership, also influences leadership. Their study provides further support for the view that KMS use may have feedback effects (not only affected by leadership, but also influencing leadership).

Clearly, discovering such feedback effects was beyond the scope of the present study (the study provides no direct empirical evidence of their existence), and has to be left for further research, building on the present study. The possibility of feedback effects, though, underscores the need to include (as was done in the present study) both system and organisational factors in models of KMS success. Organisational factors affecting system factors related to organisational success are likely, in their turn, to be affected by the system factors in the long term. If only system factors are included (such as in the model by Hwang et al., 2008), such feedback effects cannot be studied.

6.3.4.3 Instrumental Leadership

Instrumental leadership (Antonakis & House, 2004; Bryman, Bresnen, Beardsworth, & Keil, 1988; Nadler & Tushman, 1994) refers to facilitating the work of followers by providing relevant resources (path-goal facilitation) and constructive feedback (outcome monitoring). Clearly, KMS can be seen as a vehicle for providing a resource that is highly

critical at healthcare organisations—for providing job relevant knowledge; moreover, constructive feedback is also facilitated by KMS, and can be seen as a kind of knowledge. Further, KMS can be seen as enabling the blending of instrumental and distributed leadership; leadership agents in a distributed leadership process can facilitate each other's work by contributing knowledge via KMS.

The finding of the present study that transformational leadership promotes the use of KMS suggests that KMS may enable positive interaction between different aspects of leadership. By promoting the use of KMS for knowledge retrieval, transformational leadership by top management may enable instrumental leadership by top management, because top management may contribute knowledge to KMS (e.g., by using KMS to publish documents as knowledge content), thus facilitating doctors' work. Further, by promoting the use of KMS for both knowledge sharing and knowledge retrieval, top management may contribute to distributed leadership (because, as discussed earlier, KMS may promote distributed leadership) and to instrumental leadership by the health practitioners involved in distributed leadership (leadership agents). Nonetheless, the present study did not cover instrumental leadership or distributed leadership directly; therefore, the interactions between transformational, distributed, and instrumental leadership enabled by the use of KMS remain a topic for further research.

6.3.5 Perceived Security

The study considered the effect of perceived security on KMS success. Previously, this system factor had never been considered in a KMS success model. Perceived security was hypothesised to affect KMS use for sharing. No effect was discovered, suggesting that in the context of healthcare the security of knowledge shared by KMS is not a major issue affecting doctors' behaviour (see section 6.2.1.3 for a detailed discussion of the result for perceived security).

Although perceived security was initially conceptualised in terms of both environmental and behavioural uncertainty, all items relating to perceived environmental security (technology aspects of security) had to be dropped, as presented in section 5.4.1.1. As discussed in section 5.4.1.1, the likely reason for the items relating to environmental security being unreliable is that the items did not make sense to many of the respondents

because the respondents conceptualised the security of information technology primarily in terms of how people use it, rather than in terms of information technology capabilities. The implication of this result is that perceived environmental security (the technology-related aspects of security) is not relevant for doctors, because the levels of security in healthcare organisations are high enough, so that doctors do not need to be aware of the details of how security is implemented.

A major design imperative in designing security features of information systems is to make them unobtrusive, as invisible as possible to the users, so that the users can fully focus on business related features (Johnston, Eloff, & Labuschagne, 2003). If the unreliability of the items measuring environmental security is interpreted as the lack of awareness by doctors of technological aspects of security related functionality of the KMS, the implication is that the information technology used in such KMS is mature and well designed, so that the security features are, indeed, unobtrusive. This is consistent with the findings of the preliminary study (Appendix A), which provided evidence that doctors rely on commonly available general-purpose information technology (and thus, mature technology) for knowledge management.

Thus, the outcomes of this study suggest that making a distinction between perceived environmental and perceived behavioural security is not productive in the context of studying KMS in healthcare.

6.4 Implications for Practice

The understanding of the factors affecting KMS success in healthcare achieved in this study allows suggestions to be made regarding specific approaches to promoting KMS success.

Leadership is the most important organisational factor. Direct support from leaders and their involvement have a positive effect on KMS success.

Knowledge content quality is the most important system factor. The focus should be on knowledge content quality, rather than on directly promoting system use. Knowledge content quality will drive both KMS system use for retrieval and KMS system use for sharing.

There should not be too much focus on establishing incentives or on trying to affect doctors' perceptions of the organisational values and norms around knowledge sharing. Direct support and involvement of the leaders (leadership) contributes more to KMS success than incentives or perceived culture of sharing.

The rest of this section lists some specific recommendations.

Leadership. As suggested in an opinion article by Gray (1998), the position of Chief Knowledge Officer (CKO) is necessary in modern healthcare organisations to exercise leadership and to ensure knowledge content quality—that the right knowledge is captured and disseminated, and that up to date knowledge is easily accessible. To ensure knowledge content quality, management can set up a formal quality assurance process (Koumpouros et al., 2006).

Knowledge content quality. Medical and scientific knowledge must be captured and presented using simple words and a unified vocabulary that is consistent throughout the organisation. Lack of unified vocabulary has been mentioned as a knowledge sharing barrier in an experience report by Desouza (2002).

Online communities of practice can be a suitable platform for promoting frequent social interaction and hence creating a social network enabling dynamic sharing of tacit knowledge (Hara & Hew, 2007). In such an environment, peers can share stories of personal experience, learn from others, as well as motivate others to share knowledge and help others to solve problems (Wasko, Faraj, & Teigland, 2004; Wenger & Snyder, 2000). Knowledge disseminated via online communities is likely to be of high quality in terms of its relevance to context and timeliness of delivery. Leaders may support such communities by leading by example.

6.5 Limitations

When generalising the results of this study to other contexts, one should take into account its limitations due to the choice of the research approach, model, and participants.

One of its limitations is the choice of organisational constructs, which were based on the previous literature relating to KMS and KMS in healthcare. There may be other enablers of

KMS success in healthcare that were not included in this study, which could be the topic of future research.

A further limitation is that the measurement of constructs relied on self-administered questions and on self-reports. Participants self-selected to participate in the study and the accuracy of answers depended on the participants' ability and readiness to present the true state of affairs—potential sources of bias. The use of the same method and the same questionnaire to measure all constructs in the model may have led to common method bias. Bias checks available (and used in this study) provide indirect evidence only, not a guarantee.

This study relied on a cross-sectional survey, and thus provided no empirical evidence allowing the distinguishing of causes from effects.

The study treated KMS as generic systems, but different types of KMS are likely to be affected by different factors (or in different ways by the same factors). For example, factors influencing the success of a system (relying on free social networking services in open Internet) that emerged to support the activities of an informal community of practice may differ from the factors that influence the success of a knowledge repository on company intranet formally established and maintained as part of a knowledge management initiative led by top management.

This study was conducted at two geographical locations, mid-sized cities in New Zealand. The findings may not be entirely generalizable to other settings, such as rural areas.

Finally, the respondents involved in this study were doctors. The findings and implications drawn from this study may not be generalizable to other healthcare professionals, such as nurses and pharmacists.

6.6 Future Research

Based on a consideration of both contributions and limitations, I have derived a number of suggestions for future research.

KMS use in this study was measured using two dimensions of use, KMS use for sharing and KMS use for retrieval. Future research could model KMS functionality in more detail (e.g. distinguish functionality more relevant for the sharing of tacit knowledge from functionality more relevant for the sharing of explicit knowledge). Alternatively, future research could examine whether the two dimensions discovered in this research are clearly distinguished in other contexts.

The variance explained for knowledge content quality was 17 percent in this study, indicating that it was affected by factors not accounted for in the model. Prior research suggests that absorptive capacity, functional diversity, and knowledge network influence knowledge quality (Yoo et al., 2011). In the same study, it was found that knowledge quality had three dimensions: intrinsic knowledge quality, contextual knowledge quality, and actionable knowledge quality. Future research could examine (in a KMS success model) further factors affecting knowledge content quality or examine whether treating knowledge content quality as a multidimensional construct improves the explanatory power of the model.

The model formulated in the present study explained KMS use for retrieval better than KMS use for sharing. Future research could examine further determinants of KMS use for sharing.

In this study, perceived security was found to have no statistically significant effect on KMS use, although it is widely believed that perceived security influences KMS success. Future research may reconsider the content of the perceived security construct, to confirm or to disconfirm the finding of this research.

Similar considerations apply to the culture of sharing concept. Future research may look at other organisational cultural values such as innovativeness, autonomy, formalization (i.e. adherence to procedures), and expertise (Alavi et al., 2006).

This research was limited to studying doctors. A replication of work is needed to extend this study to other categories of healthcare professionals, for example, nurses, to understand the extent of the generalizability of the findings.

To overcome the limitations associated with using a cross-sectional survey, in future research the model formulated in this study could be tested by using a longitudinal study

design (e.g., measuring the factors at one point in time, and measuring the outcome variables at a later point in time).

As argued in section 6.3.4, feedback effects from KMS use to organisational factors, such as leadership, may provide insights in to the complex dynamics of KMS implementation and use at healthcare organisations. A possible extension of the research model to incorporate the feedback effects is outlined in Figure 6-3. To test the model in Figure 6-3, a longitudinal study may be needed, with organisational and system constructs measured repeatedly, at different times, resulting in a depiction of KMS implementation and use dynamics.

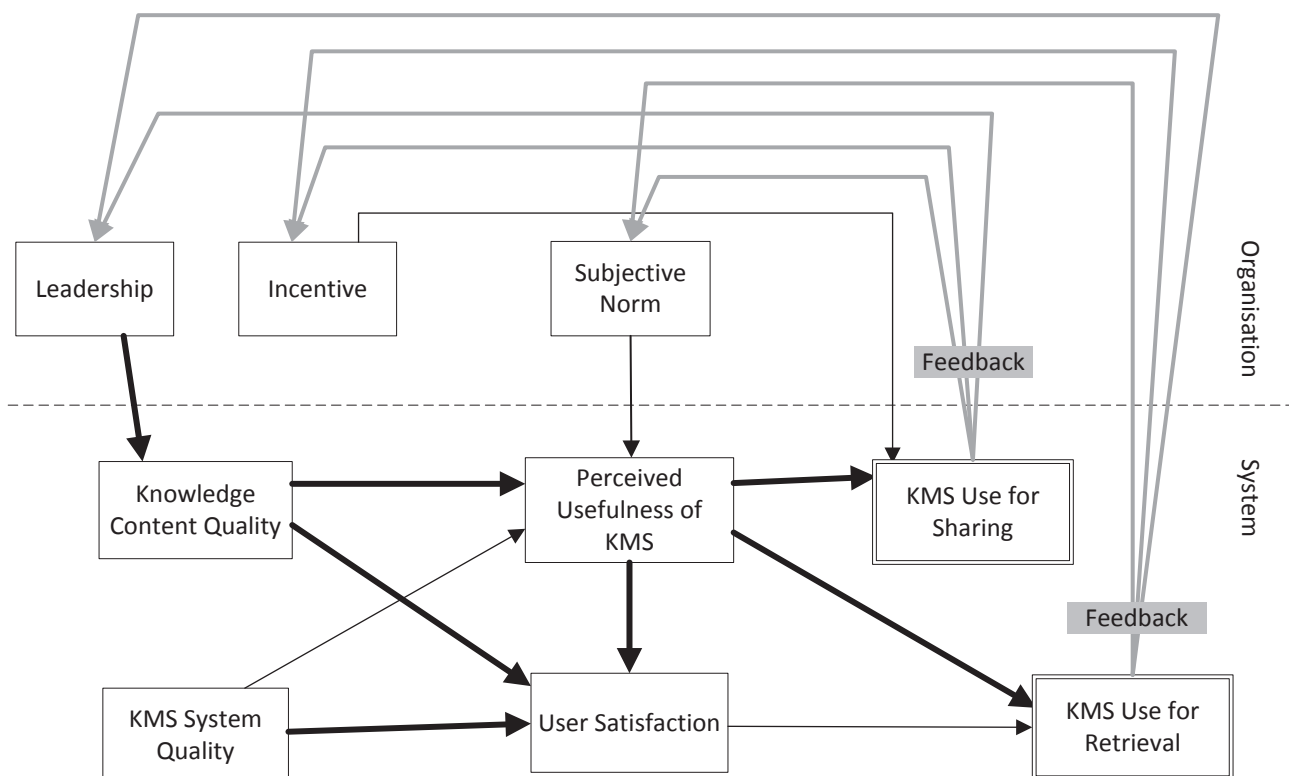


Figure 6-3. An extension of the model of the present study (see Figure 6-2) to take into account feedback effects from KMS use to organisational factors. Feedback effects are depicted as thick grey arrows.

A major limitation of this study was that it relied solely on quantitative research, and thus did not capture and interpret rich data. It is highly desirable that in future research the

meanings of the effects discovered in the present study to important stakeholders in the healthcare context (such as nurses, doctors, administrators, and management employees in healthcare) are explored by using qualitative approaches to data collection and analysis, such as in-depth interviews and ethnographic observations. The in-depth understanding of the context and of the major stakeholders' perspectives achieved via qualitative analysis of the resulting data would make the results more relevant to management practice by offering managers vicarious experiences.

Moreover, because the present study relied on a cross-sectional survey, the ability of the study to distinguish causes from effects was limited. Conducting controlled experiments at organisations (particularly at healthcare organisations) may be difficult because of the cost and because of ethical considerations. Therefore, qualitative research is the most natural approach to explore the casual relationships around the use and the success of KMS systems in healthcare. Particularly deep insights may be expected if qualitative research is combined with quantitative research, resulting in a mixed methods study. For example, a longitudinal study designed to test the models with feedback effects presented in Figure 6-3 could involve the repeated collection of both qualitative and quantitative data over a period of time. This would allow not only for testing the hypotheses, but also for exploring the meaning and the detailed mechanism of the dynamics from the perspectives of the major stakeholders.

6.7 Conclusions

The purpose of this study was to explore organisational and system factors of KMS success in healthcare, with success interpreted as KMS use for sharing and retrieval of knowledge. A research model was formulated based on the KMS success model by Kulkarni et al. (2007), an extension of the DeLone and McLean (2003) IS success model. To test the research model, a cross-sectional survey was conducted. The research participants were doctors practicing in Hamilton and Wellington (two mid-sized cities in New Zealand). The research model was tested by fitting the data obtained in the survey using PLS SEM.

Knowledge content quality and KMS system quality (system factors) affected KMS use for sharing and KMS use for retrieval via perceived usefulness of KMS and user satisfaction. Of the organisational factors considered, leadership (conceptualised as transformational

leadership—not including rewards, which were included as a separate construct) affected both KMS use for sharing and KMS use for retrieval indirectly, via system factors, and incentive affected KMS use for sharing directly. The factor affecting KMS use for sharing and KMS use for retrieval the strongest was knowledge content quality, and leadership was the organisational factor that had the strongest total effect on KMS use for sharing and KMS use for retrieval. Subjective norm affected perceived usefulness of KMS, but its total effect on KMS use was not statistically significant. In terms of the amount of variance explained, KMS use for retrieval was explained better than KMS use for sharing, even though five factors were hypothesised to affect KMS use for sharing, and only three factors—KMS use for retrieval.

The study confirmed the validity of the DeLone and McLean IS success model (DeLone & McLean, 2003) in the context of KMS use in healthcare and confirmed the importance of including organisational factors in models of KM success. For transformational and transactional leadership (included in the model as, respectively, leadership and incentive constructs), consistently with the results of prior studies, it was found that transformational leadership had stronger effects.

The main implications for practice are that managers aiming to promote the use of KMS in healthcare should practice transformational leadership and should focus on improving knowledge content quality.

By considering the outcomes of model testing in the present study in view of the literature, an extended model was proposed, which, in future research, has the potential to explain complex dynamics in KMS implementation and use in healthcare by incorporating feedback effects from KMS use to organisational factors.

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APPENDIX A: PRELIMINARY STUDY

The preliminary study presented in this appendix established the extent of use of information technologies for knowledge management by secondary healthcare organisations in New Zealand, thus establishing the feasibility of the main study. The results of the study are presented as they were published in *International Journal of Medical Informatics* (Ali, Tretiakov, & Whiddett, 2012).

The role of the preliminary study in establishing the feasibility and in motivating the design of the main study is discussed in section 4.5.

APPENDIX B: QUESTIONNAIRE PACKET FOR THE CONTENT VALIDITY STUDY

B.1 Invitation Letter

[Date]

[Recipient Name]

[Address 1]

[Address 2]

[Address 3]

Dear Sir/Madam,

Re: An invitation to evaluate the questionnaire items.

The purpose of this letter is to introduce myself and invite you to consider participating as an expert in evaluating the questionnaire items for my research project I am conducting for my doctoral study at Massey University, Palmerston North, New Zealand.

Enclosed is the answer sheet which contains the questionnaire items for your evaluation. You are expected to evaluate the items of the questionnaire whether it is relevant to the construct given. Your responses will be important for checking the validity of the contents of the questionnaire. It will take you around **10 minutes** to complete.

I have enclosed the answer sheet for you to fill up and a return envelope. I would be very grateful if you can complete the answer sheet and return it in the pre-paid, self-addressed envelope.

You may email me any queries concerning this matter to the email address given below. I once again thank you for your time and commitment. I look forward to receiving your responses.

Yours sincerely,

Nor'ashikin Ali

Doctoral Research Student

Email: s.ali@massey.ac.nz

B.2 Questionnaire

To save space, only the first page of the content validity questionnaire is given here.

ANSWER SHEET

We ask you, as an expert, to evaluate a questionnaire devoted to the determinants of Knowledge Management Systems success in healthcare. In the following, the text of the questionnaire that we ask you to evaluate is given in blue, while our instructions to you as an evaluator are given in black. No matter what we ask you to do explicitly, please feel free to also provide free-form comments by writing anywhere on this form.

A. KMS Use for Sharing

The extent to which KMS is being used to communicate with colleagues, participate in online discussion groups, discuss ideas/views/experiences, collaborate with peers, distribute knowledge, identify and locate people for knowledge and expertise.

		Please, evaluate the importance of each item for measuring the concept of "KMS use for sharing" by ticking as appropriate		
	Item	Not relevant	Important (But Not Essential)	Essential
A1.	I use KMS to communicate knowledge with colleagues	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A2.	I use KMS to contribute ideas and/or feedbacks to the forum	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A3.	I use KMS to participate in online discussion groups	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A4.	I use KMS to discuss and/or exchange ideas/views/experiences with colleagues	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A5.	I use KMS to collaborate with colleagues	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A6.	I used KMS to distribute knowledge (e.g. news, memos, reports, presentation, organization policies)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Please, suggest any other items that you think are important for measuring the construct of "KMS use for sharing", or further comment on the items we suggested.

APPENDIX C: QUESTIONNAIRE PACKET FOR THE MAIN SURVEY

C.1 Invitation Letter

30 September 2010

XXXX
XXXX
XXXX

Dear Dr. <title>,

The purpose of this letter is to introduce myself and invite you to consider participating in a research project I am conducting for my doctoral thesis at Massey University, Palmerston North, New Zealand.

The purpose of the survey is to investigate factors that may determine the success of knowledge management systems (KMS) implementation in your organisation. The research will be conducted using a questionnaire-based survey, which you can respond via online survey or hard copies that may take you only around 10 minutes.

Ethics Committee approval has been granted for the research.

I have enclosed an information sheet about my research, questionnaires, and return envelope. If you are interested in participating, please complete the questionnaires and return it in the pre-paid, addressed, return envelope. The number on the enclosed reply envelope allows us to cross your name off once you have responded and ensures that I do not send you a reminder.

If you prefer to respond via online survey, you can use the following token number to access the online survey at URL: <http://is-research.massey.ac.nz/kmssh>

Token number:

Your individual identity and responses to all questions will be kept completely confidential. You may email any questions you may have to the email address given below. A copy of the study findings will be available from me on request.

I appreciate that you are busy and so I once again thank you for your commitment and your time.

I look forward to receiving your completed questionnaire as soon as possible.

Yours sincerely,
Nor'ashikin Ali
Doctoral Research Student
Email: s.ali@massey.ac.nz

C.2 First Reminder

14 October 2010

Addressees

Dear <>,

Re: Reminder to complete and return research survey: “Determinants of KMS Success in Healthcare Organisations”

You may recall receiving a questionnaire from us two weeks ago, asking you to take part in the survey for the above study.

At the time of sending this letter, I have not yet received your response. If you have already returned your questionnaire, thank you. Please accept our apologies for sending you this reminder. If you have not yet completed the questionnaire, could you please do so as soon as possible and return it in the return envelope included in my earlier mail to you.

If you prefer to respond via online survey, you can use the following token number to access the online survey at URL: <http://is-research.massey.ac.nz/kmssh>

Token number:

Just to remind you, your individual identity and responses to all questions will be kept completely confidential and your name will not be associated with your answers. Your confidential answers will provide very valuable information for the successful implementation of knowledge management systems (KMS) in healthcare systems.

The questionnaire was carefully designed so as to involve the shortest possible commitment of your time. It should take you about 10 minutes to complete.

I count on your responses to help us in our effort to assist healthcare organisations in implementing knowledge management systems (KMS) successfully. Your input is crucial for the success of this research.

I appreciate that you are busy and so I thank you in advance for your commitment and your time.

Yours sincerely,

Nor'ashikin Ali

Doctoral Research Student

Email: s.ali@massey.ac.nz

C.3 Second Reminder

Dear < > ,

Re: Reminder to complete and return research survey: “Determinants of KMS Success in Healthcare Organisations”

You may recall receiving a questionnaire from us four weeks ago, asking you to take part in the survey for the above study.

At the time of sending this letter, we have not yet received your response. If you already have returned your questionnaire, thank you. Please accept our apologies for sending you this reminder. We realise that that you may not have had time to complete it. However, we would genuinely appreciate hearing from you.

We are writing to you again because your input is crucial for the success of this research, which is to help healthcare organisations implement knowledge management systems (KMS) successfully.

If you prefer to respond via online survey, you can use the following token number to access the online survey at URL: <http://is-research.massey.ac.nz/kmssh>

Token number:

Just to remind you, your individual identity and responses to all questions will be kept completely confidential and your name will not be associated with your answers. However, your answers will provide valuable information for the successful implementation of knowledge management systems (KMS) in healthcare systems.

The questionnaire was carefully designed so as to involve the shortest amount of your time as possible and should take you about 10 minutes to complete.

I appreciate that you are busy and so I thank you in advance for your commitment and your time.

Yours sincerely,

Nor’ashikin Ali

Doctoral Research Student

s.ali@massey.ac.nz

C.4 Questionnaire

*Knowledge Management Systems (KMS) – information technology and information systems you use in your current job for exchanging information/ knowledge, communicating, and collaborating and/or cooperating with other people within your organisation. Some of the technologies relevant to Knowledge Management are: **email, intranet, groupware/Lotus Notes, video/teleconferencing, Knowledge Portals, expert directory (i.e. for locating and accessing experts and/or expertise).***

A. KMS Use for Sharing

This section asks your opinions regarding your use of KMS for knowledge sharing.

Item	1	2	3	4	5	6	7
	Strongly disagree	Disagree	Slightly disagree	Neutral	Slightly agree	Agree	Strongly agree
A1. I use KMS to communicate knowledge with colleagues.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A2. I use KMS to contribute ideas and/or feedback.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A3. I use KMS to participate in discussion groups.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A4. I use KMS to discuss and/or exchange ideas/views/experiences with colleagues.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A5. I use KMS to collaborate with colleagues (e.g. to be part of work flow process).	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A6. I use KMS to distribute knowledge (e.g. news, memos, reports, presentation, organisation policies).	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

B. KMS Use for Retrieval

This section asks your opinions regarding your use of KMS for knowledge retrieval.

Item	1 Strongly disagree	2 Disagree	3 Slightly disagree	4 Neutral	5 Slightly agree	6 Agree	7 Strongly agree
B1. I use KMS to retrieve knowledge for decision making.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
B2. I use KMS to retrieve knowledge to solve my job-related problems.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
B3. I use KMS to retrieve knowledge that can help me improve the quality of my work.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
B4. I use KMS to identify and locate people for knowledge and expertise.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
B5. I use KMS to retrieve knowledge that can help me to be innovative.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

C. Perceived Usefulness of KMS

This section asks regarding your perceptions of using KMS in the enhancement of your job performance.

Item	1 Strongly disagree	2 Disagree	3 Slightly disagree	4 Neutral	5 Slightly agree	6 Agree	7 Strongly agree
C1. KMS help me acquire new knowledge and innovative ideas.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
C2. KMS help me effectively manage and store knowledge that I need.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
C3. KMS make it easier for me to do my job.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
C4. KMS enhance my performance on the job.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
C5. KMS enhance my effectiveness on the job.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
C6. KMS improve the quality of my work life.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
C7. KMS are useful to me in my job.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

D. User Satisfaction

This section asks your opinions regarding your attitude towards overall capabilities of the KMS in your organisation.

Item	1 Strongly disagree	2 Disagree	3 Slightly disagree	4 Neutral	5 Slightly agree	6 Agree	7 Strongly agree
D1. KMS make it easy for me to acquire the knowledge I need to do my job.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
D2. I am satisfied with the knowledge I am able to access from KMS to do my job.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
D3. KMS provide knowledge that meets my needs.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
D4. KMS in my organisation provide knowledge in a timely manner.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
D5. Overall, I am satisfied with KMS in my organisation.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

E. Knowledge Content Quality

This section asks your opinions regarding the quality of knowledge content available in KMS.

Item	1 Strongly disagree	2 Disagree	3 Slightly disagree	4 Neutral	5 Slightly agree	6 Agree	7 Strongly agree
E1. The words and phrases in content provided by KMS are consistent.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
E2. The knowledge provided by KMS is up-to-date.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
E3. The knowledge provided by KMS is important and helpful for my work.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
E4. The knowledge provided by KMS is meaningful, understandable, and practicable.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
E5. The knowledge provided by KMS is complete.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
E6. The knowledge provided by KMS is relevant to my job.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
E7. KMS provide a helpful expert directory (e.g. expert locator) for my specific work.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
E8. The link to the expert directory where I can locate newly hired or newly acquired expertise is always updated.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
E9. KMS provide contextual knowledge so that I can truly understand how that knowledge can be applied.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

F. KMS System Quality

This section asks your opinions regarding the overall quality of the KMS as Information Systems.

	Item	1 Strongly disagree	2 Disagree	3 Slightly disagree	4 Neutral	5 Slightly agree	6 Agree	7 Strongly agree
F1.	KMS are easy to use.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
F2.	KMS are user friendly.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
F3.	KMS are reliable.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
F4.	The response time of KMS is acceptable.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
F5.	There are systems/tools available for me to locate knowledge.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
F6.	The system/tools allow searches using multiple criteria.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
F7.	KMS are accessible from anywhere by the authorized users.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
F8.	KMS are adequately documented (e.g. in user manuals).	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
F9.	KMS allow me to contribute knowledge that may be useful to other people in the organisation.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

G. Leadership

This section asks your opinion regarding the commitment of leaders with respect to knowledge management (KM) and their support for and encouragement of employees to share knowledge via KMS.

Item	1 Strongly disagree	2 Disagree	3 Slightly disagree	4 Neutral	5 Slightly agree	6 Agree	7 Strongly agree
G1. Our ability to contribute knowledge is respected/recognized by the leadership.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
G2. The role of the leader in this organisation can best be described as supportive.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
G3. There is a general understanding at the top levels of management about how KM is applied to the business.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
G4. Senior management demonstrates commitment and action with respect to KM policy, guidelines, and activities.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
G5. I believe that senior management periodically reviews the effectiveness of KM for the whole organisation.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
G6. In this organisation, top management feels that the time and resources spent on the development of KM initiatives are wisely invested.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
G7. In this organisation, top management is strongly in favour of the concept of KM.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
G8. Top management has made a long-term commitment to provide funding for KM.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

H. Incentive

This section asks your opinions regarding the acknowledgement and recognition of knowledge sharing by employees.

Item	1 Strongly disagree	2 Disagree	3 Slightly disagree	4 Neutral	5 Slightly agree	6 Agree	7 Strongly agree
H1. I will receive financial incentives (e.g. higher bonus, higher salary) in return for my knowledge sharing.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
H2. I will receive increased promotion opportunities in return for my knowledge sharing.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
H3. I will receive increased job security in return for my knowledge sharing.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
H4. Knowledge sharing is built into and monitored within the appraisal system.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
H5. Generally, individuals are rewarded for teamwork.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

I. Culture of Sharing

This section asks your opinions regarding the existing culture in the organisation with respect to knowledge sharing.

Item	Please tick (✓) where appropriate						
	1 Strongly disagree	2 Disagree	3 Slightly disagree	4 Neutral	5 Slightly agree	6 Agree	7 Strongly agree
I1. Our organisation supports the culture where team-oriented work is valued.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I2. Our organisation supports the culture where working closely with others is valued.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I3. Our organisation supports the culture where sharing knowledge freely is valued.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I4. Our organisation supports the culture where trust is valued.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I5. Our organisation supports the culture where being supportive of employees is valued.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

J. Subjective norm

This section asks your perceptions regarding peer pressure to share knowledge.

Item	1 Strongly disagree	2 Disagree	3 Slightly disagree	4 Neutral	5 Slightly agree	6 Agree	7 Strongly agree
J1. Most colleagues who are important to me think that I should share knowledge with others.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
J2. Most colleagues who are important to me share their knowledge with others.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
J3. My colleagues whose opinions I value would approve of my behaviour to share knowledge with others.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
J4. My colleagues whose opinions I value share their knowledge with others.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

K. Perceived Security

This section asks you regarding the extent to which you believe that your shared knowledge is secure and protected from illegal or inappropriate use or theft.

Item	1 Strongly disagree	2 Disagree	3 Slightly disagree	4 Neutral	5 Slightly agree	6 Agree	7 Strongly agree
K1. I believe that knowledge I share will not be modified by inappropriate parties.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
K2. I believe that knowledge I share will only be accessed by authorized users.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
K3. I believe that knowledge I share will be available to the right people.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
K4. I believe that people in my organisation do not use the KMS to access knowledge they are not authorized to access.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
K5. I believe that people in my organisation use other's knowledge appropriately.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
K6. I believe that KMS have the mechanisms to avoid the loss of critical knowledge.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
K7. In my opinion, the top management in my organisation is entirely committed to security.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
K8. Overall, I have confidence in knowledge sharing via KMS.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

L. Profile of the Participant

This section asks about your demographic information.

L1. Please indicate your gender.

Male Female

L2. Please indicate your age.

18-30 years

31-40 years

41-50 years

51-60 years

61 years and over

L3. Please indicate the number of years you have been with your organisation.

L4. Please indicate your number of years of computer experiences.

L5. Please indicate your years of working experience.

L6. Please indicate the department you are attached to.

THANK YOU FOR YOUR PARTICIPATION

APPENDIX D: FACTOR LOADINGS

Table D-1 *Factors Loadings for Outcome Variables of KMS Success*

Item	Factor loading after round		
	1	2	3
KMS Use for Sharing			
KMS_S1	0.819	0.819	0.819
KMS_S2	0.891	0.891	0.891
KMS_S3	0.765	0.765	0.765
KMS_S4	0.882	0.882	0.882
KMS_S5	0.855	0.856	0.856
KMS_S6	0.835	0.835	0.835
KMS Use for Retrieval			
KMS_R1	0.861	0.878	0.878
KMS_R2	0.878	0.908	0.908
KMS_R3	0.901	0.915	0.915
KMS_R4 ^a	0.671		
KMS_R5	0.794	0.778	0.778

Note. Items wordings are given in Table F-1 in Appendix F.

^aItems removed after the first round of analysis.

Table D-2 *Factors Loadings for System Factors*

Item	Factor loading after round		
	1	2	3
Knowledge Content Quality			
KCQ1 ^a	0.698		
KCQ2	0.766	0.785	0.795
KCQ3	0.784	0.842	0.857
KCQ4	0.867	0.898	0.903
KCQ5	0.721	0.708	0.702
KCQ6	0.825	0.865	0.879
KCQ7 ^a	0.567		
KCQ8 ^a	0.601		
KCQ9 ^b	0.701	0.651	
System Quality			
SQ1	0.814	0.851	0.851
SQ2	0.859	0.889	0.889
SQ3	0.812	0.832	0.832
SQ4	0.791	0.801	0.801
SQ5	0.801	0.803	0.803
SQ6	0.738	0.739	0.739
SQ7 ^a	0.490		
SQ8 ^a	0.676		
SQ9 ^a	0.655		

Table D-2 Factors Loadings for System Factors (continued)

Item	Factor loading after round		
	1	2	3
Perceived Usefulness			
PU1	0.738	0.738	0.738
PU2	0.760	0.759	0.759
PU3	0.885	0.885	0.885
PU4	0.927	0.927	0.927
PU5	0.897	0.897	0.897
PU6	0.845	0.844	0.845
PU7	0.871	0.872	0.872
User Satisfaction			
US1	0.807	0.808	0.808
US2	0.876	0.877	0.876
US3	0.892	0.893	0.893
US4	0.825	0.823	0.823
US5	0.802	0.800	0.800
Perceived Security			
PS1 ^a	0.508		
PS2 ^a	0.555		
PS3 ^a	0.620		
PS4	0.721	0.708	0.708
PS5	0.817	0.825	0.825
PS6 ^a	0.643		
PS7	0.818	0.824	0.824
PS8	0.878	0.886	0.886

Note. Items wordings are given in Table F-2 in Appendix F.

^aItems removed after the first round of analysis.

^bItems removed after the second round of analysis.

Table D-3 *Factors Loadings for Organisational Factors*

Item	Factor loading after round		
	1	2	3
Leadership			
LS1	0.796	0.798	0.798
LS2	0.873	0.874	0.874
LS3	0.873	0.872	0.872
LS4	0.884	0.882	0.881
LS5	0.829	0.827	0.826
LS6	0.891	0.891	0.892
LS7	0.866	0.867	0.867
LS8	0.823	0.823	0.824
Incentive			
INC1	0.860	0.885	0.885
INC2	0.885	0.897	0.897
INC3	0.918	0.931	0.931
INC4	0.783	0.775	0.774
INC5 ^a	0.657		
Culture of Sharing			
CS1	0.903	0.902	0.903
CS2	0.937	0.937	0.937
CS3	0.912	0.912	0.912
CS4	0.915	0.915	0.915
CS5	0.871	0.871	0.871
Subjective Norm			
SN1	0.849	0.849	0.849
SN2	0.912	0.912	0.912
SN3	0.924	0.924	0.924
SN4	0.932	0.932	0.932

Note. Items wordings are given in Table F-3 in Appendix F.

APPENDIX E: CROSS LOADINGS

Table E-1 Cross Loadings for Outcome Variables of KMS Success

	CS	INC	SQ	KMS_R	KMS_S	KCQ	LS	PS	PU	SN	US
KMS use for sharing											
KMS_S1	0.140	0.193	0.331	0.439	0.819	0.400	0.300	0.295	0.473	0.286	0.365
KMS_S2	0.210	0.187	0.380	0.489	0.891	0.377	0.287	0.294	0.471	0.349	0.351
KMS_S3	0.121	0.270	0.311	0.390	0.765	0.277	0.226	0.132	0.322	0.186	0.312
KMS_S4	0.140	0.237	0.374	0.474	0.882	0.369	0.259	0.193	0.415	0.307	0.348
KMS_S5	0.186	0.215	0.330	0.489	0.856	0.398	0.281	0.220	0.445	0.232	0.338
KMS_S6	0.199	0.274	0.367	0.443	0.835	0.413	0.330	0.255	0.479	0.255	0.400
KMS use for retrieval											
KMS_R1	0.157	0.102	0.415	0.878	0.476	0.615	0.229	0.198	0.630	0.232	0.553
KMS_R2	0.118	0.116	0.395	0.908	0.410	0.595	0.265	0.174	0.641	0.243	0.536
KMS_R3	0.153	0.166	0.420	0.915	0.458	0.612	0.282	0.212	0.698	0.211	0.587
KMS_R5	0.072	0.250	0.421	0.778	0.541	0.520	0.292	0.223	0.637	0.173	0.507

Note. Construct codes used in the column heads are explained in Appendix F.

Table E-2 Cross Loadings for System Factors

	CS	INC	SQ	KMS_R	KMS_S	KCQ	LS	PS	PU	SN	US
Knowledge content quality											
KCQ2	0.242	0.138	0.509	0.447	0.267	0.795	0.313	0.342	0.450	0.287	0.533
KCQ3	0.229	0.184	0.526	0.710	0.472	0.857	0.359	0.340	0.761	0.335	0.677
KCQ4	0.253	0.160	0.640	0.598	0.417	0.903	0.379	0.309	0.633	0.268	0.749
KCQ5	0.132	0.116	0.509	0.349	0.211	0.702	0.296	0.211	0.385	0.083	0.582
KCQ6	0.222	0.146	0.570	0.618	0.425	0.879	0.365	0.319	0.652	0.267	0.696
KMS system quality											
SQ1	0.238	0.191	0.851	0.411	0.359	0.585	0.365	0.320	0.501	0.241	0.616
SQ2	0.330	0.252	0.889	0.394	0.375	0.568	0.458	0.362	0.519	0.249	0.644
SQ3	0.317	0.243	0.832	0.340	0.287	0.527	0.453	0.406	0.403	0.199	0.592
SQ4	0.396	0.190	0.801	0.303	0.313	0.469	0.496	0.441	0.383	0.273	0.502
SQ5	0.386	0.223	0.803	0.423	0.314	0.557	0.463	0.382	0.491	0.269	0.611
SQ6	0.330	0.284	0.739	0.450	0.392	0.549	0.435	0.387	0.463	0.258	0.537
Perceived usefulness of KMS											
PU1	0.072	0.136	0.374	0.768	0.481	0.574	0.227	0.193	0.738	0.206	0.550
PU2	0.187	0.153	0.478	0.597	0.534	0.563	0.393	0.325	0.759	0.198	0.563
PU3	0.198	0.104	0.516	0.575	0.398	0.626	0.345	0.325	0.885	0.321	0.617
PU4	0.159	0.168	0.494	0.676	0.404	0.637	0.327	0.282	0.927	0.251	0.641
PU5	0.163	0.178	0.456	0.610	0.452	0.571	0.341	0.311	0.897	0.282	0.582
PU6	0.162	0.174	0.541	0.543	0.364	0.581	0.349	0.312	0.845	0.325	0.596
PU7	0.225	0.127	0.492	0.654	0.449	0.665	0.388	0.380	0.872	0.366	0.619
User satisfaction											
US1	0.082	0.159	0.541	0.644	0.416	0.699	0.261	0.212	0.691	0.198	0.808
US2	0.168	0.119	0.585	0.523	0.279	0.673	0.322	0.237	0.584	0.163	0.876

Table E-2 Cross Loadings for System Factors (continued)

	CS	INC	SQ	KMS_R	KMS_S	KCQ	LS	PS	PU	SN	US
US3	0.183	0.196	0.640	0.610	0.338	0.724	0.331	0.240	0.631	0.203	0.893
US4	0.222	0.220	0.555	0.421	0.367	0.614	0.420	0.346	0.535	0.161	0.823
US5	0.382	0.270	0.694	0.399	0.362	0.576	0.549	0.379	0.490	0.214	0.800
Perceived security											
PS4	0.212	0.115	0.258	0.062	0.064	0.211	0.326	0.708	0.174	0.305	0.171
PS5	0.352	0.191	0.355	0.181	0.189	0.305	0.405	0.825	0.300	0.396	0.233
PS7	0.475	0.305	0.371	0.153	0.242	0.230	0.515	0.824	0.230	0.351	0.212
PS8	0.452	0.255	0.451	0.265	0.295	0.396	0.576	0.886	0.387	0.405	0.381

Note. Construct codes used in the column heads are explained in Appendix F.

Table E-3 Cross Loadings for Organisational Factors

	CS	INC	SQ	KMS_R	KMS_S	KCQ	LS	PS	PU	SN	US
Leadership											
LS1	0.563	0.375	0.499	0.305	0.380	0.426	0.798	0.465	0.393	0.292	0.405
LS2	0.634	0.386	0.480	0.281	0.346	0.407	0.874	0.494	0.358	0.280	0.401
LS3	0.528	0.422	0.507	0.233	0.279	0.335	0.872	0.502	0.359	0.234	0.386
LS4	0.584	0.448	0.497	0.211	0.286	0.314	0.881	0.539	0.299	0.206	0.354
LS5	0.490	0.391	0.441	0.231	0.229	0.280	0.826	0.456	0.284	0.197	0.347
LS6	0.544	0.418	0.442	0.253	0.254	0.337	0.892	0.535	0.313	0.265	0.375
LS7	0.582	0.383	0.427	0.265	0.251	0.350	0.867	0.549	0.355	0.268	0.362
LS8	0.529	0.371	0.371	0.291	0.222	0.337	0.824	0.509	0.335	0.226	0.344
Incentive											
INC1	0.224	0.885	0.209	0.113	0.179	0.136	0.358	0.253	0.122	0.123	0.179
INC2	0.267	0.897	0.203	0.168	0.218	0.133	0.327	0.208	0.138	0.140	0.157
INC3	0.330	0.931	0.291	0.200	0.303	0.191	0.458	0.284	0.187	0.147	0.231
INC4	0.325	0.774	0.258	0.133	0.216	0.160	0.462	0.261	0.150	0.140	0.211
Culture of sharing											
CS1	0.903	0.346	0.375	0.159	0.190	0.239	0.611	0.450	0.183	0.320	0.222
CS2	0.937	0.281	0.387	0.172	0.213	0.259	0.576	0.427	0.198	0.298	0.239
CS3	0.912	0.272	0.311	0.116	0.160	0.216	0.575	0.445	0.138	0.336	0.176
CS4	0.915	0.273	0.354	0.103	0.147	0.249	0.580	0.456	0.174	0.286	0.208
CS5	0.871	0.335	0.383	0.097	0.186	0.220	0.631	0.473	0.187	0.236	0.225
Subjective norm											
SN1	0.296	0.188	0.287	0.252	0.390	0.257	0.271	0.420	0.293	0.849	0.210
SN2	0.318	0.153	0.273	0.213	0.274	0.282	0.290	0.389	0.279	0.912	0.208
SN3	0.291	0.126	0.304	0.223	0.274	0.296	0.268	0.432	0.327	0.924	0.219
SN4	0.265	0.108	0.223	0.205	0.228	0.271	0.231	0.388	0.287	0.932	0.172

Note. Construct codes used in the column heads are explained in Appendix F.

APPENDIX F: OPERATIONALIZATION OF CONSTRUCTS

Items for outcome variables, KMS use for sharing (KMS_Sh) and KMS use for retrieval (KMS_R), are listed in Table F-1; items for system factors, knowledge content quality (KCQ), KMS system quality (SQ), perceived usefulness of KMS (PU), user satisfaction (US), and perceived security (PS), are listed in Table F-2; and items for organisational factors, leadership (LS), incentive (INC), culture of sharing (CS), and subjective norm (SN), are given in Table F-3.

Table F-1 *Operationalization of Outcome Variables of KMS Success*

Code	Wording	Source
KMS_Sh: KMS use for sharing <i>Introduced in section 3.3.2.</i>		
KMS_Sh1	I use KMS to communicate knowledge with colleagues.	
KMS_Sh2	I use KMS to contribute ideas and/or feedback.	
KMS_Sh3	I use KMS to participate in discussion groups.	
KMS_Sh4	I use KMS to discuss and/or exchange ideas/views/experiences with colleagues.	Formulated in this study (see section 4.4.1.1).
KMS_Sh5	I use KMS to collaborate with colleagues (e.g. to be part of workflow process). work flow process }	
KMS_Sh6	I use KMS to distribute knowledge (e.g. news, memos, reports, presentation, organisation policies).	
KMS_R: KMS use for retrieval <i>Introduced in section 3.3.3.</i>		
KMS_R1	I use KMS to retrieve knowledge for decision making	
KMS_R2	I use KMS to retrieve knowledge to solve my job-related problems	
KMS_R3	I use KMS to retrieve knowledge that can help me improve the quality of my work	Formulated in this study (see section 4.4.1.1).
KMS_R4	I use KMS to identify and locate people for knowledge and expertise <i>Removed as unreliable—see section 5.4.1.1.</i>	
KMS_R5	I use KMS to retrieve knowledge that can help me to be innovative	

Table F-2 Operationalization of System Factors

Code	Wording	Source adapted from
KCQ: Knowledge content quality <i>Introduced in section 3.4.1.1.</i>		
KCQ1	The words and phrases in content provided by KMS are consistent. <i>Removed as unreliable—see section 5.4.1.1.</i>	Wu and Wang (2006)
KCQ2	The knowledge provided by KMS is up-to-date.	DeLone and McLean (2003)
KCQ3	The knowledge provided by KMS is important and helpful for my work.	Wu and Wang (2006)
KCQ4	The knowledge provided by KMS is meaningful, understandable, and practicable.	Wu and Wang (2006)
KCQ5	The knowledge provided by KMS is complete.	DeLone and McLean (2003)
KCQ6	The knowledge provided by KMS is relevant to my job.	DeLone and McLean (2003)
KCQ7	KMS provide a helpful directory (e.g. expert locator) for my specific work. <i>Removed as unreliable—see section 5.4.1.1.</i>	Wu and Wang (2006)
KCQ8	The link to the expert directory where I can locate newly hired or newly acquired expertise is always updated. <i>Removed as unreliable—see section 5.4.1.1.</i>	Wu and Wang (2006)
KCQ9	KMS provide contextual knowledge so that I can truly understand how that knowledge can be applied. <i>Removed as unreliable—see section 5.4.1.1.</i>	Wu and Wang (2006)
SQ: KMS system quality <i>Introduced in section 3.4.1.2.</i>		
SQ1	KMS are easy to use.	Wu and Wang (2006)
SQ2	KMS are user-friendly.	Wu and Wang (2006)
SQ3	KMS are reliable.	Wu and Wang (2006)
SQ4	The response time of KMS is acceptable.	Wu and Wang (2006)
SQ5	There are systems/tools available for me to locate knowledge.	Kulkarni et al. (2007)

Table F-2 Operationalization of System Factors (continued)

Code	Wording	Source adapted from
SQ6	The system/tools allow searches using multiple criteria.	
SQ7	KMS are accessible from anywhere by the authorised users. <i>Removed as unreliable—see section 5.4.1.1.</i>	Kulkarni et al. (2007)
SQ8	KMS are adequately documented (e.g. in user manuals). <i>Removed as unreliable—see section 5.4.1.1.</i>	Kulkarni et al. (2007)
SQ9	KMS allow me to contribute knowledge that may be useful to other people in the organisation. <i>Removed as unreliable—see section 5.4.1.1.</i>	Kulkarni et al. (2007)
PU: Perceived usefulness of KMS <i>Introduced in section 3.4.1.4.</i>		
PU1	KMS help me acquire new knowledge and innovative ideas	Kulkarni et al. (2007)
PU2	KMS help me effectively manage and store knowledge that I need	Wu and Wang (2006)
PU3	KMS make it easier for me to do my job	Kulkarni et al. (2007)
PU4	KMS enhance my performance on the job with colleagues	Kulkarni et al. (2007)
PU5	KMS enhance my effectiveness on the job	Kulkarni et al. (2007)
PU6	KMS improve the quality of my work life	Kulkarni et al. (2007)
PU7	KMS are useful to me in my job	Kulkarni et al. (2007)
US: User satisfaction <i>Introduced in section 3.4.1.3.</i>		
US1	KMS make it easy for me to acquire the knowledge I need to do my job	Wu and Wang (2006)
US2	I am satisfied with the knowledge I am able to access from KMS to do my job	Kulkarni et al. (2007)
US3	KMS provide knowledge that meets my needs	Kulkarni et al. (2007)
US4	KMS provide knowledge that meets my needs	Kulkarni et al. (2007)
US5	Overall, I am satisfied with KMS in my organisation	Wu and Wang (2006)

Table F-2 Operationalization of System Factors (continued)

Code	Wording	Source adapted from
	PS: Perceived security <i>Introduced in section 3.4.1.5.</i>	
PS1	I believe that knowledge I share will not be modified by inappropriate parties <i>Removed as unreliable—see section 5.4.1.1.</i>	Pavlou (2001)
PS2	I believe that knowledge I share will only be accessed by authorized users <i>Removed as unreliable—see section 5.4.1.1.</i>	Pavlou (2001)
PS3	I believe that knowledge I share will be available to the right people <i>Removed as unreliable—see section 5.4.1.1.</i>	Pavlou (2001)
PS4	I believe that people in my organisation do not use the KMS to access knowledge they are not authorized to access	Pavlou (2001)
PS5	I believe that people in my organisation use other's knowledge appropriately	Pavlou (2001).
PS6	I believe that KMS have the mechanisms to avoid the loss of critical knowledge <i>Removed as unreliable—see section 5.4.1.1.</i>	Pavlou (2001)
PS7	I believe that KMS has the mechanism to protect knowledge from being stolen	Salisbury et al. (2001)
PS8	In my opinion, the top management in my organisation is entirely committed to security	Yenisey et al. (2005)
PS9	Overall, I have confidence in knowledge sharing via KMS	Pavlou (2001)

Table F-3 Operationalization of Organisational Factors

Code	Wording	Source adapted from
LS: Leadership <i>Introduced in section 3.4.2.3.</i>		
LS1	Our ability to contribute knowledge is respected/recognised by the leadership	Ash (1997)
LS2	The role of the leader in this organisation can best be described as supportive	Ash (1997)
LS3	There is a general understanding at the top levels of management about how KM is applied to the business	Kulkarni et al. (1997)
LS4	Senior management demonstrates commitment and action with respect to KM policy, guidelines, and activities	Kulkarni et al. (2007)
LS5	I believe that senior management periodically reviews the effectiveness of KM to the whole company	Kulkarni et al. (2007)
LS6	In this organisation, top management feels that the time and resource spent on the development of KM initiatives are wisely invested	Guimaraes, Igarria, and Lu (1992)
LS7	In this organisation, top management is strongly in favour of the concept of KM	Guimaraes, Igarria, and Lu (1992)
INC: Incentive <i>Introduced in section 3.4.2.4.</i>		
INC1	I will receive financial incentives (e.g. higher bonus, higher salary) in return for my knowledge sharing.	Lin (2007)
INC2	I will receive increased promotion opportunities in return for my knowledge sharing.	Lin (2007)
INC3	I will receive increased job security in return for my knowledge sharing.	Lin (2007)
INC4	Knowledge sharing is built into and monitored within the appraisal system.	Kulkarni et al. (2007)
INC5	Generally, individuals are visibly rewarded for teamwork. <i>Removed as unreliable—see section 5.4.1.1.</i>	Kulkarni et al. (2007)

Table F-3 *Operationalization of Organisational Factors (continued)*

Code	Wording	Source adapted from
CS: Culture of sharing <i>Introduced in section 3.4.2.2.</i>		
CS1	Our organisation supports a culture where team-oriented work is valued.	
CS2	Our organisation supports a culture where sharing information freely is valued.	
CS3	Our organisation supports a culture where being supportive of employees is valued.	Formulated in this study (see section 4.4.1.2).
CS4	Our organisation supports a culture where working closely with others is valued.	
CS5	Our organisation supports a culture where trust is valued.	
SN: Subjective norm <i>Introduced in section 3.4.2.1.</i>		
SN1	Most colleagues who are important to me think that I should share knowledge with others.	Ryu et al. (2003)
SN2	Most colleagues who are important to me share their knowledge with others.	Ryu et al. (2003)
SN3	My colleagues whose opinions I value would approve of my behaviour to share knowledge with others.	Ryu et al. (2003)
SN4	My colleagues whose opinions I value share their knowledge with others.	Ryu et al. (2003)

APPENDIX G: SOME FURTHER THEORIES MENTIONED IN THE LITERATURE REVIEW

This appendix briefly introduces a number of theories from social psychology that have been used in studies covered in the literature review. Unlike the theories introduced in sections 2.3.1, 2.3.2, 2.3.3, and 2.3.4, none of these theories were a major source for the research model of the present study (see Figure 3-1) and the main intention of this appendix is to provide the background information for the literature review.

The subsections of this appendix are organised as follows. First, a theory is briefly outlined. Then, examples of the use of the theory in management information systems and healthcare related studies are given (when available). Finally, an account of how the theory is relevant to this study is given.

G.1 Theory of Reasoned Action

The theory of reasoned action argues that that an individual forms an intention to engage in a behaviour before actually engaging in the behaviour (Fishbein & Ajzen, 1975) (see Figure G-1). The intention is influenced by attitude (the individual's overall feelings of favour or disfavour) towards the behaviour and by the subjective norm. The subjective norm reflects the individual's beliefs regarding what she (or he) is expected to do.

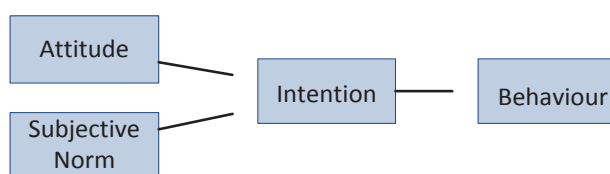


Figure G-1. Theory of reasoned action (Fishbein & Ajzen, 1975).

Hansen, Jensen, and Solgaard (2004) tested an extension of the TRA model in the context of the use of an online grocery shop by Danish and Swedish consumers and found that subjective norm and attitude affected intention to use (the actual behaviour was not included in the study). Guo et al. (2007) compared the TRA model with an extension of the TRA model involving perceived behavioural control (the perception by the individual of her or his ability to execute the behaviour) in the context of predicting smoking by teenagers in China (perceived behavioural control was interpreted as the perceived

capability to refuse cigarettes); they found that both models predicted behavioural intention, with the extended model predicting the behaviour better (not surprisingly, a model with larger number factors predicted more variance in the outcome variable).

Historically, TRA was one of the foundations of TAM (see section G.7) and TAM2 (see section G.8), but it is less commonly used in MIS research than TAM or TAM2 (Venkatesh, Morris, Davis, & Davis, 2003), possibly because it is more general and is not explicitly focussed on technology related issues.

In this thesis, TRA is mentioned in Section 2.3.2 to justify the inclusion of the subjective norm construct in the research model and in Section 2.4.2, when introducing the studies by Ryu et al. (2003) and Bock et al. (2005).

None of the hypotheses of the research model (see Figure 3-1) relied on TRA for justification, and therefore, the present study did not involve testing TRA in a new context. The hypothesis that subjective norm affects perceived usefulness of KMS can be seen as (very remotely) related to TRA, which is discussed in section 3.5.2.1.

G.2 Decomposed Theory of Planned Behaviour

The theory of planned behaviour suggests that an individual's behavioural intention and ultimately, behaviour, is determined by attitude, subjective norm, and perceived behavioural control (Ajzen, 1985). Thus, it is an extension of the theory of reasoned action (introduced in section G.1), with perceived behavioural control added. Perceived behavioural control refers to both the individual's belief in her (or his) ability to execute the behaviour and to her (or his) belief in the availability of the necessary resources.

The decomposed theory of planned behaviour (see Figure G-2) extends the theory of planned behaviour by suggesting the determinants of attitude, subjective norm, and perceived behavioural control (Taylor & Todd, 1995). The theory posits that attitude is determined by relative advantage (the extent to which the behaviour is perceived to be more instrumental than the alternatives in achieving the individual's organisation's goals), complexity (the extent to which the behaviour is perceived to be difficult to execute), and compatibility (the extent to which the behaviour fits with the potential adopter's existing values, previous experiences and current needs). Another direct determinant of behavioural

intention, subjective norm is determined by peer influence (the peers' beliefs regarding what the individual is expected to do) and superiors' influence (the superiors' beliefs regarding what the individual is expected to do). Finally, perceived behavioural control is determined by self-efficacy (the individual's belief in her or his ability to successfully execute the behaviour), resource facilitating condition (perception of whether resources, such as time, are available to support the behaviour), and technology facilitating conditions (perception of whether there is technological infrastructure supporting the behaviour).

Taylor and Todd (1995) tested the model (in Figure G-2) in the context of the use of computing resource centre by business school students in the USA. All of the relationships suggested by the model were confirmed. It has to be noted, though, that Taylor and Todd did not test the individual hypotheses for the components of attitude, subjective norm, and perceived behavioural control, but added up the indicators, and for many of the hypotheses p values were close to .5, in spite of very large numbers of participants—786 students participated in the study.

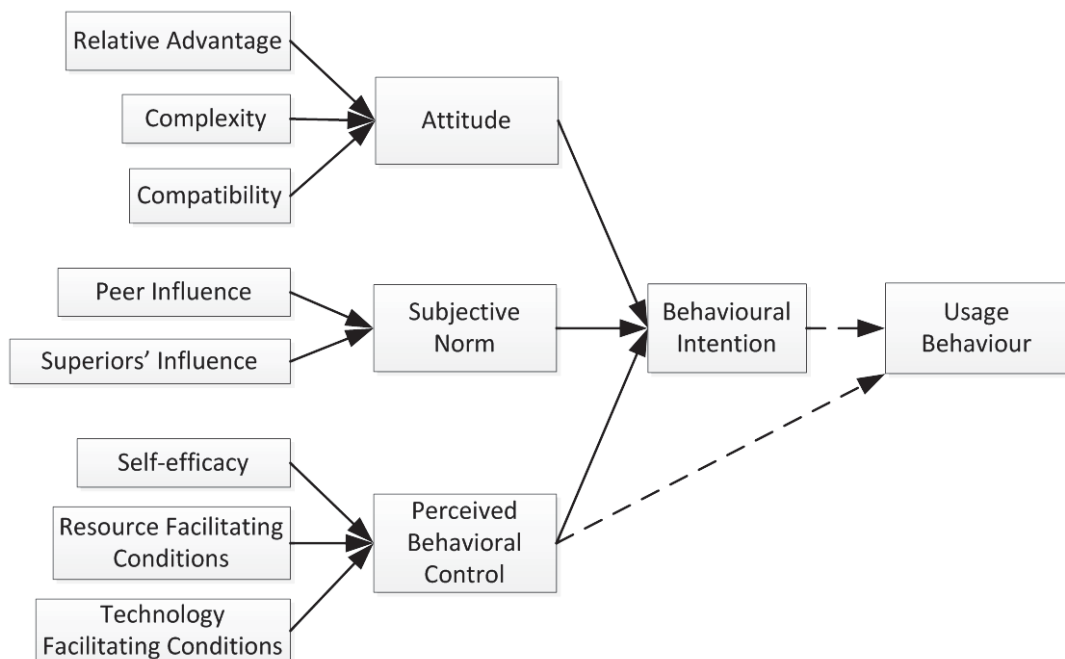


Figure G-2. Decomposed theory of planned behaviour (Taylor & Todd, 1995).

Hsu and Chiu (2004) tested a model based on the decomposed theory of planned behaviour to study the satisfaction by and the use of e-services by IS managers at top companies in Taiwan (in the model, behavioural intention was interpreted as satisfaction). The model

involved subjective norm (decomposed into interpersonal influence and external influence), attitude towards e-service usage (decomposed into perceived usefulness, perceived risk, and perceived playfulness), and perceived behavioural control (decomposed into internet self-efficacy, and perceived controllability). Interpersonal influence, perceived usefulness, and perceived playfulness were found to affect e-service satisfaction, which in turn affected e-service continuance intention. Self-efficacy was found to affect e-service intention. One should note that Hsu and Chiu interpreted “decomposition” as replacement—the model did not involve the separate concepts of subjective norm, e-service usage, and perceived behavioural control (unlike suggested by the model by Taylor & Todd, 1995, in the article where the decomposed theory of planned behaviour was initially introduced).

In this thesis, the decomposed theory of planned behaviour is mentioned in section 2.4.2 to introduce the studies by Kankanhalli et al. (2005b) and Bock et al. (2006). The model in the study by Kankanhalli et al. (2005b) involved perceived output quality, availability of resources, and incentives (thus, it was a trimmed down version of the model introduced by Taylor and Todd, 1995, with none of the constructs corresponding to perceived behavioural control). Perceived output quality, availability of resources, and incentives were found to affect EKR usage. The model in the study by Bock et al. (2006) involved collaborative norms, perceived ease of use, future obligation, perceived usefulness, seeker knowledge growth, self-efficacy, and resource facilitating conditions. Collaborative norms, self-efficacy, and resource facilitating conditions were found to affect KMS use behaviour. Both articles took an approach similar to Hsu and Chiu (2004) and interpreted decomposition as replacement.

In the research model of the present study (see Figure 3-1) the subjective norm and perceived usefulness constructs can be seen as related to similar constructs in the decomposed theory of planned behaviour (with perceived usefulness related to relevant advantage). The overall structure of the models, however, is quite different. The model of the present study is based on the DeLone and McLean IS success model, which, unlike the decomposed theory of planned behaviour, emphasizes system factors, and therefore, is a better choice in view of the problem addressed by the present study. The present study did not involve testing the decomposed theory of planned behaviour.

G.3 Social Exchange Theory

The social exchange theory suggests that an individual is likely to engage in behaviours that she (or he) expects and desires to be reciprocated (Blau, 1964; Kelley & Thibaut, 1978; Thibaut & Kelley, 1959).

Ahuja et al. (2007) tested a model intended to explain work exhaustion and organisational commitment by road warriors (employees spending a lot of time on the road). The model was tested at a large computer software services company in the USA. The construct of fairness and rewards (motivated by the social exchange theory) was found to affect organisational commitment, but not work exhaustion. Thus, perception that the organisation is likely to reward fairly the employee efforts (that rewards will come and will be commensurate with the employee efforts) resulted in a greater commitment of the employee to the organisation. Nonetheless, fairness and rewards did not result in the employees engaging in over-working, with the associated work exhaustion (which was, in a sense, contrary to the social exchange theory).

In section 2.4.2, the social exchange theory is mentioned when introducing the study by Jarvenpaa and Staples (2000). Jarvenpaa and Staples, motivated by the social exchange theory, hypothesised that task interdependence, the employee's need to interact with employees from other departments, affects the employee's use of collaborative electronic media, and the hypothesis was confirmed. In the same section, the theory is mentioned when introducing the study by Kankanhalli et al. (2005a). Based on the social exchange theory, Kankanhalli et al. (2005) hypothesized that reciprocity expectations affect knowledge sharing; the hypothesis was confirmed.

In section 2.5, the social exchange theory is mentioned in connection with discussing the Kulkarni et al. (2007) KM Success Model. Kulkarni et al. (2007) justified the inclusion of the incentive construct based on the social exchange theory; I provide an argument, however, that such a justification may be not appropriate (refer to section 2.5 for details).

None of the hypotheses in the research model of the present study (see Figure 3-1) were based on the social exchange theory.

G.4 Social Capital Theory

The social capital theory suggests that an individual perceives social networks she (or he) is engaged in as having value (constituting social capital). Thus, she (or he) is likely to engage in behaviours that maintain and enhance her (or his) social networks (Nahapiet & Ghoshal, 1998).

Chow and Chan (2008) studied the effects of social capital on knowledge sharing; they hypothesised that social capital affects attitude towards knowledge sharing and subjective norm about knowledge sharing, with attitude and subjective norm, in their turn, affecting intention to share knowledge (thus, the model was an extension of TRA, see section 0). Social capital was conceptualized as a three-dimensional construct comprising social network, social trust, and shared goals. Social network and social trust were found to affect both of their dependent variables, but social trust had no effects (the article provides no compelling explanation why social trust had no effects; quite possibly, this was because of problems with the operationalization).

Ahern and Hendryx (2003) studied the effects of social capital on trust in physicians. Based on a survey of adults in the USA, they found that individuals with low levels of social capital residing in cities are less likely to trust in physicians than individuals with high levels of social capital. The indicators of social capital included social trust, civil engagement, and contributions to charities.

In section 2.4.2, the social capital theory is mentioned in connection with the study by Kankanhalli, Tan, and Wei (2005). Motivated by the social capital theory, Kankanhalli et al. hypothesized that trust (the belief in the good intent, competence, and reliability of employees with respect to contributing and reusing knowledge), norms (the perception that employees at the organisation expect each other to share knowledge), and identification (the perception of similarity of values, membership, and loyalty with the organisation) affect EKR usage. Kankanhalli et al. viewed trust, norms, and identification as resources embedded in human relationships at the organisation that constitute social capital. All the effects were confirmed. It should be noted that the concept of norms in the study by Kankanhalli et al. is close in content to the subjective norm construct introduced in section

2.3.2 used in the theory of reasoned action (see section G.7) and in TAM2 (see section G.8).

None of the hypotheses in the research model of the present study (see Figure 3-1) were based on the social exchange theory. Nonetheless, one may argue that all of the organisational factors of a culture of sharing and a subjective norm in the research model (see Figure 3-1) can be seen as broadly related to the social capital theory, because they may be seen as representing some of the value accumulated in the organisation's social networks.

G.5 Social Cognitive Theory

The social cognitive theory suggests that an individual's behaviour is influenced by outcome expectations and by self-efficacy, which is the individual's belief in her (or his) ability to successfully execute the behaviour (Bandura, 1986).

Compeau and Higgins (1995) studied the effects of computer self-efficacy and computer use outcome expectations on computer use by professionals. The participants were the subscribers to a Canadian business periodical. Both self-efficacy and computer use outcome expectations were found to affect anxiety (a state of emotion resulting from the feelings of worry, tension, and apprehension), affect (the positive or negative feeling that is based on experience and that can influence an individual's reaction to people, objects, and situations) and usage; anxiety and affect also affected usage. Wu, Wang, and Lin (2007) studied the effects of self-efficacy in the context of the use of mobile healthcare systems (MHS) by healthcare practitioners at hospitals in Taiwan. Self-efficacy affected perceived usefulness and perceived ease of use, which in turn affected behavioural intention to use (the model was an extension of TAM, see section G.7).

In this thesis, self-efficacy is mentioned in section 2.4.2 when introducing the studies by Kankanhalli et al. (2005a) and by Chen and Hung (2010).

None of the hypotheses in the research model of the present study (see Figure 3-1) were based on the social cognitive theory.

G.6 Theory of Cognitive Integration

The theory of cognitive integration suggests that a user's attitude is determined by her (or his) evaluation of the relevant system aspects weighted by her (or his) perceptions of their importance (Anderson, 1971).

In the present study the theory of cognitive integration is mentioned in section 2.4.2 when introducing the study by He and Wei (2009). Based on the theory of cognitive integration, He and Wei believed that when deciding to engage into knowledge seeking or knowledge contribution behaviours, individuals consider and evaluate various aspects of the knowledge sharing situation, make decision on the basis of integrating such aspects, and act accordingly. The aspects included in the model were social relationship, enjoyment in helping, reciprocity, image, organisational reward, management influence, and contribution effort. The cognitive integration process was modelled by including into the model the construct of contribution belief, with the aspects used as its formative indicators.

The approach used by He and Wei (2009) is unique and may have potential, but further research is required to assess its validity. Testing the validity of the theory of cognitive integration was not the purpose of the present study; therefore, the study relied on better-established approaches.

G.7 Technology Acceptance Model

The technology acceptance model (TAM) (Figure G-3) suggests that that an individual's use of an information system is affected by behavioural intention (intention to use the system), which is, in turn, is affected by two beliefs: perceived usefulness (PU), the extent to which the individual believes that using the system will improve her (or his) job performance, and perceived ease of use (PEOU), the extent to which the individual believes that using the system will be free of effort (Davis, 1989). Initially, the model involved the concept of attitude towards using the system (the individual's overall feelings of favour or disfavour with respect to using the system), which was hypothesised to mediate the effects of perceived usefulness and perceived ease of use on behavioural intention; in many of the subsequent studies, the construct of attitude was dropped, and in

the highly quoted review of technology acceptance research by Venkatesh, Morris, Davis, and Davis (2003), the model is introduced without it.

The basic TAM model focuses solely on individuals' beliefs and does not involve any variables describing the organisational context. The model has received a lot of attention; it has been retested in a broad range of contexts and extended by further constructs to improve its explanatory power. One important extension of TAM, TAM2, is discussed in detail in section G.8. Despite the popularity of the model (according to Google Scholar, at the time of writing this thesis, September 2013, the Davis's, 2003, article introducing TAM has been cited 7290 times), TAM is not universally recognized as valid. A meta-analysis by Sharma, Yetton, and Crawford (2009) demonstrated that in many of the studies relying on TAM, the relationships discovered can be attributed to common method bias (see section 4.9.3 for an introduction of common method variance—a threat to internal validity of survey based research).

The following two paragraphs introduce some examples of the use of TAM in research, focusing on the outcomes for the effects on attitude, intention to use, and actual use.

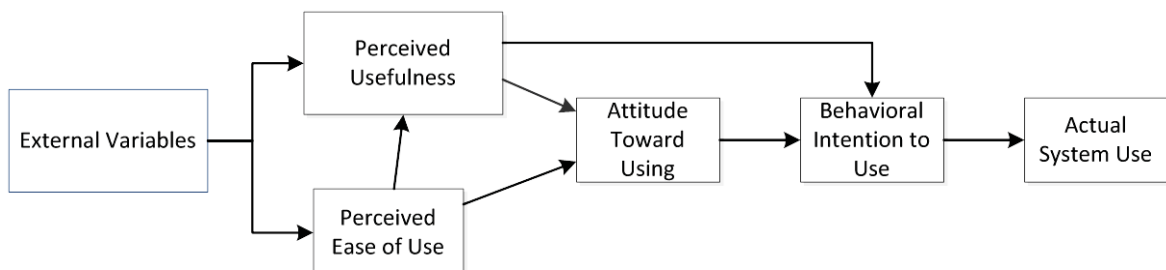


Figure G-3. Technology acceptance model (TAM) (Davis, 1989).

Amoako-Gyampah and Salam (2004) tested TAM in the context of an Enterprise Resource Planning system implementation at a healthcare products manufacturer in the USA and found that perceived usefulness and attitude towards the system affected intention to use; both perceived usefulness and perceived ease of use affected attitude. Gefen, Karahanna, and Straub (2003) extended TAM to explain the effects of trust on intended use of an e-commerce site, and found that trust, perceived usefulness, and perceived ease of use affected intended use. Yi and Hwang (2003) studied the use by students of a web-based class management system and found that perceived usefulness and perceived ease of use affected behavioural intention and behavioural intention affected use; unlike most of the

TAM studies, the actual use was also measured and it was found that behavioural intention is a relatively weak predictor of actual use. Turner, Kitchenham, Brereton, Charters, and Budgen (2010) conducted a systematic review of TAM studies involving measuring self-reported and actual used and concluded that behavioural intention is, overall, a relatively weak predictor of use—a finding that puts in doubt the value of TAM studies that did not measure system use (ultimately, managers are interested in the actual behaviour, and explaining behavioural intention is of value in practice only if behavioural intention results in actual behaviour).

TAM has also been tested in the context of explaining technology use at healthcare organisations. Hu, Chau, Sheng, and Tam (1999) tested the basic TAM model in the context of a telemedicine system implementation at hospitals in Hong Kong and found that perceived usefulness and attitude towards the system affected intention to use. Tung, Chang, and Chou (2008) extended TAM to include perceived financial costs to the organisation and trust in system security and tested the resulting model in the context of an electronic logistics information system use at medical centres and hospitals in Taiwan; they found that perceived financial cost, compatibility, perceived usefulness, perceived ease of use and trust affected intention to use.

Chuttur (2009) provided a historical overview of the TAM research and noted the lack of “practical effectiveness” (p. 1) of the model. Indeed, the idea that people are more likely to use an information system if they think it is useful and can be used free of effort is probably quite obvious to most practitioners and, arguably, revalidating the TAM model in various contexts does little to contribute to practice.

In this thesis TAM is mentioned in the literature review (section 2.4.2) to introduce the study by Kankanhalli et al. (2005b), to introduce the construct of perceived usefulness (section 3.4.1), which is one of the constructs of the research model (see Figure 3-1), and in the conclusion and discussion chapter (section 6.2.1), when exploring the implications of the results.

None of the hypotheses of the research model relied on TAM for justification, and therefore, the present study did not involve testing TAM in a new context. In the research model (see Figure 3-1), the hypotheses regarding the effects of Perceived Usefulness on

KMS Use for Sharing and KMS Use for Retrieval (H5 and H6) can be seen as somewhat related to TAM, which is discussed in sections 6.2.1 and 3.5.1.

G.8 Technology Acceptance Model 2

To extend the basic TAM model to make it suitable to explain the use of systems that are mandatory to use, Venkatesh and Davis (2000) proposed TAM2 (see Figure G-4). The most notable difference between TAM2 and TAM is the inclusion in TAM2 of the subjective norm construct. Subjective norm describes the extent to which the user feels that important others at the organisation believe that the user should be using the system. The subjective norm is hypothesised to affect intention to use directly, along with perceived usefulness and perceived ease of use. The direct effect of subjective norm on intention to use is moderated by voluntariness (the extent to which the user believes she or he is expected to comply with the views of important others) and experience (with more experienced users expected to be less sensitive to the opinions of important others, because they can rely on their experience to make decisions regarding system use). The model also included a number of constructs intended to explain perceived usefulness: image (the extent to which the user believes that using the system would increase her or his status), job relevance, output quality, and results demonstrability (the extent to which the usefulness of the system is visible, so that the user can be influenced by watching others using the system).

The following two paragraphs introduce examples of the use of TAM2 in research, focusing on the outcomes for the hypotheses involving subjective norm and for the effects on intention to use and actual use.

Venkatesh and Davis (2000) tested TAM2 in the context of the use of systems for data and information retrieval at five large organisations in the USA and found that subjective norm affected intention of use directly and also affected perceived usefulness. Both perceived usefulness and perceived ease of use affected intention to use.

Variations of TAM2 have been tested in the context of explaining technology use at healthcare organisations. Chang, Hwang, Hung, and Li (2007) tested a variation of TAM2 in the context of the use of clinical decision support systems at hospitals in Taiwan and

found that performance expectancy (perceived usefulness), effort expectancy (perceived ease of use), and social influence (subjective norm) affected behavioural intention. Yi, Jackson, Park, and Probst (2006) tested a variation of TAM2 in the context of the use of personal digital assistants at hospitals in the USA and found that subjective norm and perceived usefulness affected behavioural intention.

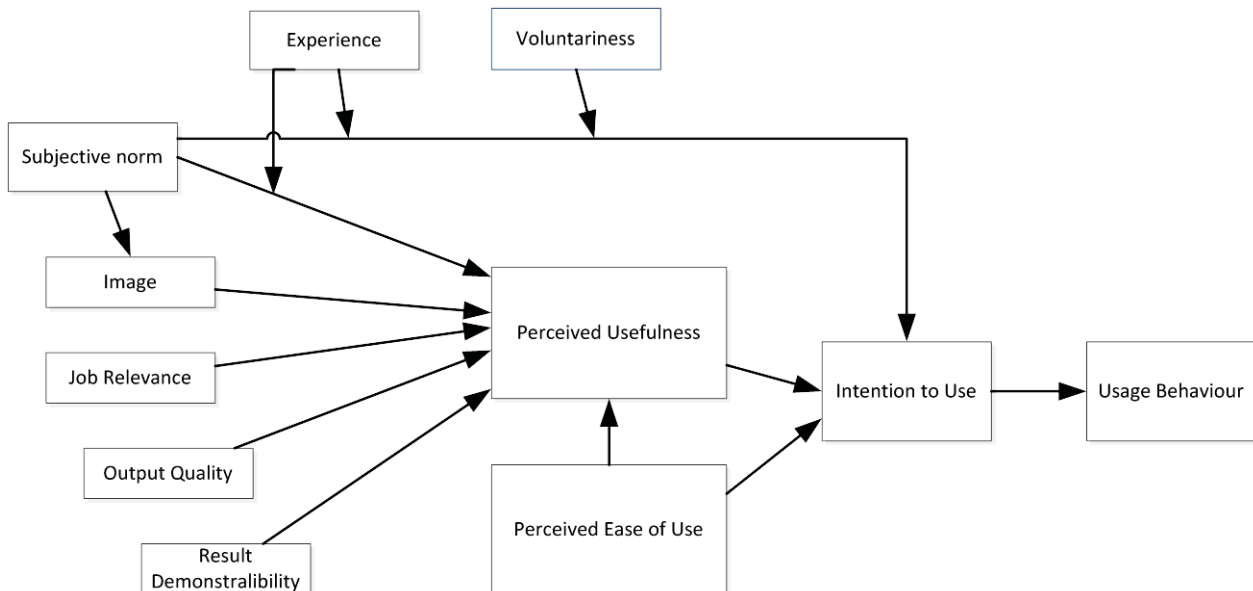


Figure G-4. Technology acceptance model 2 (TAM2) (Venkatesh & Davis, 2000).

In this thesis, TAM2 is mentioned in sections 1.4 and 2.3.2 to justify the inclusion of subjective norm and perceived usefulness in the research model. TAM2 is also mentioned in section 2.5 in the context of assessing the KMS success model by Kulkarni et al. (2007). TAM2 is referred to in section 3.5.2, to justify the hypothesis that subjective norm affects perceived usefulness of KMS (hypothesis H11), and when discussing the outcomes of hypotheses testing, in section 6.2.2.4.

Overall, however, the research model of the present study (see Figure 3-1) borrowed very little from TAM2, and the study cannot be seen as testing TAM2 in a new context.

APPENDIX H: A NOTE ON STYLE

When writing this document, I followed, for as much as practicable, the recommendations of the Publication Manual of the American Psychological Association (American Psychological Association, 2010), henceforth referred to as Publication Manual. In particular, I did not avoid the use of active voice and of first person (not just in section 1.8, which describes my background as a researcher, but throughout the thesis) (see Publication Manual, p. 77) and I used simple past tense when discussing work by other researchers and when reporting my own results (Publication Manual, p. 78). For examples of recent theses following similar conventions with respect to using first-person pronouns, see Day (2007), Lempp (2009), and Wilson (2013).

Even though the Publication Manual prescribes the use of Merriam-Webster's Collegiate Dictionary (2005) for spelling and language reference (Publication Manual, p. 96), because the thesis was written in New Zealand, I used British English and relied on the Oxford English Dictionary (<http://www.oxforddictionaries.com>). In particular, I used the term "thesis" to denote this document, because it is a "long ... dissertation ... written by a candidate for a university degree" (a definition given by the Oxford English Dictionary). When referring to the research activities that have resulted in writing the present thesis, I used the terms "study" (again, following a definition by the Oxford English Dictionary: "a detailed investigation and analysis of a subject or situation") or "research". For examples of recent theses using the terms "thesis" and "study" in similar ways, see Enraght-Moony (2013) and Wilson (2013).

English language does not have a gender-neutral third-person pronoun. One may argue that when a third-person pronoun is used and empathy is involved, it should be acceptable for a writer to use a pronoun that matches the writer's gender. For example, because I am female, it is more natural for me to empathise with female writers; therefore, I could write, "I think, a writer sounds more credible when she uses third-person pronouns that match her gender". Such approach, however, would clearly be against what is prescribed by the Publication Manual, which requires writing to be gender neutral. Therefore, in this thesis I used the "she or he" construct (one of the options suggested by the Publication Manual, page 73). For examples of recent theses using a similar approach, see Chan (2009) and Donnelly (2011).

If I used all of the devices suggested by Publication Manual as possible ways of dealing with the third-person pronoun gender neutrality issue (Publication Manual, page 73), it may have resulted in more vivid prose. However, I did not anticipate that readers of this thesis are going to read it for pleasure, as a work of literature. Therefore, in dealing with this particular issue and in addressing writing style issues in general, I followed the overall approach to research writing suggested by Day and Sakaduski (2011) and focused on achieving clarity, rather than on maximizing literary quality of the text.