School of Information Systems

# A Study on the Contribution of Knowledge Identification to Knowledge Management Effectiveness

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**Declaration**

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

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

The research presented and reported in this thesis was conducted in accordance with the National Health and Medical Research Council National Statement on Ethical Conduct in Human Research (2007) – updated March 2014. The proposed research study received human research ethics approval from the Curtin University Human Research Ethics Committee (EC00262), Approval Numbers HRIS_10_17, HRIS_11_04, HRIS_13_09.

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# Abstract

In a knowledge-intensive economy where knowledge provides a sustainable source of competitive advantage, it is not surprising that an organisation's ability to leverage knowledge effectively (or effective Knowledge Management) is critical for it to not only thrive but also survive. Recent KM literature suggests the same: effective KM has a positive impact on organisation performance.

What is surprising however, is the contrast between the amount of literature around managing organisational knowledge and literature around identifying organisational knowledge. Literature around the process of identifying knowledge that exists within an organisation's boundaries, a process referred to in this thesis as Knowledge Identification, or KI, is limited.

This limited literature is accentuated by the lack of empirical evidence that supports the critical nature of KI in KM. While the literature suggests that KI is one of the first KM processes to be executed in a KM initiative, it seems that we have thus far overlooked this critical process and have instead focused on other KM processes. Research to date fails to explain the extent to which KI contributes to KM; the assertion that organisations need to know what knowledge they have to leverage that knowledge has thus far been based only on case studies and anecdotal evidence.

Thus, the primary objectives of this thesis is to deepen our understanding of how organisations establish what knowledge they have and to what extent this process of identifying what knowledge exists within the organisation (KI) contributes to effective KM.

The research draws data from two levels of analysis - an organisational level and an individual level - and is conducted in three successive phases. The nature of the first phase is exploratory, with the intent to establish: the extent to which organisations practise KI, the methods organisations use to identify knowledge that exists within their boundaries, and the extent to which KI methods are perceived as problematic.

In the second phase, in-depth interviews are conducted with KM stakeholders (both non-management and management) across various organisation types and sizes with a view to further investigate the problems that organisations face with respect to KI and surface factors that influence KI effectiveness.

Extensive analysis of the interview transcripts led to the construction of a model which depicts four factors that influence KI effectiveness: Knowledge Recording, Knowledge Needs Identification, KI Methods Effectiveness and KI Operationalisation.

This model is validated in the third and final phase via web-based surveys, to which participants across the world were invited to respond. The analysis of the survey data involves covariance-based Structural Equation Modelling which takes the form of an Exploratory Factor Analysis followed by a Confirmatory Factor Analysis.

Data analysis showed which of the four factors actually contribute to KI effectiveness and to what extent KI effectiveness contributes to KM effectiveness. The results obtained confirm the critical nature of the relationship between KI and KM: effective KI contributes significantly to effective KM.

These results along with the revised model constitute a theoretical contribution to the KM literature. This research warrants more investigation in the space of KI and its influence on not only other KM processes such as Knowledge Sharing or Knowledge Retention, but also more broadly on organisational performance, capabilities and learning.

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# Chapter One: Introduction

According to the former Hewlett Packard (HP) CEO Lewis Platt: "if HP knew what HP knows, we would be three times as productive." (Sieloff 1999). Such is the value claimed on an organisation being aware of knowledge that already exists within its boundaries.

In other words, assuming what is true at HP is true in other organisations, there is significant value in identifying the relevant and needed knowledge that exists within organisation boundaries. However, there are perhaps other relevant factors, including how and what works to "know what you know".

This research examines this claim with a view to offer insights into the following question: To what extent does establishing the relevant and needed knowledge that already exists within the boundaries of an organisation, a process referred to in this thesis as Knowledge Identification (KI), contribute to Knowledge Management (KM) effectiveness?

Based on the findings of a three-phase research project grounded in the domain of KM, and in which I quantify the relationship between KI and KM, and which I report on in this thesis, I argue that KI does contribute to KM effectiveness significantly.

Before we delve into the research project and into the concepts of KM and KI, first, chapter one describes the lens or the overarching perspective adopted in approaching this research. By the end of chapter one, the research objectives and the research significance are stated, and the organisation of this thesis is outlined.

## 1.1. The Rise of the Knowledge Economy

In a discourse on Knowledge Management, it is important to appreciate that the knowledge economy as we witness it today was not always so. It is also important to understand what the drivers of the knowledge economy were and which of them still remain.

The introduction of machines during the industrial revolution of the 18th century, marked the beginning of what can described as a major shift in what drives the world economy. Before knowledge, machines were the key driver of the world economy.

Organisations worldwide effectively substituted machines for human labour to gain in productivity and competitive advantage. Examples of such machines include the steam engine, the telegraph and the sewing machine. Here is an example of how machines have contributed in the logistics and supply chain industry:

> Aided by machines, organisations were able to produce shipping containers (then known as “metal boxes”) in the second half of the 20th century. These shipping containers would minimise transport costs (e.g. by removing labour costs), increase productivity and revolutionise no less the freight industry and world-trade. In fact, containerisation explains a 320% rise in bilateral trade over the first five years after adoption (since 1962) and 790% over 20 years in a set of 22 industrialised countries (Bernhofen, El-Sahli and Kneller 2013).

Machines played - and still do - a significant role in driving the world economy during the 20th century. However, in the 21st century, machines no longer play a key role in driving competitiveness. The 21st century is an era marked by knowledge as a key driver, as the sustainable source of competitive advantage and as “our most powerful engine of production” (Marshall 1920, p. 115; Porter and Millar 1985).

The knowledge-based economy (or ‘knowledge economy’) can be evidenced in a number of ways. For example in the shift in the value of intangible assets (i.e. knowledge-based assets) compared to tangible assets.

For example, in 1982 in the United Sates, property, plant and equipment (PP&E) accounted for 62.3% of the market value of mining and manufacturing firms. By 1991, PP&E accounted for only 37.9% of the market value (Blair 1995, p. 234). In 1999, intangible assets represented as much as 85 to 90% of the value of Standard & Poor's 500 (Webber 1999).

Further, over a 20-year period between 1981 and 2001, the number of patents issued to American inventors more than doubled; patents issued in the United States climbed from less than 47,642 to more than 168,040, suggesting a "marked acceleration in the production of new knowledge" (Powell and Snellman 2004, p. 202).

The shift in value clearly did not happen overnight but gradually - and globally. We can observe a similar trend by looking at the estimates of the gross domestic product (GDP) in Australia. Between 1974 and 2009, estimates of the GDP share from the services industry (which includes knowledge-based products and services) in Australia outgrew that of the manufacturing industry (Deloitte 2013).

We produce and use knowledge in the 21st century at a rate significantly higher than in previous centuries. The reasons for this shift toward a knowledge-based economy abound.

One popular reason offered is that knowledge provides a more sustainable source of competitive advantage than tangible resources. That is, tangible resources more often than not quickly become available to competitors whereas knowledge is more difficult to replicate and reproduce (Sharratt and Usoro 2003).

Below are two examples of how knowledge in the form of intellectual property (IP) generates wealth:

> In 2007, the value chain of Barbie dolls manufactured in China and sold in American stores was deconstructed. In rough figures, the IP - the Barbie name and design - captured 40% of the value of the Barbie dolls. The retailers also took 40%. The tangible elements, parts and materials took 10%, logistics took 6 to 7% and the assembly took 3 to 4% (Pascoe 2011). Thus, the real value (i.e. the wealth) of Barbie dolls is in the IP.

It is worth emphasising that it is not that tangible assets and machines do not have or do not provide value; they do. However, the need to have the knowledge and skill-set required to leverage both tangible and intangible assets for competitive advantage has never been more acute.

The rise in the value of knowledge sparked relentless attempts by organisations across the world to pursue knowledge for competitive advantage. The former HP CEO Platt is also quoted stating: “Knowledge management is all that there is in our company. We live and die on our intellectual property.” (Sieloff 1999, p. 53). The same interest in knowledge prompted organisations across the globe to embrace and leverage Knowledge Management (KM) for organisational performance.

The knowledge economy expanded throughout the 21st century, penetrating every industry sector. Knowledge-based products and services became a dominant force of commerce; and managing knowledge (or KM) became a topic *du jour* among both researchers and practitioners.

Many researchers and practitioners have explored the concept further, and thus, KM became an umbrella term encompassing multiple KM processes including:

- the creation of new knowledge (Knowledge Creation),
- the storage of knowledge (Knowledge Storage),
- the transfer or dissemination of knowledge (Knowledge Sharing),
- the use of knowledge (Knowledge Use) and
- the retention of knowledge (Knowledge Retention).

Each KM process addresses specific organisational needs and each carries varying amounts of investment, activities and difficulties.

These changes reflect the state of affairs of the KM domain - both in practice and conceptually. While the concept of KM in its current state is relatively more mature compared to its inception days, there are still a number of problems and challenges that organisations face with respect to leveraging knowledge they have effectively.

Not all organisations who have invested in KM are fully satisfied; and there are many which still struggle with KM, both as a concept and its practical application and are dissatisfied with their lack of success in putting KM in practice.

For example, two surveys carried out in 2009 and 2011 with 1430 and 1230 respondents respectively, consisting of executives across multiple sectors, found KM to be significantly below average satisfaction ratings, even though KM was in the top ten most used management tools in both surveys (Rigby and Bilodeau 2009, 2011).

More recently, a survey of 729 individuals around the world who declared that KM activity formally exists in their organisations (Griffiths 2015) showed the following:

- Many KM professionals do not appear to have the necessary awareness and/or permissions to respond to unmet demand for KM activities in the organisation.
- The value and/or significance of Knowledge Management activities is still not being appropriately recognised or reported within most organisations.
- KM lacks maturity and integration within the organisation.

Researchers and practitioners have examined the reasons why KM often does not bring full satisfaction and the problems organisations face with respect to KM. In the next section, I introduce the KM problem investigated in this research and through examples, I argue that it is a significant problem.

## 1.2. The Knowledge Management (KM) Problem

### 1.2.1. Problem Definition

The KM problem that this research investigates can be viewed in more than one way. At a high level, the problem investigated is that organisations often do not know what they already know. They often do not know what knowledge they have already (Nevo, Benbasat, and Wand 2009, 2012; O'Dell and Grayson 1998; Tsoukas 2003).

At a lower level, we note that the problem is that within the unknown knowledge lies knowledge that is relevant and needed for organisational performance; and this has the potential to negatively impact organisational performance (through inefficiencies, uninformed decisions, and redundant activities).

Note that while this problem relates specifically to internal knowledge, awareness of external knowledge (e.g. knowledge of competitors) is equally important. For the purpose of this research, I focused specifically on internal knowledge.

Before continuing further, it is important that I clarify the term knowledge and what guided my choice for the form of knowledge that I focused on.

First, on the term 'knowledge'. Knowledge itself, can take various forms; and many taxonomies and ontologies are used and created in an attempt to represent the various forms of knowledge. Fundamentally, the forms that knowledge can take can be visualised on a spectrum which ranges from tacit knowledge to explicit knowledge.

Tacit knowledge is knowledge that is difficult to express or codify and remains predominantly embodied (e.g. skills and know-how). Explicit knowledge on the other hand is knowledge that has already been codified and contained within externally recorded formats (e.g. documents, videos). Between those two extremes lies implicit knowledge, knowledge that can be easily expressed or codified, but for various reasons is not.

There is also the aspect of competence and expertise - both terms are relevant and related to knowledge. Lai (2003) defines competence as "the gained knowledge, skills, abilities and attitudes that makes it possible to carry out the relevant functions and tasks according to the defined requirements and goals." Likewise, expertise refers to "the characteristics, skills, and knowledge that distinguish experts from novices and less experienced people." (Ericson 2006).

In this thesis, I used a purpose-driven and generic definition of the term 'knowledge' (which I discuss further in chapter two) to encompass facts, information and skills.

The above clarification is important because it helps us answer this question: Where does the (unknown) knowledge exist in organisations and in what forms does it live? Knowledge in organisations exists, lives, and is embodied or captured in in various forms - for example, in the heads of employees, in documents (printed or electronic), and in the organisation culture.

Second, on the form of knowledge I focused on. In pursuing this research, I focused on knowledge that employees have (incl. internal organisational knowledge and knowledge of competitors and customers). That said, instead of focusing only on the tacit knowledge employees hold between their two ears, I adopted the entire knowledge-form spectrum from tacit to explicit knowledge, with a focus on implicit knowledge (i.e. knowledge that can be easily expressed or codified, but for various reasons is not). I explain why below.

First, my focus on employees was informed by the numerous studies that demonstrate that employees have knowledge (in various forms) that is relevant and needed to organisational performance. While much of this knowledge is gained on the job, through experience, much of this same knowledge is often not shared, recorded, or used effectively by other employees (Alavi and Leidner 2001; Davenport and Prusak 2000; Evans and Ali 2013; Hibbard 1997, Hinds and Pfeffer 2002; Kreiner 2002; Leonard and Sensiper 1998; Zack 1999).

Second, in seeking answers and explanations to 'Why do organisations often not know what they know?', I uncovered a vast number of references to processes and problems around knowledge sharing and capturing tacit knowledge (e.g. see Hinds and Pfeffer 2002; Mitchell 2005; Polanyi 1966).

A large proportion of the literature that relates to knowledge sharing is indeed tied to the KM problem at hand. The reason for this is because to some extent, both the concepts of Knowledge Sharing and Knowledge Identification (KI) share a similar goal: better exploit existing knowledge.

Organisations cannot know what knowledge their employees have if the employees are unwilling to share their knowledge. Hence the focus on employees and capturing their knowledge. The problem here is that this knowledge is often tacit, that is it is difficult to express or codify and remains predominantly embodied.

For more details on the problems around Knowledge Sharing and capturing tacit knowledge, the reader is encouraged to see Garud and Kumaraswamy (2005), Hinds and Pfeffer (2002) and Mitchell (2005).

Having clarified the interpretation of the term 'knowledge' in this thesis and justified the focus on internal knowledge and on employees in this research, I discuss the significance of the problem next. This will not only provide the rationale for why this is a problem worth researching, but also unpack the problem and clarify potential nuances. Following that, I review some of the solutions proposed and define the research scope and objectives.

### 1.2.2. Problem Significance

Organisations that are unaware of relevant and needed knowledge (irrespective of the form of the knowledge) that exists within their boundaries, face a significant and complex problem, both in terms of scale and its cascading ramifications.

For example, consider an employee re-creating or duplicating work because she or her manager does not know that the organisation already has done this work. Take this example and scale it to a team, to an entire department or subsidiary, duplicating work. We can easily picture how this problem can affect organisations both at an organisational level and at an employee level and how it can become significant and costly.

The problem may affect both small and large organisations. However, it is more likely to affect large organisations than smaller ones because larger organisations have a higher number of knowledge-holders with higher degree of separation between inquirer and answerer, in physical, divisional, or area of expertise senses.

The type of industry in which organisations operate may also be a factor. It is less likely that this problem affects organisations that operate in industries where a high level of documentation is required - e.g. a law firm.

The ramifications of this KM problem are also multi-fold. I explain below how this problem is at the source of multiple, subsequent problems that organisations face with respect to leveraging knowledge that they have. Specifically, I discuss how the KM problem at hand affects organisational performance, how much this problem costs and the impact that the ageing workforce has on this problem.

**Organisational Performance**

It is difficult for organisations to leverage or tap into knowledge that they do not know they have. Organisations cannot use this knowledge or share it effectively with others to use.

Employees possessing knowledge and skills that are relevant and needed by both colleagues and managers within the same organisation, are often unknown to those same colleagues and managers. "Talk about a waste!" (Nevo, Benbasat, and Wand 2009, 2012).

According to Gilmour (2003), in a survey of 536 professionals in medium and large organisations (with 1000 or more employees) in the United States in 2003, 51% admitted that wrong decisions were regularly made because employee knowledge was not effectively tapped - due to a lack of awareness or access to the knowledge.

Organisations which are unaware of knowledge that they have are likely to spend money unknowingly on duplicating work already done (Lee et al. 2005) or worse, make poor decisions.

**The Cost of Not Knowing**

To estimate how much this problem can cost an organisation, consider how much time, money and other resources an organisation can waste on duplicating work already done, or how organisations could have utilised their own resources better - were they aware of either the knowledge that they already had or the sources of this knowledge.

Note that measuring accurately either the cost of duplicating work already done or the cost of failing to leverage knowledge effectively is not always an exact science. More often than not, those costs can be more easily and accurately measured after it is already too late.

One of the difficulties in measuring or estimating those costs is that they often depend on a number of factors including the magnitude of the work duplicated and the value of the knowledge used. Not all knowledge holds equal value and what may be valuable today may not be so tomorrow.

In a similar fashion, while some knowledge is needed or critical to the performance of the organisation - and generally more costly, other knowledge is relatively less useful or less needed - and generally less costly.

Nevertheless, the cost is high. In 1999, the International Data Corp. in the United States estimated that the Fortune 500 could waste up to US$12 billion a year due to "intellectual rework, substandard performance, and inability to find knowledge resources." (Feldman and Sherman 2001, p. 7).

Emphasising the substantial value of its unknown knowledge, a former HP CEO stated that, "If HP knew what HP knows, we would be three times as profitable." (Davenport and Prusak 2000). The case at HP is not an isolated one; CEOs across the world wish that they knew what they know already (Robinson and Ensign 2009).

**An Ageing Workforce**

Complicating matters further, as the participation rate of older workers continues to increase and a large proportion of "baby boomers" are set to retire, the risk of losing knowledge (along with the sources of the knowledge) has recently become a more serious concern (DeLong 2004; Parise, Cross, and Davenport 2006; Stam 2009; Jennex 2014). In fact, the turnover of employees of any age who take knowledge to other organisations where they may be employed poses a risk.

An ageing workforce puts the risk of losing critical knowledge - and to a certain extent, knowledge that organisations may not know that they have - at a level all too high. "Skills, knowledge, experience, and relationships walk out the door every time somebody retires - and they take time and money to replace." (Dychtwald, Erickson, and Morison 2004). For example, in one particular organisation, the next anticipated wave of almost 700 retirements would mean the loss of over 27,000 years of experience (Leonard, Swap, and Barton 2014).

One of the many challenges that organisations face is how to retain that knowledge. The difficulty that organisations face in retaining knowledge is how to identify what knowledge needs to be retained - which often means identifying what relevant and needed knowledge employees have that needs to be captured (Joe and Yoong 2006). This task is likely to be more challenging if organisations do not know who or where their sources of relevant and needed knowledge are in the first place.

In the next section, I introduce Knowledge Identification as a potential solution to the KM problem, following which I define the scope and objectives of this research.

## 1.3. Enter Knowledge Identification (KI)

I alluded earlier to the fact that a vast amount of literature points to knowledge sharing and capturing tacit knowledge in an attempt to solve the KM problem at hand. However, the problem seems to persist still: organisations often do not know what they know.

This means that perhaps there is another piece to the puzzle that we are not looking at and possibly not looking for. We need a different perspective on this problem, where we explore solutions beyond knowledge sharing or capturing tacit knowledge.

Instead of walking down this well-travelled path of knowledge sharing and capturing tacit knowledge, I investigated the problem at hand through a different lens, by examining one seemingly commonly overlooked KM process where organisations proactively identify the knowledge that exists within their boundaries - a process referred to in this thesis as Knowledge Identification (KI).

Some researchers advocate for a more proactive and targeted approach in identifying internal organisational knowledge. They argue that organisations should not wait for the knowledge to come pouring in knowledge repositories as is often the case for Knowledge Sharing systems, but instead should take steps to create processes where organisations go to the knowledge - in whichever form the knowledge may be and wherever the knowledge may be located (Henczel 2001; Hylton 2003). In other words, favouring a pull rather than a push approach.

The terms used in the literature to refer to this particular approach and its underlying process vary. For example, Hylton (2003) uses the term 'knowledge audit' to refer to the "accurate identification, quantification, measurement and assessment of the sum total of tacit and explicit knowledge in the organization".

Other terms that have been used include: knowledge identification (Egbu, Hari, and Renukappa 2005) and knowledge sourcing (Gray and Meister 2004). All three terms have also been used to refer to either additional or other activities.

For the most part of this thesis, for the purpose of consistency and more reasons discussed in chapter two, I use the term 'Knowledge Identification' to describe this process whereby organisations identify the relevant and needed knowledge that exists within their boundaries.

Some researchers argue that KI is an essential process in undertaking a KM initiative. For example, Hylton (2003) argues that a knowledge audit (KI) is the “indisputable first step in a knowledge management initiative” and to not have a knowledge audit is “a travesty of justice to knowledge management.”

The premise of the argument is as follows: that the ability of organisations to identify effectively who has relevant and needed knowledge or where relevant and needed knowledge resides, has a positive effect on their ability to leverage the knowledge that they have.

For instance, having established who knows what internally, organisations can then ask those employees or those groups of employees to codify that knowledge, or tell other employees whom to ask for knowledge.

In other words, knowing who or where the knowledge sources are and what knowledge those sources hold, potentially leads to organisations being able to leverage that knowledge far more effectively - ultimately, for more effective organisational performance.

In his work on social media and Knowledge Acquisition in organisations, Leonardi (2015, p. 748, citations in original) pointed out that knowledge of “who knows what” and “who knows whom” is often linked to “team performance on routine tasks (Ren et al. 2006), people’s ability to recombine existing ideas into new innovations (Majchrzak et al. 2004), reduction in work duplication across the organization (Jackson and Klobas 2008), and many more positive benefits.”

Indeed, there is a difference between ‘identifying knowledge that the organisation has’ where the focus is on the knowledge and ‘identifying who knows what in the organisation’ where the focus is on the knowledge holders.  KI is the process that encompasses the two.

More importantly, the approach that underpins KI has the potential to not only solve the KM problem at hand, but also address some of the issues in the Knowledge Sharing space.

In the next section, I briefly discuss the need for this research, in the form of a research agenda.

## 1.4. Research Agenda

If organisations are to manage and leverage the knowledge that they have for organisational performance effectively, are they not meant to know who or where their knowledge sources are and what knowledge those sources hold in the first place?

Yet, while researchers point out the critical nature of the process of KI *vis-à-vis* KM, there is no empirical evidence that demonstrates the strength of the relationship between effective KI and effective KM (e.g. see Cheung et al. 2007; Gourova, Antonova, and Todorova 2009). There is no empirical evidence that demonstrates the strength of the relationship between effective KI and effective KM, or between the process whereby organisations identify who knows what within their boundaries and effective KM.

Worse, literature around KI and evidence that quantifies the relationship between KI and KM appear to be limited. Burnett, Williams and Grinnall (2013) note that prior to the 21st century, very little attention within the field of KM was given to KI; while models around KI practice are emerging, most have shortcomings (e.g. some models do not factor in the underlying business processes of the organisation).

The notion that organisations which do identify the knowledge that they have are more effective in KM than organisations which do not, has remained so far, just that: a notion, based on anecdotes and case studies. Do organisations attempt to find out what knowledge they have? Do organisations stand to gain in KM effectiveness by practising KI?

It is unclear whether or not the perception of KM practitioners towards KI is aligned to that of researchers. This 'how' question represents a number of things: from methodology to systems and tools. In this research, I refer to the means of practising KI, including systems, technology, tools and techniques as KI methods.

Not many KI methods have been tried and tested, and found effective. There are many researchers and practitioners who argue that the methods organisations use to identify the knowledge that exists within their boundaries are simply lacking (i.e. there are not many) or lack effectiveness.

For example, Huber (1991, as cited in Alavi and Leidner 2001, p. 119) pointed out that organisations "have weak systems for locating [i.e. identifying] and retrieving [i.e. acquiring] knowledge that resides in them."

More recent surveys indicate similar findings about those "weak systems". In a recent survey conducted in the context of an ageing workforce, 75% of 124 surveyed organisations across the for-profit and not-for-profit sectors in the United States and Canada said that they have processes for identifying critical talent (i.e. employees with relevant and needed knowledge), but only about one third said that their programmes for managing it were extremely effective (Mercer 2014).

Similarly, in a survey conducted by the American Productivity & Quality Center (APQC), when asked 'How effective is your organization's approach for locating experts and/or expertise?', 10% out of the 132 respondents responded 'Very effective', 63% responded 'Somewhat effective' and 27% responded 'Not effective at all' (O'Dell and Trees 2013).

Talent, expert or expertise location systems are other examples of KI methods; and the findings above indicate that they are not effective to a great extent.

Excluding literature or KI methods that are confidential in nature, commercially available or not accessible to the public domain, literature around KI practices and the relationship between KI and KM remain limited and thus warrant this research. I explain how I conducted the literature review in chapter two. The scope and specific objectives of this research are defined in the following section.

## 1.5. Research Scope and Objectives

As stated in the previous section, literature around KI (the process of identifying relevant and needed knowledge that exists within the boundaries of an organisation) and evidence that quantifies the relationship between KI and KM appear to be limited.

One possible explanation for the unpopularity of KI is the prevalent lack of attention to KI and KI practices, and that lack of evidence that support KI. This lack of evidence to support KI explains in part why KI practices are not as widespread and in another part perhaps why organisations are unaware of the knowledge that they (or their employees) have. We are yet to appreciate, if not understand the significance of Knowledge Identification.

Establishing whether or not KI is critical to KM contributes to ascertaining whether or not further research into KI is warranted. Hence, the primary objective of this research is to measure the strength of this relationship.

However, the scope of this research is not limited to measuring the strength of the relationship between KI and KM. The need to deepen our understanding of KI practices among organisations and identify and explore the problems different KM stakeholders face with respect to KI warranted further investigation.

To that aim, secondary research objectives were developed which aimed at deepening our understanding of Knowledge Identification practices among organisations and act as stepping stones to accomplishing the primary research objective. The tables below list the primary and secondary research objectives.

**TABLE 1-1 PRIMARY RESEARCH OBJECTIVES.**

| The primary objective of this research was to: |
|---|
| 1. deepen our understanding of KI practices among organisations, and<br>2. verify the critical nature of the relationship between KI and KM. |

**TABLE 1-2 SECONDARY RESEARCH OBJECTIVES.**

| The secondary objectives of this research were to: |
|---|

3. identify the KI methods currently used by organisations and the extent to which KI is practised among organisations,
4. identify and explore the problems different KM stakeholders face with respect to KI and KI methods, and
5. identify the factors that influence KI effectiveness.

Further, I also adopted an organisational (or wholistic) perspective on KM. That is, I looked at how organisations rather than individuals approach KM. I assumed a rather generic definition of 'organisation': "a group of individuals working together to achieve one or more objectives" (Cambridge Dictionaries Online, 2016).

With regards to the term 'knowledge', to reiterate, the knowledge referred to here is not hidden knowledge or knowledge that is yet-to-be created or analysed and extracted from knowledge repositories. It is knowledge that already exists within the boundaries of the organisation, but that remains yet-to-be identified, captured and stored for later consumption.

In other words, while I focused on knowledge that employees have I did not focus only on the tacit knowledge employees hold between their two ears. Rather, I adopted the entire knowledge-form spectrum from tacit to explicit knowledge, with a focus on implicit knowledge (i.e. knowledge that can be easily expressed or codified, but for various reasons is not).

In the next section, I point out the theoretical and practical significance of this research.

## 1.6. Research Significance

This research accomplished the above research objectives and in so doing has both theoretical and practical significance.

### 1.6.1. Theoretical Significance

First, this research contributes to the literature by filling a knowledge gap. The research generated theory that identifies the factors that influence KI effectiveness and quantified the relationship between KI to KM.

The research did not just provide a theory, but it also operationalised and tested that theory. Instead of a process-driven model, the model presented is a factor-based model. I used a mix of qualitative and quantitative data collection and data analysis methods to construct and subsequently validate the model depicting the relationship between KI effectiveness and KM effectiveness.

Second, this research draws attention to KI. Compared to other KM processes in the KM literature, research on KI has been limited. Partial findings of this research have already been published to the academic community (e.g. see Newk-Fon Hey Tow et al. 2015), with the hope of drawing further attention to KI.

Third, the findings of the research impact the KM domain directly but also impact indirectly other KM-related domains including: organisation memory (OM) and organisational learning (OL). The findings warrants further research between the relationships between KI and OM, and KI and OL.

Finally, this research explored KI practices, uncovering the methods organisations use to practise KI and the problems organisations face with respect to KI. This is detailed in the practical significance of the research below.

### 1.6.2. Practical Significance

In terms of practical significance, this research investigated a problem which affects a number of organisations worldwide.

This research investigated the problems organisations face with respect to KI and KI methods and determined the factors which may lead to more effective KI and KI methods. The findings of this research established whether or not KI methods lack in effectiveness and more importantly, in which areas they do.

This research also shed some light on the problems that organisations face with respect to identifying the relevant and needed knowledge that exist within their boundaries. This research investigated whether or not organisations do practise KI, to what extent organisations are and what methods organisations use to practise KI.

## 1.7. Organisation of This Thesis

The remainder of this thesis is organised as follows:

Chapter two, reviews literature most relevant to this Knowledge Management and Knowledge Identification and establishes a list of research questions that this research set out to answer.

In chapter three, the research design or how this research was conducted and what methods were used to obtain the answers to the research questions are discussed.

The research findings obtained are presented and discussed in chapters four through six. Chapter seven concludes this thesis while making recommendations for future research.

## 1.8. Chapter Summary

Chapter one opened with an account of the increase in the value of knowledge *vis-à-vis* tangible assets between the 18th and the 21st centuries and laid the foundations of the research conducted.

The KM problem of organisations being often unaware of knowledge that they have and the ramifications of organisations being unaware of the knowledge that exists within their boundaries were discussed.

The Knowledge Identification process whereby organisations identify the relevant and needed knowledge that exists within their boundaries was pointed out as a critical, yet largely overlooked process in KM.

The next chapter takes a critical look at relevant literature surrounding Knowledge Management and Knowledge Identification.

"The only thing that you absolutely have to know is the location of the library."

Albert Einstein.

# Chapter Two: Review of Relevant Literature

Chapter one set the scene and the context of this research and laid the foundations of this thesis. I introduced the Knowledge Management (KM) problem investigated in this research and discussed some of the approaches proposed to solve the problem, along with some of the subsequent and related problems.

I also highlighted the approach that I focused on in chapter one. This approach takes the form of a process whereby organisations identify the relevant and needed knowledge that exists within their boundaries - a process referred to as Knowledge Identification (KI). This research thus revolves around KI.

The objectives of chapter two are to:

- review the relevant literature around the concepts of KM and KI,
- obtain a richer understanding of KM and KI,
- map out the conceptual landscape of this research, and
- define the gap in the literature that this research set out to fill.

Chapter two is thus organised as follows:

- Section 2.1 examines the literature around knowledge and establishes a definition of knowledge.
- Section 2.2 covers the literature around Knowledge Management. Some of the milestones in the history of KM, some notable KM definitions and frameworks, and some measures of effective KM are reviewed and discussed. By the end of section 2.2, the definitions and the rationale for the definitions of KM and KM effectiveness are established.
- Section 2.3 covers the literature around Knowledge Identification. I discuss the relationship between KI with KM, the deliverables of KI, the different terminologies used to represent KI, and some notable KI methods. Also in

this section, I define KI and KI effectiveness and provide the rationale for the definitions chosen.

- By the end of section 2.3, the gaps in the literature will become clear. These gaps formed the basis of the research questions that this research project set out to answer. These gaps are listed in section 2.4.

In conducting the literature review, I was informed by Jennex (2015). I used a number of search tools and repositories that were at my disposal via my university including Google Scholar. Reading through the publications and journals, I followed the ontology of the field and used multiple search criteria to search for relevant literature.

The terms or combination of terms that I used include: knowledge management, knowledge sharing, knowledge identification, knowledge audit, knowledge sourcing, knowledge management strategy, finding out who knows what.

I limited by search by publication date, reading only relevant papers since early 1950s (the term 'Knowledge Management' was coined in the late 1960s) and within the fields of Knowledge Management, Organisation Science, and Information Systems. I did not incorporate papers in other fields.

# 2.1. Knowledge

In chapter one, I briefly discussed the knowledge economy and pointed out that knowledge is a source of sustainable competitive advantage. Knowledge can provide competitive advantage because it is "valuable, rare, inimitable and non-substitutable." (Omerzel and Gulev 2011, p. 349).

However, I did not provide a detailed explanation of what constitutes knowledge itself. This section covers the review of relevant literature around the concept of knowledge.

Note that a comprehensive review of the literature on the concept of knowledge goes beyond the scope of this thesis. The purpose of this review is to be cognisant of the pertinent discussions surrounding the concept.

This review helped me gain an understanding of what knowledge is and establish a working definition of the term 'knowledge'. It also provided me with an *aperçu* of what is involved in managing knowledge (KM), which is discussed in section 2.2.

## 2.1.1. Knowledge: An Introduction

Knowledge has been described as a "messy", "esoteric" and "tricky" concept and as "one of the most nebulous and difficult concepts" (Maqsood, Finegan and Walker 2004, p. 295; Tsoukas and Vladimirou 2001, p. 975; Wiig 1993, p. 71). Reasons for this abound and there are multiple ways to address this. I first discuss why knowledge is a nebulous concept; and by the end of this section on knowledge, I explain the choice for the definition used in this research.

It is difficult to capture the essence of what knowledge is. Like many abstract concepts, the concept of knowledge suffers from a definitional issue in terms of difficulty in expressing clearly what the term means or represents.

The term 'knowledge' is an umbrella term and can be interpreted in many different ways. For example, the term 'knowledge' can be used metaphorically. For example, knowledge is often referred to in a metaphorical sense to mean power (e.g. knowledge is power, or *scientia potentia est*).

Knowledge literally does not mean power (power here meaning the ability or capacity to do something). Instead, knowledge in its usual and literal sense lives in the form of dictionary definitions. One of those definitions is: "facts, information, and skills" (Oxford Dictionaries, 2013).

Another example that demonstrates the multi-faceted nature of the term 'knowledge' is its corresponding verb 'to know'. In the English language, the verb 'to know' can be used in different contexts:

- An awareness or familiarity of something or someone

  For example compare the two: "I know of Enterprise Architecture." - I have heard the name, but that is about all I know; and "I know about Enterprise Architecture." - I have learnt this subject and can do the architecture.

- An understanding of something or someone (e.g. to demonstrate empathy), or a familiarity of something or someone.

  For example, "I know how Rachel feels."

In contrast, in the French language, there are two variations of the verb 'to know'. The French language distinguishes between the verb *savoir* (to know) to denote the knowledge of facts and skills gained through education and practice (e.g. I know how to bake a cake), and the verb *connaître* (to be familiar with) to denote knowledge of facts gained through experience and of people through an acquaintance (e.g. I know the way. I am familiar with this road.).

In either language, using just the verb 'to know' has its limitations. For example, it does not provide the degree or the depth of the knowledge. For example, 'I know about Enterprise Architecture' does not tell us how well or how much I know about the topic.

The origin of the term "knowledge" is twofold. The term "know" draws from the Latin word *noscere*, and means to know or to learn while the suffix "ledge" may have originally meant "process" or "action" (Searle, 1969 as cited in Senge et al. 1999, p. 421).

Eleven definitions of knowledge sorted by publication date are listed in table 2-1 below. Eight of the definitions were taken from the literature via Google Scholar; the ninth and eleventh are dictionary-definitions.

**TABLE 2-1 KNOWLEDGE DEFINITIONS.**

| **Knowledge is:** |
|---|
| 1. "a justified true belief" (Plato, adapted by Gettier 1963, citing Plato).<br>2. the ability to make effective decisions and take effective action (adapted from Senge 1990).<br>3. "a dynamic human process of justifying personal belief toward the 'truth'" (Nonaka and Takeuchi 1995).<br>4. "*information that is relevant, actionable, and based at least partially on experience*." (Leonard and Sensiper 1998, p. 113, emphasis in original).<br>5. "a justified belief that increases an organization's capacity for effective action." (Alavi and Leidner 1999, adapted from Nonaka 1994 and Hubber 1991).<br>6. "a fluid mix of framed experience, values, contextual information, and expert insight that provides a framework for evaluating and incorporating new experiences and information." (Davenport and Prusak 2000, p. 5).<br>7. "the meaningful links people make in their minds between information and its application in action in a specific setting." (Dixon 2000, p. 13).<br>8. "the collection of expertise, experience and information that individuals and workgroups use during the execution of their tasks." (Vasconcelos et al. 2005).<br>9. defined as: "facts, information, and skills acquired through experience or education; awareness or familiarity gained by experience of a fact or situation." (Oxford Dictionaries 2013).<br>10. "the ability to understand information and to then form judgements, opinions, make predictions and decisions based on that understanding." |

(BBC 2014).

11. "the state or fact of knowing" (Farlex 2015).
12. "information that has been culturally understood such that it explains the how and the why about something or provides insight and understanding into something (Note that this is a tailored version of many commonly accepted definitions of knowledge as summarized in Wikipedia)." (Jennex and Bartczak 2013, p. 27).

Admittedly, these eleven definitions represent a selective list of knowledge definitions; for example, most of the definitions listed have an organisational context. However, even as philosophers, business people, psychologists and engineers have all exercised their minds for centuries on the concept, there is still no agreed-upon academic definition of 'knowledge'.

As Stenmark (2002) correctly pointed out, the way researchers perceive knowledge depends largely on the discipline that the researchers are from. Some researchers use the terms 'information' and 'knowledge' interchangeably to mean the same thing. For example, in their definition of information, Kogut and Zander (1992, p. 386) imply that information is a form of knowledge. They define information as "knowledge which can be transmitted without loss of integrity".

Those who use the terms interchangeably view knowledge and information as static or absolute, and objective. They perceive knowledge as facts and information which can be grouped or accumulated to form an end-result.

Consider for example, a document (either in a printed or electronic format). Some researchers argue that it is the content of the document - which is intrinsically static - that makes the document a form of knowledge. For example, the document may consist of instructions on how to change a flat tyre or how to pick the right stocks for a financial portfolio; those instructions or those sets of instructions are knowledge.

Other researchers (e.g. Davenport and Prusak 2000) on the other hand, go to great lengths to differentiate knowledge from information. They distinguish knowledge among certain kinds or forms of information, typically selecting pieces of information which are more subjective, dynamic and to some extent, embodied - for example, skills and know-how.

These researchers emphasise on the thought process(es) involved to acquire and develop knowledge, and perceive knowledge as an ability, an activity or a process. Knowledge in this sense is hard to write down, experience-based, a 'gut feel', highly context-dependent, and often characterised by 'it depends'.

Using the above example of the document containing instructions on a particular topic, the same researchers in this case would consider the document as information, and knowledge is the process by which an individual absorbs, understands, interprets, analyses and actions on the information contained in the document.

The definitions above do highlight the issues surrounding the concept of knowledge. I alluded to some in the discussion above already. In the next sub-sections, I elaborate further on the different forms that knowledge can take, the subjective nature of knowledge and the knowledge hierarchy, from naught to knowledge. I provide the rationale for the definition of knowledge used in this research following that.

### 2.1.2. Knowledge: Subjectivity and Objectivity

For researchers who perceive knowledge as objective, knowledge is static and absolute. As Stenmark (2002) puts it, "knowledge is understood as an artefact that can be handled in discrete units and that people may possess." Knowledge is generated in a particular format and is free from any form of bias - for example, a mathematical formula or a Wi-Fi patent.

On the other hand, consider the painting skills of an artist, the teaching skills of a professor, or the presentation skills of a manager. These are examples of knowledge that varies from one individual to the next, and that is subjective and experience-based.

Such description of knowledge is often attributed to the term 'experience' (e.g. see Davenport and Prusak 2000). In fact, four out of the eleven KM definitions in table 2-

1 above have the term ‘experience’ in them. The term ‘experience’ conveys subjectivity, emphasises practice, an activity, or a process which typically involves context, meaning, values and beliefs.

While knowledge can be defined as “facts, information, and skills acquired through experience or education; the theoretical or practical understanding of a subject”, experience is “the knowledge or skill acquired by a period of practical experience of something, especially that gained in a particular profession” (Oxford Dictionaries 2013).

Either way of perceiving knowledge (objectively or subjectively) is right to some extent. That is, knowledge is neither completely subjective nor completely objective. The painting skills of one artist would most likely differ from next artist; and mathematical formulae are static and objective or universally agreed upon. For example, everyone would agree that two plus two equals four.

A key question here is what makes knowledge subjective or objective? Let us consider this example below on subjectivity and objectivity:

All things held constant and ordinary (no bias), consider someone asking about the room temperature (chilly versus pleasant). Say a dozen of people give differing reports. It is often the agreement of the majority that is taken to be indicative of objectivity.

The key take-away here is that knowledge involves a degree of both subjectivity and objectivity. This is important for two reasons: First, it helps frame the definition of knowledge. Second, it helps in understanding the forms that knowledge can take. I discuss the different forms that knowledge can take next.

### 2.1.3. Knowledge: Forms

Knowledge can take various forms. For example, using the earlier examples, financial procedures written in a book is a form of knowledge; the painting skill of an artist is another form of knowledge.

The general consensus on the question of knowledge form is that there is a spectrum of forms that knowledge can take. On one end of that spectrum, there is explicit knowledge and on the other end, there is tacit knowledge:

Explicit knowledge is knowledge that has already been codified - for example, the rules of Australian football on a web site. On the other hand, tacit knowledge is knowledge that is difficult to express or codify - for example, how to be a good football kicker.

The extent to which the tacit knowledge is needed and used to produce explicit knowledge is a contentious issue. Some (e.g. Polanyi 1956) argue that tacit knowledge is the only - and true - form of knowledge. They argue that tacit knowing (i.e. the process of knowing or coming to know) is the root of all knowing.

The premise of the argument is that one needs tacit knowledge to create, acquire or interpret explicit knowledge. Consider for example, how we come to know how to think, to learn or to speak. We are perhaps born with some amount of tacit knowledge and not *tabula rasa*.

Others have argued that it is knowledge that has been separated from the individual, made explicit and "freed from human interest and attitude that is the only true form of knowledge" (Chia 2003; Rechberg and Syed 2014, p. 428).

Exactly how many forms knowledge can take is subject to debate as the investigation and exploration of more knowledge forms continue. Note that knowledge in the form of skills and know-how is not simply facts and information supplemented by context, meaning, values or beliefs but it is knowledge that is constructed from meaningful experience and that is generally embodied.

Some of the generally accepted forms of knowledge that fall within that spectrum include: know-how, know-what (also known as declarative knowledge), know-when, know-who or know-why.

In the business intelligence-related literature, we can observe the use of sophisticated analytical tools that analyse data to produce what has been described as insights, actionable information and knowledge.

The types of analytics include: descriptive (what happened?), diagnostics (why did it happen?), predictive (what will happen?) and prescriptive (what should I do?) (Howson 2015). To some extent, these too represent some form of knowledge.

More examples of other forms of knowledge include: group or collective knowledge (i.e. knowledge held by a group of people or an organisation - for example, organisational culture) and implicit knowledge (i.e. knowledge which can be easily expressed but for various reasons is not - for example, trade secrets).

The key take-away here is that there is a multitude of forms that knowledge can take. These forms of knowledge can be laid across a spectrum; on one end of that spectrum, there is explicit knowledge and on the other end, there is tacit knowledge. More importantly, explicit and tacit knowledge are the "two sides of the same coin" (Tsoukas 2005, p. 158).

This leads us to the third aspect of knowledge that I considered in this thesis: the progression from naught to knowledge.

### 2.1.4. Knowledge: Lineage

This aspect of knowledge has reached some degree of general consensus. Knowledge is often described as the result of a progression from data to information to knowledge or from information to knowledge (see Rowley 2007).

As early as in 1934, that progression seemed a given. For example, Eliot (1934) wrote in his essay: "Where is the wisdom we have lost in knowledge? Where is the knowledge we have lost in information?"

The semantics are important here as the definitions of information and knowledge (and other terms such as data and wisdom) remain the subject of many debates. For example, Liew (2007) points out the logical fallacy, specifically the circular definitions, in some definitions where knowledge is defined in relation to information, i.e. data in terms of information, information in terms of data and/or knowledge, and knowledge in terms of information - without clear and complete definition of each individual term.

However, as pointed out earlier, researchers go to great lengths to differentiate the knowledge and information. Data is not the same as information and information is not the same as knowledge.

It is commonly understood that data (fragments or pieces of information) becomes information when it is structured, organised, or supplemented with meaning and context. Information in turn becomes knowledge when it is supplemented further by meaning and context, and values and beliefs. Knowledge becomes the result of a deduction or an analysis of a set of information.

The depiction of the data-to-knowledge progression has also been the subject of many debates. Though its origin is unclear, according to Rowley (2007), Ackoff (1989) is a source for the hierarchy. The most popular depiction is the knowledge hierarchy, drawn in a pyramid shape, as shown in figure 2-1 below (Rowley 2007).

While the pyramid shape helps to visualise the progression from data to information to knowledge, it has also led to many unwanted confusions: both in terms of the structure of the hierarchy and the definitions of the elements in the hierarchy.

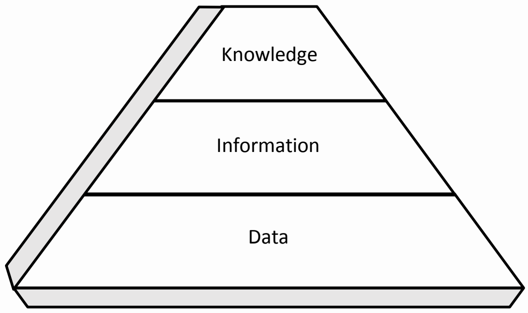



**FIGURE 2-1 KNOWLEDGE HIERARCHY.**

For example, a pyramid portrays a decreasing amount of information that can be extracted from data and likewise, a decreasing amount of knowledge that can be extracted from information. The pyramid also depicts an equal amount of effort required to move from one entity to another, which may not be necessarily accurate.

If we take a top-view of the pyramid, we can imagine knowledge being a subset of information, and information being a subset of data. The idea that knowledge is a subset of information is not new. For example, Naisbitt (1982, p. 24) suggests the same: “we are drowning in a sea of information and yet starving for knowledge.” However, this may not be accurate as it is difficult to quantify the comparative value between data, information and knowledge.

Applying the pyramid, Ackoff (1989, p. 3) went even further and estimated that “on average about forty percent of the human mind consists of data, thirty percent information, twenty percent knowledge, ten percent understanding, and virtually no wisdom.” No evidence has been put forward to substantiate these claims.

Further, the pyramid depicts a linear progression from data to knowledge. However, this linear progression is not always clear. Knowledge itself is not static (assuming a subjective view of knowledge) and can be sourced from not only information but from data as well.

For example, when sophisticated analytical tools are applied on data to produce insights, the data-to-knowledge progression rules are perhaps less strict and the point at which information becomes knowledge is less clear.

Indeed, while the pyramid portrays progression, it puts constraints on how we see the creation, development and even the containment of knowledge. It does not show the difference in properties between data, information and knowledge.

Such understanding and application of the knowledge pyramid as pointed out above, has led to many (unsuccessful) attempts to eradicate the pyramid. Alternative models exist, though there are not many.

For example, the action-knowledge-information model can be drawn as a circle to show iteration (Williams 2014). In his model, Williams (2014) depicts knowledge as “created from framed experience, values, contextual information and expert insights” and information is “created as a representation of an action, object or a cognitive concept (knowledge).”

Note that the term ‘action’ is used to represent the physical or social element or a descriptor of a physical world, and because it is a less passive term than say ‘event’. Whether or not and to what extent the KM community subscribes to this model remains to be seen.

## Summary

There is clearly much that can be discussed about knowledge; and in a lot of cases, we are effectively debating the "two sides of the same coin" (Tsoukas 2005, p. 158). There are a number of debates surrounding: the process of knowing or coming to know (i.e. the thought process that forms knowledge), how knowledge is absorbed, or the lifespan of knowledge (i.e. the ephemeral nature of knowledge, or knowledge having a half-life).

There are also debates around the metaphors used to depict knowledge. For example, knowledge is often conceived or visualised as a tree (to represent a taxonomy) (see Henriques 2003). However, a tree may not be the most accurate depiction of knowledge. An argument can be made that knowledge is depicted more accurately as a network (e.g. Swan et al. 2000).

For further discussions on knowledge, the interested reader is encouraged to see Alvesson and Kärreman (2001), Baskerville and Dulipovici (2006), Dewey and Bentley (1949), Gourlay (2006) and Lima (2015).

The above review of the literature on the concept of knowledge provided a richer understanding of what knowledge is. The above review demanded that a closer attention be paid to the definitions of knowledge used by the authors while reviewing the literature on Knowledge Management.

In the next sub-section, I explain the rationale for choosing the definition of knowledge used in this research.

### 2.1.5. Knowledge: Definition Used in This Research

I applied two criteria to reach the definition of knowledge used in this research. First, the definition had to accommodate for the purpose of this research - that is, it had to be appropriate from a Knowledge Identification perspective. As noted in chapter one, my focus was on knowledge that is relevant and needed for organisational performance - where needed knowledge is a subset of relevant knowledge.

That said, we need to keep in mind that knowledge is highly context-dependent and has a temporal and subjective value. What one person might perceive as valuable knowledge may be useless for another person. What one person might perceive as valuable knowledge at a point in time, may be useless for the same person at another point in time.

The second and related criterion was: the definition had to be broad. The aim was to discard as few definitions and interpretations of knowledge in the KM literature as possible. The definition had to be broad enough to accommodate for varying definitions and interpretations of the term 'knowledge' in the literature while keeping true to the essence of what knowledge is - in its broad sense.

Hence, I adopted a dictionary-definition of knowledge. In this thesis, knowledge is defined as: "facts, information and skills" (Oxford Dictionaries 2013).

This dictionary-definition is appropriate for the purpose of this research for a number of reasons. The key reason: it meets the two criteria above. It follows the usual and literal sense of what knowledge is. The term 'knowledge' is often used as a shorthand to knowledge and information, and codified knowledge is represented as information about the knowledge.

The definition encompasses the entire spectrum of knowledge: from tacit knowledge, in the form of skills employees possess, to explicit knowledge, in the form of facts and information (in printed or electronic form).

This definition also adheres to the view that knowledge involves a degree of both subjectivity (information and skills; to some degree context and values can also be translated into information) and objectivity (facts and information).

I summarise this review of the literature on the concept of knowledge in the next sub-section. Then, equipped with this definition of knowledge, I review the Knowledge Management (KM) literature in the next section.

### 2.1.6. Summary of Knowledge

With a view to understand the concept of Knowledge Management, I reviewed the literature surrounding knowledge itself. The purpose of section 2.1 was to develop a richer understanding of what knowledge is. Some notable definitions of knowledge were examined and a definition of knowledge was established. In this thesis, knowledge is defined as: "facts, information and skills".

In the next section, literature surrounding KM is reviewed.

## 2.2. Knowledge Management (KM) and KM Effectiveness

In the previous section, I reviewed the literature around the concept of knowledge with a view to gain a richer understanding of what knowledge is and establish a working definition of knowledge. I adopted the dictionary-definition of knowledge: "facts, information and skills" (Oxford Dictionaries 2013).

In this section, I continue the review of relevant literature - around KM. The problem of organisations struggling with leveraging the knowledge that they have effectively because they often do not know what they know, is intimately related to Knowledge Management (KM). In this section, I review the literature around KM and KM effectiveness to develop a rich understanding of what KM is about and what KM effectiveness means.

As noted in the previous chapter, the rise in the value of knowledge sparked relentless attempts by organisations worldwide to pursue knowledge for competitive advantage. Organisations worldwide recognised the wealth-generating capacity of knowledge (including knowledge-based products and services), in terms of human and intellectual capital, research and development efforts (including research into machines, advanced manufacturing and automation technology), investments in information and communication technology (ICT), in education and training, and organisational reforms (Edwards et al. 2009; Powell and Snellman 2004, p. 200).

Recognising the above, organisations also pursued effective KM for organisational performance. As Amidon (as cited in Holsapple and Joshi 2000, p. 47) put it: "knowledge resources need to be carefully managed rather than being left to serendipity."

To understand what KM is about, I examined some of the milestones in the KM history. This allowed me to obtain a general view of KM, understand how KM contributes to organisational performance, how this problem is relevant to KM, and extract some possible lessons learnt.

I also reviewed and discussed some notable definitions of KM and some KM processes and frameworks, with a view to establish and produce working definitions of both KM and KM effectiveness.

What emerged from the discussion on KM processes and KM frameworks was where exactly Knowledge Identification (KI) fits within KM. This section thus also serves as a link to the process of KI - which is examined in the next section (section 2.3).

The sub-section below goes through some of the milestones in the field of KM.

### 2.2.1. KM: Milestones

KM has roots and branches in various fields (Despres 2011). The varying amounts of KM-related literature in different fields is indicative of the extent to which Knowledge Management is a multi-faceted concept.

That said, the activity of managing knowledge has been practised for a long time. Be it by carving on stones or by story-telling, we have managed what we know for millennia. However, we do not have the same grasp of knowledge or managing knowledge as before. As the chronological review of KM below will show, we have a relatively new but refined grasp of KM.

**KM's promise – and failure**

The term 'Knowledge Management' appeared in the literature only about 50 years ago - KM is indeed a relatively new term. The term 'Knowledge Management' was coined around the time when Drucker (1967) pointed out the changes in the workforce as the industrial age receded and the knowledge era emerged.

Drucker (1967) coined the term 'knowledge worker' to reflect the different set of skills employees would need to work in a knowledge era and advised employers to recognise and capitalise on the knowledge embedded within their employees.

A number of events spurred the interest in knowledge. For example, as pointed out earlier in chapter one (Introduction), it was the rise in the value of intangible assets (i.e. knowledge-based assets) compared to tangible assets.

While machines played a significant role in driving the world economy during the 20th century, the 21st century is an era marked by knowledge as a key and sustainable source of competitive advantage and as "our most powerful engine of production" - (Marshall 1920, p. 115; Porter and Millar 1985).

Further, "the wave of attention to knowledge was partly due to computerisation, and in particular studies into artificial intelligence and technologies to manage and maintain the knowledge found in organisations." (Hedesstrom and Whitley 2000). Computerisation was seen as a driver and an enabler of KM - which in turn would driver organisational performance.

Indeed, near the end of the industrial revolution, organisations were not only and simply interested in the manufacturing power of machines, but were also interested in machines that would support and drive KM (e.g. KM systems): machines that would for all intent and purposes, create and supply knowledge. As Kimble (2013) notes:

> "Much of what was being written about KM at the time was concerned with the promise of increasing returns (Teece, 1998) from the creation of databases of expertise (Davenport et al., 1998). These, it was claimed, would make the "treasure house" of knowledge that existed inside organizations more widely available (O'Dell & Grayson, 1998)."

Not everyone shared the same optimism about machines and KM. For example, Drucker was not an advocate of the concept of KM. Instead, he stressed that knowledge cannot be managed, arguing that knowledge is what employees construct in their heads. Drucker favoured the tacit form of knowledge and was of the opinion that employees should be entrusted to do the most with their knowledge:

> "You can't manage knowledge. Knowledge is between two ears, and only between two ears. When employees leave a company, their

> knowledge goes with them, no matter how much they've shared." (Drucker, as cited in Kontzer 2001).

That did not stop organisations from pursuing KM. For example, some saw opportunity in the idea or the promise that machines could emulate human thinking or be capable of human intellect. An example of such a KM machine or system is the expert system.

Expert systems are rule-based systems designed to emulate the decision-making ability of humans. They consist of inference engines which compute rules (or logic) and knowledge bases which store the rules and the relevant knowledge.

Those rules that are written and added to the expert systems to teach these systems how to 'think', represent the real value of those systems. Such a system could be used for example to guide medical practitioners in diagnosing a patient, having provided the system with all the symptoms felt by that patient.

However, there were problems with these systems - and KM - at the time. The problem was not that knowledge cannot be codified, but how the knowledge is codified (which is a subjective process).

Knowledge and the codification of knowledge were seen as fairly static and the process of knowledge creation was thought as process akin to mathematical addition and subtraction, rather than the outcome of deep and thorough analysis and deduction. The statement below epitomises the attitude toward knowledge at the time:

> "There is only one language suitable for representing information - whether declarative or procedural - and that is first order predicate logic. There is only one intelligent way to process information and that is by applying deductive inference methods." (Kowalski 1980).

This rigid view toward knowledge was unsurprisingly problematic. As discussed in the earlier section on knowledge, knowledge is not static but quite the opposite. The ramifications of adopting this were expectedly negative:

> The "failures are legion, as are the often exaggerated claims made by proponents of these systems (see Dreyfus and Dreyfus, 1986, pp. 106-117). It has also been demonstrated that writing an expert system always involves changes in the content of the expert knowledge (Hatchuel and Weil, 1995)." (Johnson, Lorenz, and Lundvall 2002, p. 252).

Indeed, it was difficult to capture the tacit knowledge of experts in the form of rules. It was also expensive and difficult to build and maintain large expert systems.

That said, it was a case of a good idea with a poorly implemented solution. The case for expert systems was (and still is) sound. Some expert systems did make a significant and positive impact on the manufacturing industry - especially in areas where the rules (the knowledge bases) were static or less prone to changes (e.g. see the XCON/R1 expert system (Barker and O'Connor 1989)).

In other words, the problem at the time was that we thought that somehow, machines could think or demonstrate thinking (c.f. Turing 1950). As an analogy, we thought that we could program a kitchen appliance once and expect the appliance to perform any task we want it to. However, kitchen appliances work fine for what they are programmed to do, but they need to be re-programmed to perform additional tasks.

It took some time for organisations and the KM community at large to recognise the dynamic, malleable and subjective nature of knowledge. During that time, huge sums of money had been wasted and confidence in KM suffered a heavy blow.

Some researchers and practitioners have even claimed that KM had become nothing more than a management fad, or dead (see Milton 2012; Ponzi and Koenig 2002; Serenko et al. 2010; Wilson 2002, 2005).

A few decades later, in the 1990s, the interest in KM grew again. Indeed, the number of publications having the term “Knowledge Management” in their titles was low during the 1970s and 1980s (during the industrial era).

Fewer than 100 papers were written on the topic of KM until 1995. Between 1995 and 2002, around 5,000 papers were published on Knowledge Management and intellectual capital (Serenko and Bontis 2004).

Reasons for the renewed interest in Knowledge Management in the 1990s abound. For one, there was the economic need for more effective KM. This need was driven by the opportunities and the challenges brought about by the knowledge-based economy and newer, more advanced and more powerful technologies (including the widespread use of the Internet and professional and social networking, and the proliferation of Personal Computers, smart phones).

A glance at the 2015 list of the “100 companies that matter in Knowledge Management” by KMWorld or the 2014 list of “Global Most Admired Knowledge Enterprises (MAKE)” by The KNOW Network (2014) illustrates how organisations, irrespective of industry and location have embraced the concept of KM.

Another reason for the renewed interest in KM involves the new approaches to KM. It became increasingly clear that the technology at the time were limiting and that there were other parts of the puzzle (which were until then largely overlooked) that should have been considered and leveraged: including, the employees (the knowledge providers and users) and the organisation culture. Kluge, Stein and Licht (2001, p. 25) reflect on their experiences:

> “despite management commitment and healthy budgets, these [KM] programs often floundered or failed. In each case something was missing. A vital ingredient of the knowledge management recipe had not just been left in the cupboard; it was not even on the shopping list. All these companies lacked the right cultural context that would create and nurture reciprocal trust, openness and cooperation.”

The KM community in response, expanded their locus of attention; there was less focus on technology and more focus on people and business processes. Organisations sought to find more effective ways to tap into the knowledge employees have and ways to create an environment conducive to knowledge sharing.

I next review the development of the people-centric approach to KM.

## A people-centric approach to KM

The limitations of earlier KM technology made way to a more HR (Human Resources) or people-centric view of KM. The old motto "More IT [i.e. more Information Technology, machines, software engineering, and artificial intelligence], less people!" often referred to during the early generation of KM systems was revised (Borghoff and Pareschi 1997, p. 838).

The people-centric approach - at the heart of which was the notion that people have knowledge - became *de rigueur* (Davenport, DeLong, and Beers 1998; Desouza 2003; Gourlay 2001; McDermott 1999; Spender and Grant 1996).

As Lank (1997, p. 406) reinforced: "'people are our greatest asset' is perhaps too simplistic: it is the knowledge and expertise within them that is truly the asset." This resonates with Drucker's focus on people and his argument that that knowledge is what people construct in their heads.

There was a renewed appreciation that knowledge flows within groups of employees (Sharratt and Usoro, 2003). These "groups of people informally bound together by shared expertise and passion for a joint enterprise" are called "communities of practice" (Wenger and Snyder 2000, p. 139).

Organisations sought to capture and leverage that knowledge and thus focused on KM processes such as Knowledge Sharing and Knowledge Acquisition. Some of the major events and actions taken that shaped the people-centric approach include:

- the popularity of knowledge sharing programmes (processes, frameworks, as such),
- the focus on transforming or converting tacit to explicit knowledge, and

- the SECI (Socialisation, Externalisation, Combination, Internalisation) process and the *Ba* (roughly translated as 'place' or a context) proposed by Nonaka and Konno (1998; Nonaka, Toyama, and Konno 2000).

IT remained intertwined with KM. Although IT could not substitute for "the rich interactivity, communication, and learning that are inherent in personal [human] dialogue", IT played a different, but still important, role in KM (Fahey and Prusak 1998).

Rather than focusing on the Technology in IT, the KM community focused on the Information in IT. That is, finding out ways to use technology to support and enable the knowledge-holders (employees). As Prusak (1998, as cited in Schütt 2003) explains: "You cannot manage knowledge like you cannot manage love, patriotism or your children. But you can set up an environment where knowledge evolves."

Indeed, organisations used IT to set up this 'environment'. This is evidenced by organisations taking advantage of the then-new communications technologies and choosing to invest in developing the technical infrastructure required to facilitate knowledge sharing (Rumizen 1998). Examples of such technology include user-driven Knowledge Sharing systems such as wikis and intranets.

IT was thus seen no longer as a driver of KM, but as an enabler of KM (Fahey and Prusak 1998; Martiny 1998, p. 76). A socio-technological view of KM which mediates both people and technology was adopted, and newer KM systems which were aligned to this revised view on KM were developed.

### 2.2.2. KM: Next steps

Where exactly the field of KM is going next and what the next areas of focus will be, are yet to be seen - both in theory and practice. Even at a global level, organisations in different countries put KM into practice differently. For example, for an account of differences in managing knowledge in China, Japan and the United States, see Burrows, Drummond and Martinsons (2005).

In contrast to the previously cited allegations that KM was merely a management fad or dead (p. 53), KM is certainly not dead. With an expanding knowledge economy, there is no doubt that KM will have an important role to play in the future.

KM also remains a big business. Organisations are buying in into KM to leverage and capitalise on knowledge that they have, which in turn contributes to organisational performance and competitive advantage. Their return on investment (ROI) on KM is both maximised and sustained by continuously leveraging the knowledge that they have.

Globally, market revenues stood at US$34.17 billion in 2007. Approximately 67.6% of those revenues came from KM services. These revenues were projected to exceed US$157 billion in 2012 (PRWeb 2008, para. 2). For more dollar values, see Stewart 2002, Murphy and Hackbush 2007).

Interestingly, with more technological advances in artificial intelligence, machine learning, data mining and data analytics, we can see and expect a shift back to an IT-focused KM - with a view to deliver on the early KM promise of machine intellect. According to Ihrig and MacMillan (2015, p. 82), KM is already playing a role in big data and analytics:

> "When executives talk about "knowledge management" today, the conversation usually turns very quickly to the challenge of big data and analytics. That's hardly surprising: Extraordinary amounts of rich, complicated data about customers, operations, and employees are now available to most managers, but that data is proving difficult to translate into useful knowledge."

This raises the question: are KM and big data and analytics the same? They certainly do share certain activities including identifying the relevant sources of data, cleansing the data, analysing the data and producing actionable information, sharing and retaining that information. These activities form part of what is referred as KM processes. In this sense, big data and analytics are the same, but the focus or the intent of big data and analytics and KM are potentially not the same.

Herschel and Jones (2005) drew a comparison between Knowledge Management and Business Intelligence and argue that Business Intelligence should be viewed as a subset of KM where Business Intelligence focuses on explicit knowledge, and KM encompasses both tacit and explicit knowledge. Both concepts promote learning, decision-making, and understanding.

It is of course not all about technology or organisational performance; and there are a number of things that work hand-in-hand with KM. For example, it has been shown that KM is also linked to Organisation Memory (OM) and Organisational Learning (OL). The figure below depict this relationship.

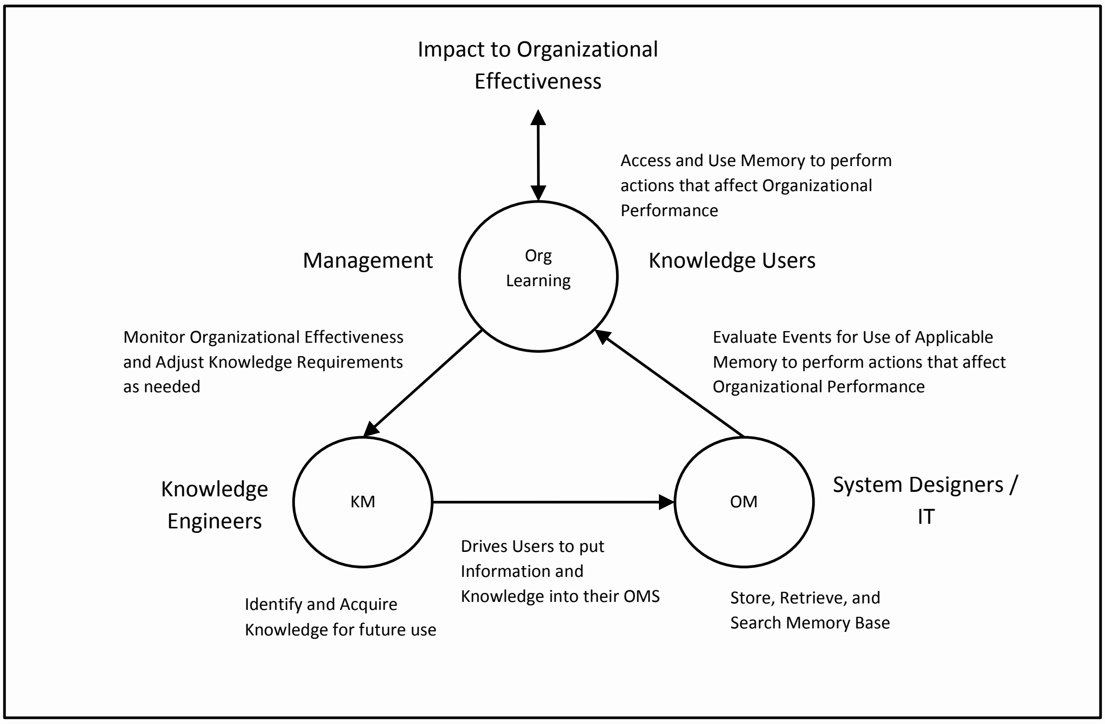



**FIGURE 2-2 RELATIONSHIP BETWEEN KM, OM AND OL (ADAPTED FROM JENNEX 2007).**

While a universally accepted definition of either OM or OL is yet to be established, according to Jennex and Olfman (2002, p. 2), “OM has two principle goals: to integrate information across organizational boundaries and to control current activities and thus avoid past mistakes. Basic functions of OM are perception, acquisition, abstraction, recording, storage, retrieval, interpretation, and transmission of organizational knowledge."

OL on the other hand is "understood as a change in the organization's knowledge base and in the rage of potential organizational behaviors (deHolan and Phillips 2004; Huber 1991)" (as cited in Fortis et al. 2016, p. 2).

**Summary**

I have so far taken a chronological view of KM, discussed some of the key milestones, and some lessons learnt.

What Knowledge Management is about and what makes up KM have evolved substantially since its inception. KM is not just one single process, KM is not just about machines, or about curating and sharing documents, it is also about improving collaboration among employees, fostering a culture of knowledge creation, as such.

To deeply and fully understand KM and its relationship with organisational performance, a chronological view of KM does not suffice; we need to understand the various processes within KM. It is that synergy of KM processes working effectively that speak to what KM is about.

Thus, to understand KM further, I examine the KM processes more closely. I review the literature around KM processes in the following sub-section.

### 2.2.3. KM: Processes and Frameworks

What emerged from the discussion of the various milestones in KM literature in the previous sub-section was that KM is a complex concept involving more than just one process. This sub-section examines the various KM processes.

Examining KM definitions to uncover the different underlying processes of KM and understand how they work together is not the most effective approach to explore KM processes and understand how they work together. As I will show in the next sub-section, KM definitions generally (and sensibly so) do not list all KM processes individually.

Instead, to complete this exercise, I examined a number of KM frameworks. KM frameworks often accompany KM definitions to illustrate the various processes, design aspects or technical architectures that are involved in practising KM and are often the result of the lessons learnt from KM projects (Pawlowski and Bick 2012).

KM frameworks also offer insights into what KM is about, and where necessary consolidate and harmonise views, to ultimately create a common understanding of KM (Heisig 2009). Although KM definitions and KM frameworks are generally aligned, they too differ in terms of interpretations around what KM is about.

Some examples of KM frameworks and KM processes are shown on the following pages. These KM frameworks are by no means exhaustive. For example, Heisig (2009) compared 160 KM frameworks around the globe published between 1995 and 2003. The KM frameworks shown depict the three types of frameworks: prescriptive, descriptive and hybrid (Rubenstein-Montano et al. 2001).

The following discussion on KM frameworks will overlap KM and KM processes, KM *vis-à-vis* organisation performance, and Knowledge Identification (KI) as a KM process.

**KM processes**

The KM frameworks depicted below show an array of KM processes. Most KM processes depicted are named after the activities that they represent. For example, the KM process Knowledge Creation involves the creation of (new) knowledge.

According to Heisig (2009, p. 10), there is consensus among researchers about the core KM processes, which include “sharing, creating, using, storing and identifying”. Heisig (2009) further points out that the two most commonly KM processes covered in KM frameworks are: Knowledge Sharing and Knowledge Creation.

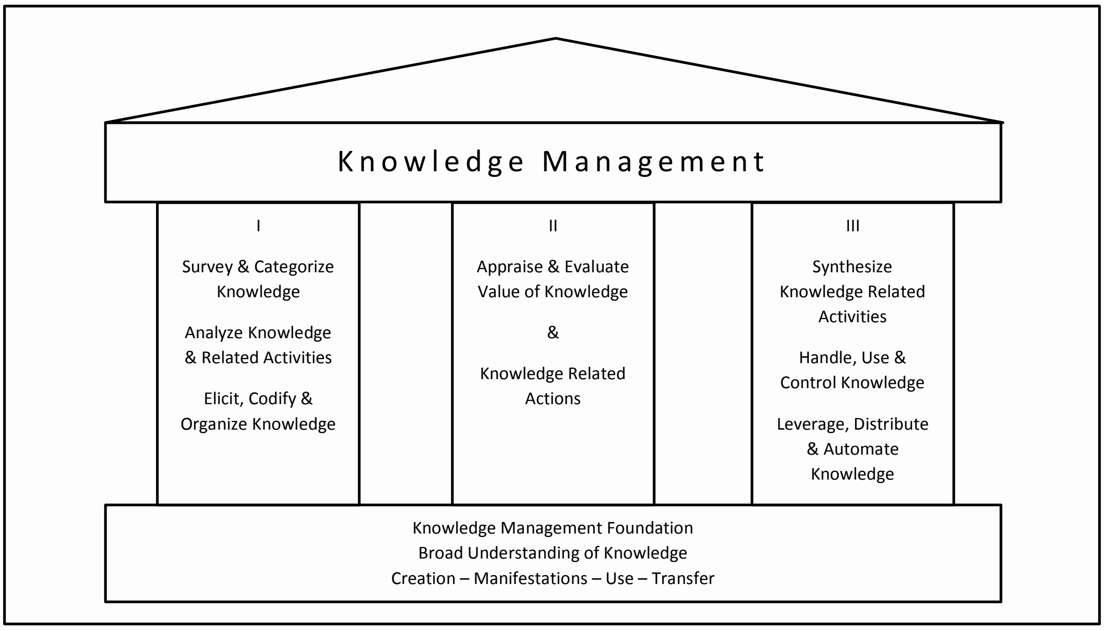



**FIGURE 2-3 KM PROCESSES (ADAPTED FROM WIIG 1993).**

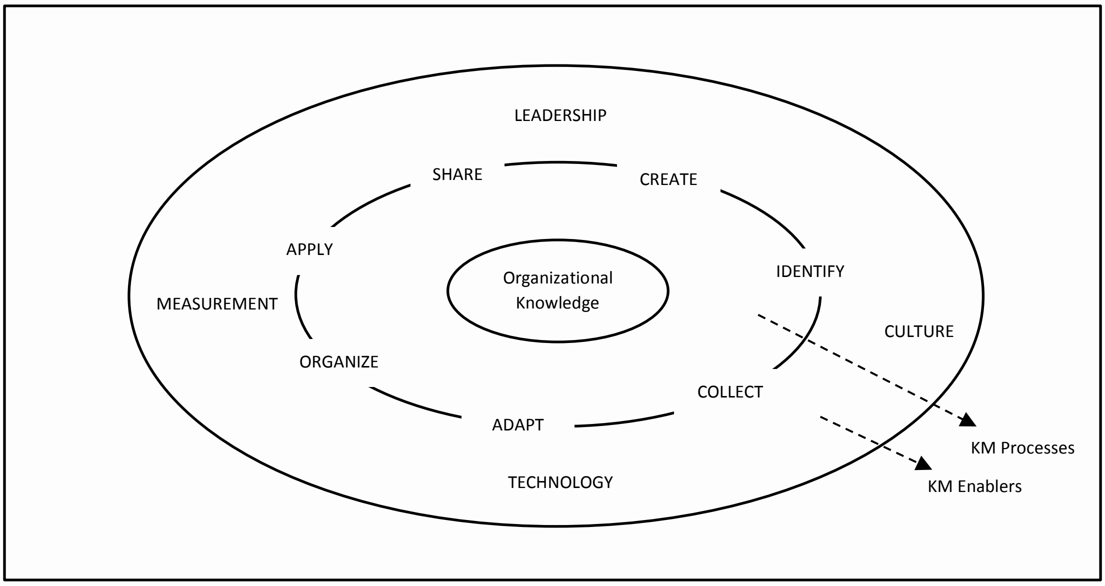



**FIGURE 2-4 KM PROCESSES (ADAPTED FROM ANDERSEN 1996).**

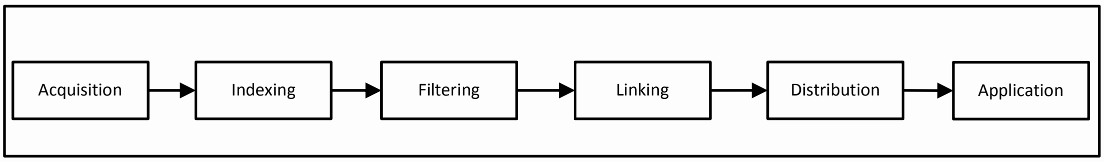



**FIGURE 2-5 KNOWLEDGE MANAGEMENT PROCESSES (ADAPTED FROM ALAVI 1997).**

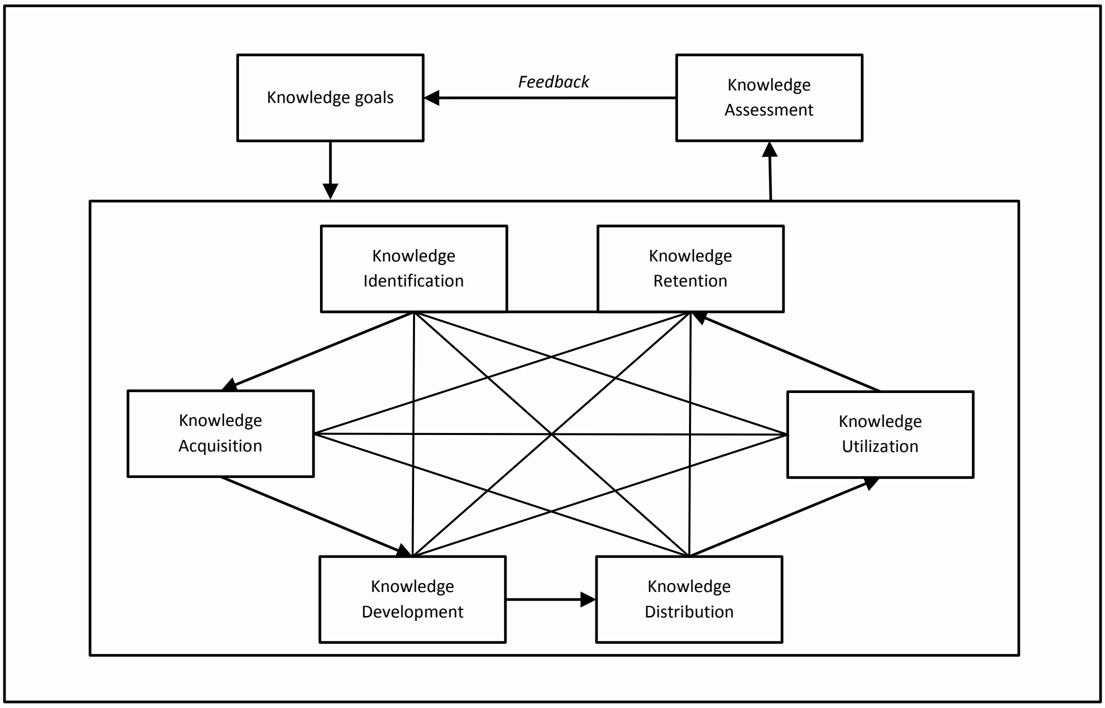



**FIGURE 2-6 KM PROCESSES (ADAPTED FROM PROBST ET AL. 2000, P. 30).**

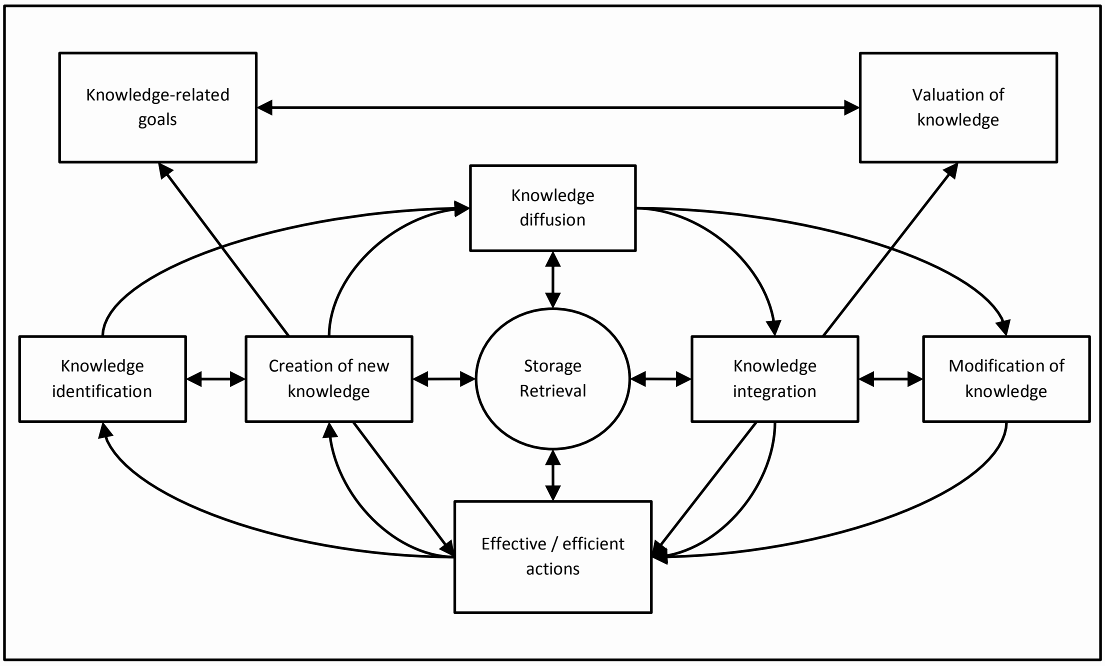



**FIGURE 2-7 KM PROCESSES (ADAPTED FROM REINHARDT 2001, P. 193).**

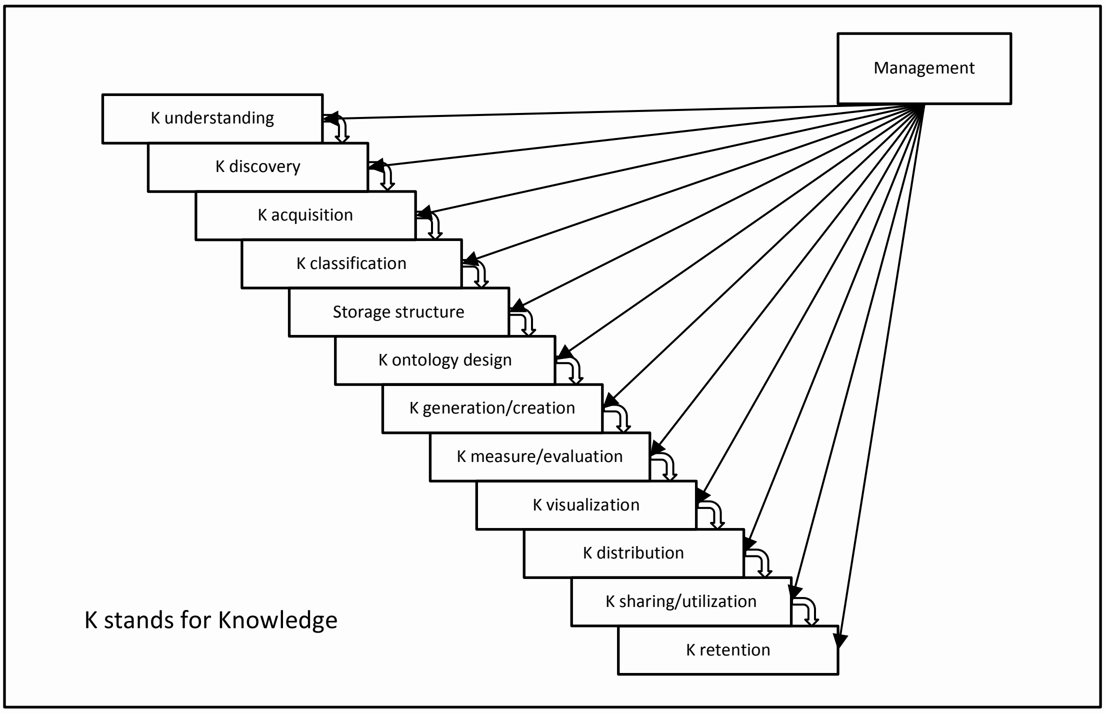



**FIGURE 2-8 KM PROCESSES (ADAPTED FROM SUN 2004).**

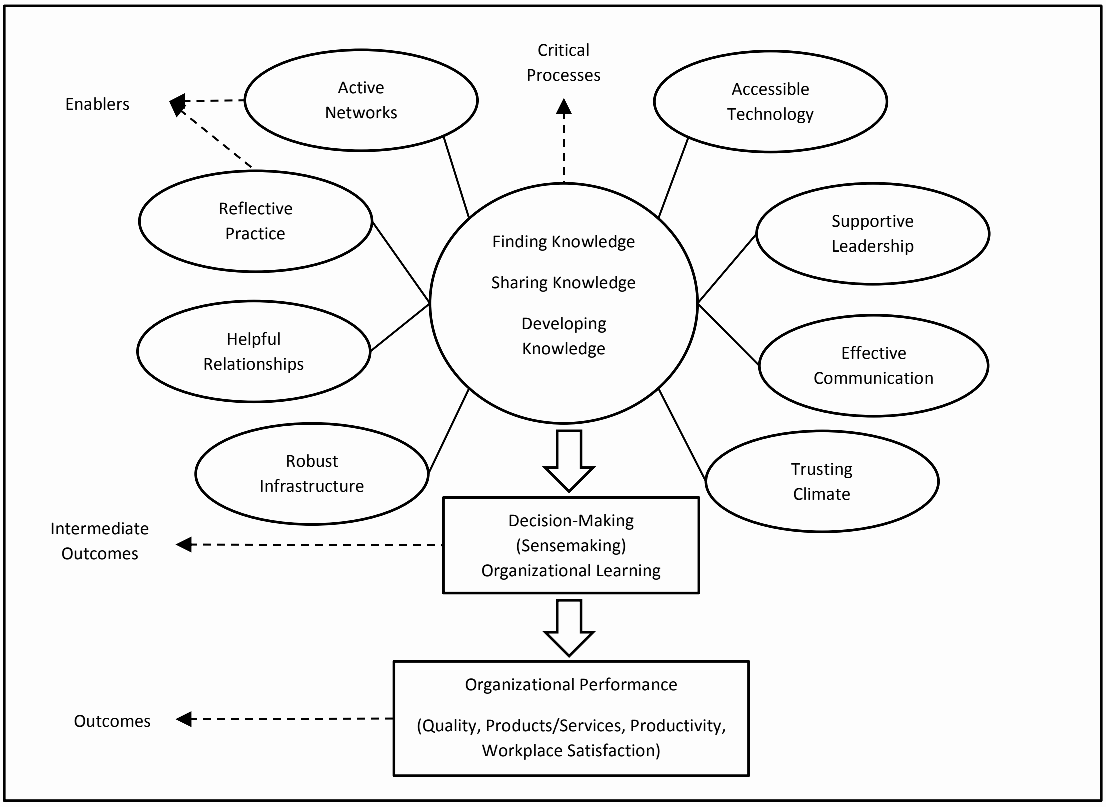



**FIGURE 2-9 KM PROCESSES (ADAPTED FROM ORZANO ET AL. 2008).**

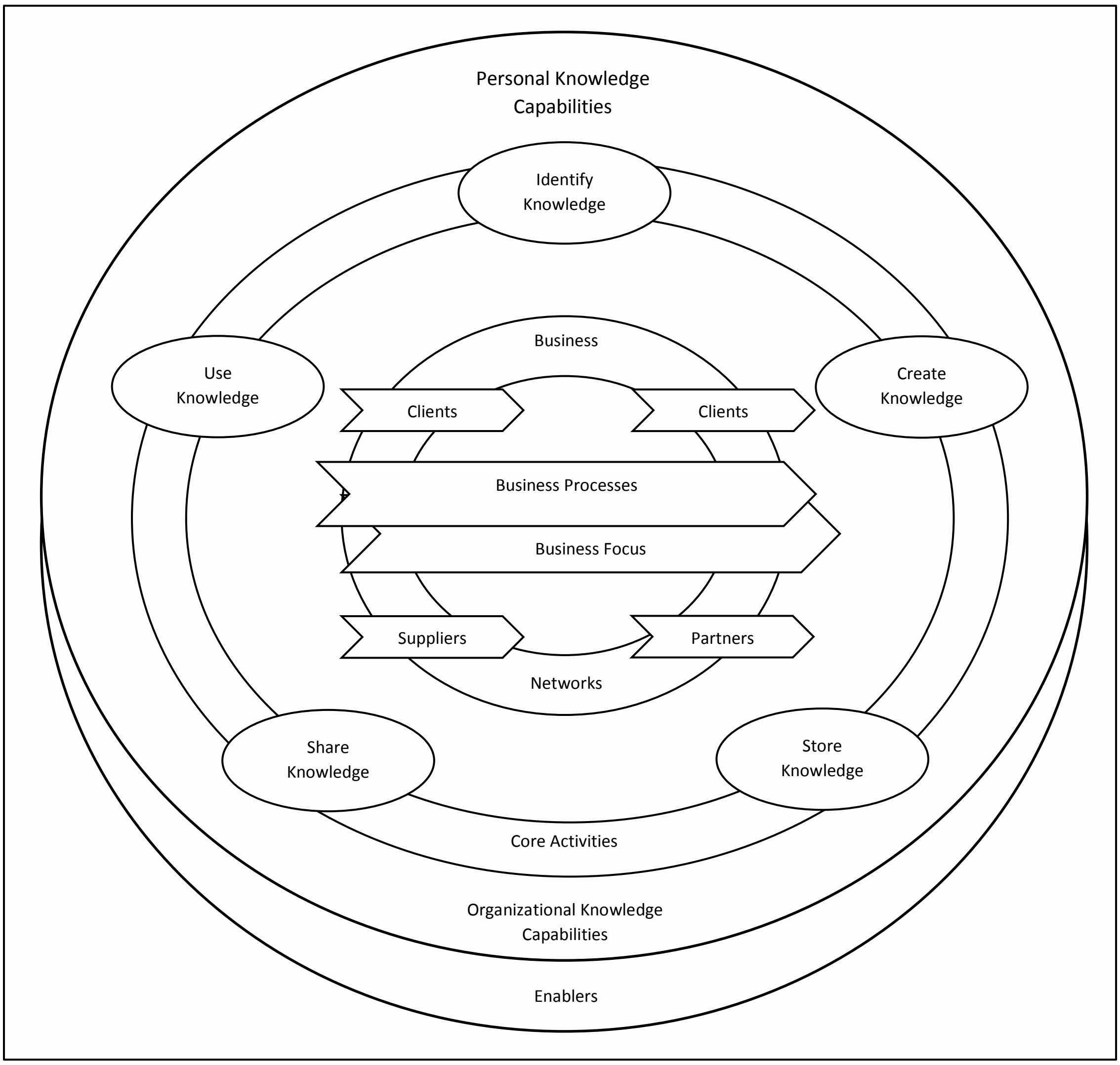



**Figure 2-10 KM processes (adapted from CEN 2004).**

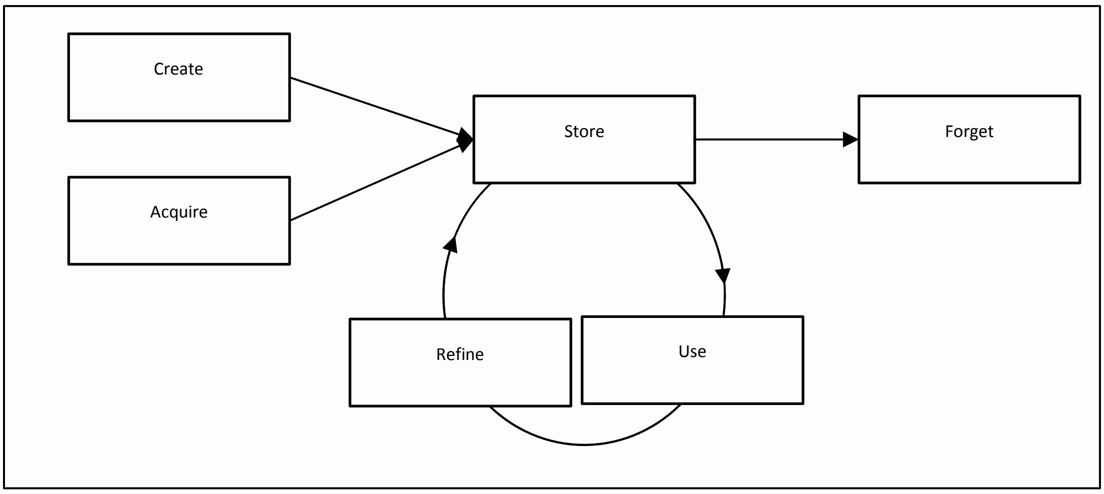



**Figure 2-11 KM processes (adapted from Edwards 2015).**

Note that even though some KM frameworks may share similar naming conventions for the KM processes, the authors of these frameworks do not necessarily share the same interpretation of what the KM processes mean or should mean. For example, not all 'Knowledge Identification' in the KM frameworks mean exactly the same thing.

Most frameworks, and intentionally so, depict KM at a high level, providing a holistic view of what KM is about. Note that the size of the shapes on the frameworks is not proportional to the amount of work involved.

The content of those frameworks support the argument that KM has evolved over time, that KM involves more than just technology, and that certain KM processes may have been perceived as more significant and hence depicted on the frameworks.

This may explain why depending on which KM process (or processes) an organisation focuses on, what KM means for that organisation may differ from other organisations. For example, some organisations which focus on Knowledge Sharing may refer to KM as Knowledge Exchange while others which focus Knowledge Use may refer to KM as Intelligence Management.

This applies for researchers as well. For example, in his KM framework (see figure 2-11), Edwards (2015, p. 32) specifically omits the KM process of Knowledge Sharing and focuses on other KM processes. As he explains: "We believe this difference in focus is important, since we do not regard knowledge sharing, at least in an organizational context, as an end in itself, but as a means to some wider purpose."

Deciding on which KM framework to adopt depends on a number of criteria including the needs and KM maturity of the organisation. An organisation may decide to follow one KM framework from another based on its needs and its KM maturity - both of which change and evolve over time. For examples of different KM maturity levels, the reader is encouraged to see APQC (2015a), Edwards et al. (2005), Ehms and Langen (2002), Mehta et al. (2007), and Paulk et al. (1993).

Furthermore, while some frameworks take into account the outcomes of KM (e.g. the application of knowledge, decision-making, achieving organisational performance or knowledge goals), others focus on the KM processes and the relationships among the KM processes.

There is indeed a flow among the KM processes. While some of the frameworks depict KM as a linear and sequential process with a start and an end, others depict KM as an iterative process, in a mesh format where KM processes are all linked to each other.

We can easily visualise the relationships among KM processes by considering how employees use knowledge in their day-to-day work. For simplicity of the example, let us put the organisation culture and the technology aside, and assume that the employees know what knowledge they need to do their job, where to find it or who has the knowledge needed:

Employees acquire knowledge that they need (Knowledge Acquisition). They apply or develop the knowledge acquired (Knowledge Use) and in doing so, create new knowledge (Knowledge Creation). Employees then share the knowledge developed or created with their colleagues (Knowledge Sharing) and store the knowledge for later consumption (Knowledge Storage or Knowledge Retention).

While there is clearly a flow among the knowledge processes in the example above, the key take away here is that the flow among the KM processes is not necessarily linear and sequential.

That said, this flow is important because it implies that the deliverables or outcomes of one (upstream) KM process have the potential to enable or improve subsequent (or downstream) KM processes.

For example, employees can only use the knowledge that they need once they have acquired the knowledge needed - assuming of course that the employees do not already have that knowledge. Likewise, at an organisational level, organisations cannot use, store or even retain knowledge if they have not acquired that knowledge yet.

**Organisation Performance**

This is where we can also have a better understanding of how KM can have a positive impact on organisation performance. These different KM processes (individually or collectively) are manifested in the day-to-day activities of an organisation, including making decisions, solving problems, learning, and strategic planning. These activities in turn support the various business processes of the organisation (Amir and Parvar 2014; Nicolas 2004; Tubigi, Alshawi and Alalwany 2013).

Numerous studies suggest that KM affects organisational performance directly or indirectly in a positive manner. For example, DeFond et al. (2013, p. 359) examined the stock market reaction to, and future performance of, organisations receiving the "Most Admired Knowledge Enterprise" (MAKE) award and were able to demonstrate that "excellence in KM leads to higher stock prices".

However, evidence to prove empirically that effective KM leads to organisation performance is still lacking. This relationship is very difficult to prove empirically (i.e. without using case studies or qualitative data). According to Choi, Poon and Davis (2008, p. 236): "Previous research has contributed to our understanding of whether and how KM strategies help or hinder organizational performance. However, little consideration has been given to the underlying factors that can explain such results."

Researchers often imply this positive effect; but the researchers who prove this relationship with empirical evidence are very rare (Choi, Poon and Davis 2008; Rašula, Vukšić and Stemberger 2012; Zack McKeen and Singh 2009).

One reason for this is that while there are many established metrics to measure organisation performance, those to measure effective KM are limited and contentious. Organisational performance itself can be understood from various angles and can be gauged using various financial or non-financial indicators (e.g. profit maximization, market penetration, cost minimization, among others).

The measures for KM Effectiveness are less refined. I discuss the difficulties in establishing measures of KM Effectiveness, who is accountable for defining KM Effectiveness and list the measures used in this research in section 2.2.4 below.

**Knowledge Identification**

Using to the same example above of employees using knowledge that they first have acquired, the KM process of Knowledge Acquisition is the enabler of subsequent KM processes and is in this sense a significant KM process. The Knowledge Acquisition process enables subsequent KM processes such as Knowledge Use, Knowledge Storage and Knowledge Retention.

KM frameworks can also be used to establish which KM processes enable subsequent processes. These processes are likely to be depicted as the first processes on the frameworks - and there are quite a few. The KM processes: Knowledge Acquisition, Knowledge Understanding, Knowledge Identification and Knowledge-related Goals have all been suggested.

This is where we can observe and trace Knowledge Identification in the KM literature - as a KM process. For example the authors KM framework in figure 2-10 (CEN 2004, p. 10) explain:

> "Identify knowledge: This is a crucial and strategic step. People and organizations are encouraged to think about what they want to achieve and the knowledge that is required to make it happen. It should include an analysis of what existing knowledge is already available and what knowledge is lacking (so-called "gap analysis"). This applies on the organizational level for strategic knowledge needs and on the personal level for the daily search for required knowledge and information."

KI is discussed in more detail in section 2.3 below, but it is worth point out a few things here: First, while not applicable to all KM frameworks, on few frameworks, KI is depicted as a distinct KM process. KI is either critical or of lesser importance to KM compared to other processes. KI is either represented as (or among) the first KM process (or processes) or missing entirely from the KM definitions and frameworks.

That said, as mentioned earlier, according to Heisig (2009), there is consensus among researchers about the core KM processes, which include "sharing, creating, using, storing and identifying". This suggests that KI is perhaps implied within those KM frameworks where KI is not explicitly mentioned.

Second, and in the same vein, being depicted as one of the KM processes to be (or that should be) executed first suggests that KI potentially enables or improves subsequent KM processes. However, as we observed, there is more than one KM process that is drawn as the first KM process to be executed.

This is of course a simplistic view. The position of KI on KM frameworks is only an indication of its significance; it does not necessarily dilute the importance of other KM processes. That is, identifying knowledge that exists within the boundaries of the organisation is not an end in itself.

The discussion above provided a much richer understanding of what KM is about and what role KM plays within an organisation. Next, I summarise the content covered so far before reviewing some KM definitions and establishing the definition of KM used in this research.

**Summary**

The discussion above provided us with further insights into KM. The KM frameworks reinforced our observation that KM is about leveraging knowledge through various KM processes, and drew our attention to those specific and key processes involved.

The KM processes in a way describe what leveraging knowledge means. KM is about Knowledge Sharing, Knowledge Use or Knowledge Retention. However, KM is clearly not about one particular KM process; KM is not merely about managing, curating or sharing what we know or what we have. KM represents a strong and positive synergy of processes, technology, employees, and organisational culture.

More importantly, the discussion on KM frameworks highlighted the process which this research focused on: Knowledge Identification. Before proceeding further to reviewing the literature on KI, working definitions of both KM and KM effectiveness were established.

### 2.2.4. KM: Definitions

Having acquired a richer understanding of what Knowledge Management is about, this sub-section reviews existing definitions of KM with a view to contribute to the choice of the definition used in this research.

Like knowledge, defining KM has been the subject of numerous debates; there is no agreed-upon academic definition of KM (DeFond et al. 2013), but there are many existing KM definitions. However, the lack of consensus surrounding the definition of KM is being addressed. Efforts are being made to address this definitional issue among researchers (Jennex, Smolnik, and Croasdell 2007, 2009).

Despite the persisting debate around what exactly KM is about, there is general consensus that the overarching purpose of KM is to leverage knowledge for goals such as organisational performance. Numerous studies have demonstrated that leveraging knowledge effectively has a positive impact on organisational performance (e.g. see O'Dell and Hubert 2011; Quast 2012; Wu and Holsapple 2013).

Some of notable definitions of KM taken from the literature and practice and sorted by publication date are listed in table 2-2 below.

**TABLE 2-2 KNOWLEDGE MANAGEMENT DEFINITIONS.**

| **Knowledge Management:** |
|---|
| • "is understanding the organization's information flows and implementing organizational learning practices which make explicit key aspects of its knowledge base. … It is about enhancing the use of organizational knowledge through sound practices of information management and organizational learning." (Broadbent 1997, pp. 8-9).<br>• is "the process of capturing, distributing, and effectively using knowledge." (Davenport and Prusak 1998, p. 107).<br>• is "a discipline that promotes an integrated approach to identifying, capturing, evaluating, retrieving, and sharing all of an enterprise's information assets." (Duhon 1998).<br>• is "an amalgamation of concepts borrowed from the artificial intelligence/knowledge-based systems, software engineering, BPR |

| **Knowledge Management:** |
|---|
| [Business process reengineering], human resource management, and organizational behavior fields." (Liebowitz 1999, p. iii).<br>• "is nothing more than managing information flow, getting the right information to the people who need it so that they can act on it quickly." (Gates and Hemingway 1999, p. 238).<br>• "involves efficiently connecting those who know with those who need to know, and converting personal knowledge into organisational knowledge." (Yankee Group, as cited in The Economist 2000).<br>• "predominantly seen as information management by another name (semantic drift)." (Davenport and Cronin 2000, p. 1).<br>• is "an effort to increase useful knowledge in the organization" (McInerney 2002, p.1014).<br>• is a "trans-disciplinary approach to improving organisational outcomes and learning, through maximising the use of knowledge. It involves the design, implementation and review of social and technological activities and processes to improve the creating, sharing, and applying or using of knowledge." (Standards Australia 2005, p. 2).<br>• "is the practice of selectively applying knowledge from previous experiences of decision making to current and future decision making activities with the express purpose of improving the organization's effectiveness." (Jennex 2005).<br>• is a "disciplined, holistic approach to using expertise effectively for competitive advantage." (Arkell 2007, p. 14).<br>• is about "supporting and achieving the creation, sharing, retention, refinement and use of knowledge (generally in an organizational context)" (Edwards et al. 2009, p. 114).<br>• "ensures that the right person has the right knowledge, at the right time, to deliver and support the services required by the business." (ITIL Service Management framework 2009, p. 106).<br>• is the "effective knowledge processes associated with exploration, exploitation and sharing of human knowledge (tacit and explicit) that use appropriate technology and cultural environments to enhance an |

| **Knowledge Management:** |
|---|
| organization's intellectual capital and performance." (Jashapara 2011, p. 14). |

To some extent, the definitions themselves also show the evolution of the concept of KM. The definitions in the 2000s and 2010s are progressively more refined than those of the 1990s. These refinements have transformed KM into a clearer and more easily understood concept.

Note the definition developed by Standards Australia. Bodies like Standards Australia (see AS5037 - 2005), the British Standards Institution, or the Standards Institution of Israel (see Israeli Standard SI 25006 for Knowledge Management) have gone so far as to prescribe KM definitions along with KM standards.

These standards are evidence of the value of and need for KM at a national level and that KM is a recognised practice around the world. In fact, discussions at a global level around the creation of KM standards or addition of KM-related items by global bodies like the International Organization for Standardization (ISO) (see ANSI/ISO 9001 - 2015) and the Institute for Information Management (IIM) have also been renewed.

That said, there are a number of differences and similarities among the definitions - there are more similarities than differences. One example of the differences is that while a few definitions make it clear that KM involves both the explicit and the tacit forms of knowledge. Most simply refer to knowledge in its general interpretation – as facts, information and skills.

While some definitions are more conceptual and abstract, focusing on the various processes that make KM, others are more outcome-focused and tangible, offering more precision in terms of what exactly KM means when put in practice (e.g. "getting the right information to the people who need it" (Gates and Hemingway 1999, p. 238)).

Finally, while some definitions draw parallels between knowledge and information (see Davenport and Cronin 2000, p. 1), others do make a distinction between the two (see Broadbent 1997, pp. 8-9).

Some of the similarities among the KM definitions include: they use the terms 'information' and 'knowledge' interchangeably to mean the same thing, they portray KM broadly about managing organisational knowledge (knowledge within the boundaries of organisations) and about leveraging organisational knowledge through a number of different means and ways (i.e. getting the right knowledge to the right people).

Further, most definitions share an organisational view of KM, depicting KM as an organisational endeavour. Most definitions also describe KM as a concept, an activity or a process - compared to a technology - which encompasses a number of processes (including Knowledge Creation, Knowledge Exploration and Knowledge Sharing).

Finally, some KM definitions encapsulate a number of KM processes. I covered those KM processes in the earlier sub-section. In fact, listing too many KM processes in a KM definition makes the definition itself become quite convoluted and dilutes the purpose of KM at its core. Hence, we need to be careful about which processes we do include in a KM definition.

I discuss the definition used in this research next.

### 2.2.5. KM: Definition Used in This Research

Judging by the KM definitions listed in table 2-2 above, there are sufficient good and rich KM definitions that exist in the literature. Some are less clear than others; but the general sense of what KM is, is covered. More importantly, a number of those existing KM definitions are appropriate and can be used for the purpose of this research. I do not need to create a new KM definition.

To arrive at the choice of KM definition that I used for this research, I used the contents in sections 2.2.1 (KM: Processes and Frameworks) and 2.2.2 (KM: Definitions) collectively. I reviewed the KM definitions listed in table 2-2 and the KM frameworks depicted. The following items were also taken into consideration:

- What the overarching purpose of KM is (i.e. differentiating between the purpose of KM and the things that enable, support or improve KM),
- KM is a process. A process can be defined as "a series of actions, changes, or functions bringing about a result" (Farlex 2015).
- What can be specifically measured in KM (i.e. what are tangible, actionable and concrete outcomes of KM),
- The practice of KM across the for-profit and not-for-profit sectors (i.e. KM is not practised merely by the for-profit organisations), and
- The clarity and succinctness of the definition (i.e. the definition should convey what it is meant to and leave out the rest).

Hence, in this thesis, Knowledge Management (KM) is defined as: "the process whereby organisations identify and leverage knowledge assets to drive and support overall organisational performance" (Jennex, Smolnik, and Croasdell 2016; O'Dell and Grayson 1998).

Note that the definition speaks to the what and the why, rather that the when or the how of KM. This definition also speaks directly to the KM problem at hand.

This definition views KM as an ongoing and iterative process. KM can be viewed virtually as a verb, rather than a noun. The definition posits a key role that KI plays in KM. The verb to identify is used to stress this role.

The verb to leverage is used because it encompasses a number of KM processes. For example, leveraging knowledge involves creating, sharing, developing, applying, or using knowledge.

By using the term 'knowledge assets', this definition takes the view that knowledge is a valuable resource. Knowledge assets can take various forms including documents (in printed or electronic form), databases or employees, and come from sources both internal (e.g. employees, local database) and external (e.g. public-domain information) to the organisation.

Finally, this definition perceives KM as ultimately about not only supporting but driving organisational performance. Organisational performance connotes: successful projects completions, higher returns on investments, as such.

In terms of KM frameworks, among those depicted earlier, the framework most aligned to this definition and to which I subscribed, is that of Probst et al. (2000, p. 30) as depicted in figure 2-6 above.

Having obtained an understanding of what KM is about and having established a working definition of KM, the next step is to understand what effective KM means. As noted earlier in chapter one of this thesis, there is no empirical evidence that demonstrates the strength of the relationship between effective KI and effective KM - but what does effective KM looks like? The next sub-section develops the definition and measures of KM effectiveness used in this research.

### 2.2.6. KM Effectiveness: Definition Used in This Research

Having just a working definition of KM was not enough to undertake this research. I also needed a definition and measures of KM effectiveness. In this sub-section, I establish and justify the definition and measures of KM effectiveness used in this research.

I begin by examining who owns KM and who takes responsibility for KM initiatives. If KM is a process, who has a say in what the outcome(s) of this process should look like? What does effective KM look like? I then examine some definitions and measures of KM effectiveness and some factors influencing KM effectiveness. Finally, I explain how I defined and measured KM effectiveness.

**Who owns KM?**

Based on the discussion in the previous sub-sections, the responsibility for Knowledge Management should fall under the leadership arm of the organisation or a coordinated approach at an executive or senior management level. This is because KM initiatives require a broad and cross-functional view of the department or the organisation, and require substantial investments both in IT and organisational processes.

Who eventually ends up with the responsibility of KM, depends largely on the scope of the KM initiative (e.g. is it organisation-wide or department-wide?), the intent of the KM initiative, and the size of the organisation (e.g. do we need a specific role to oversee KM activities in a five-person organisation?).

Interestingly, while many have proposed roles such as Chief Knowledge Officer, Chief Learning Officer or Chief Privacy Officer (see Awazu and Desouza 2004; Raub and Von Wittich 2004) or Chief Executive Officer or Managing Director (see Hasen, Nohria and Tierney 1999), most research conducted have been prescriptive and few researchers have tried to understand or explore actual KM roles and responsibilities.

Among the few, Burstein et al. (2010) carried out a survey to determine who has authority over KM strategy among the top 900 organisations in Australia (ranked by profit, listed in the 'Who's Who in Business, 2005' of Dun and Bradstreet Marketing Pty. Ltd.).

They found that four in five organisations have a formal position for authority over KM strategy. Senior executives acknowledged that they have this authority. In ranking order: CEO (28%), Exec Group (24%), CIO (11%), DHR (Director of Human Resources) (7%), CKO (6%) and no formal role (24%). There was no available data to indicate the composition of the executive group "and whether this group included CKO." Burstein et al. (2010).

For some understanding of characteristics of Knowledge Managers including demographics, education and personal motivation, see McKeen and Staples (2001) and Zyngier and Owen (2013).

I look at some of the definitions of KM effectiveness, next.

**KM effectiveness definitions**

A review of the KM literature shows that neither definitions nor measures of KM effectiveness are common. The rarity of KM effectiveness definitions is not due to a lack of research around KM but because most researchers do not explicitly define KM effectiveness.

While one could easily argue that the definition of KM effectiveness is an extension of the definition of KM, developing definitions of KM effectiveness is tricky as well - for two reasons.

First, a definition of KM effectiveness should be rooted in the KM definition it adheres to - and we know from earlier review of the literature that reaching an agreed-upon definition of KM itself is tricky.

Second, each individual KM process is effective in its own way. That is, KM effectiveness is not the same as Knowledge Sharing effectiveness or Knowledge Creation effectiveness. We should be mindful therefore to not dilute the value of other KM processes.

Another reason for the rarity of KM effectiveness definition is that researchers seem to gravitate toward the term 'success' rather than 'effectiveness'. One of the reasons for this is because these researchers have based their theses around the Information System (IS) success model of DeLone and McLean (1992, 2003).

At face value, both terms are synonyms; but there is a slight nuance between the terms 'success' and 'effectiveness'. The term 'success' connotes a larger degree of subjectivity than 'effectiveness'. What one organisation considers as success or a favourable outcome can be different from the next organisation.

In contrast, what one organisation considers as effective or the extent to which it is capable of meeting a said expectation is less likely to be different from the next organisation.

In this research, I focused on what it means for organisations to practise KM well. I focused on the capabilities of organisations which practise effective KM. The term 'effectiveness' was thus preferred over 'success'. I thus adopted a capability focus.

I had to subscribe to a definition of 'effectiveness'. Effectiveness is defined in this thesis as: "the capability of producing a desired result" (Farlex 2015).

To arrive at the definition of KM effectiveness used in this research, I reviewed the existing KM definitions so as to ensure that the definition used was rooted in the KM definition used in this research.

Thus, in this research, KM effectiveness is defined as: "the extent to which an organisation is able to identify and leverage its knowledge assets to drive and support organisational performance". The term 'able' is used here as a synonym of capable.

I look at some of the measures of KM effectiveness, next.

**Measures of KM effectiveness**

Measures of KM effectiveness are uncommon. While the lack of definitions of KM effectiveness is due to nomenclature used (i.e. success over effectiveness), measures of KM effectiveness are rare for two reasons: First, there is a lack of research in this area. Second, because investigating the factors that influence - compared to reflect - KM effectiveness or success have proven to be more popular.

That said, there are criteria to develop measures of KM effectiveness. For example, measures of KM effectiveness should be rooted in the definitions of KM and KM effectiveness and reflect the outcomes of effective KM.

In their recent and ongoing attempt to address the definitional issue that KM faces, Jennex, Smolnik and Croasdell (2012) defined KM success as "capturing the right knowledge, getting the right knowledge to the right user, and using this knowledge to improve organizational and/or individual performance". They further cautioned that while success factors identify what may be needed for successful KM, they do not necessarily establish measures for KM success.

In other words, we should make the explicit decision to distinguish the measures that represent the factors that contribute to KM effectiveness, from those that reflect KM effectiveness. A factor can be defined as "an element or cause that contributes to a result" (Farlex 2015).

Here is an example of factors that contribute to KM success. In their studies of 31 "successful knowledge projects", Davenport, De Long and Beers (1998, p. 50) found eight specific common factors namely:

- link to economic performance or industry value,
- technical and organizational infrastructure,
- standard, flexible knowledge structure,
- knowledge-friendly culture,
- clear purpose and language,
- change in motivational practices,
- multiple channels for knowledge transfer and
- senior management support.

The above are factors that should be taken into consideration to achieve KM effectiveness; but what do not reflect what effective KM looks like.

Another criterion to be considered when developing measures of KM effectiveness is whether the measures should reflect KM at an organisational level, a departmental level, or particular function. As mentioned earlier, in this thesis, I investigated KM from an organisational point of view and therefore required measures of KM effectiveness at an organisational level.

To establish the measures of KM effectiveness used in this research, I reviewed the literature for measures that reflect either KM effectiveness or KM success. Some of these measures are listed below and the specific measures of KM effectiveness used in this research are listed after that.

Kulkarni, Ravindran and Freeze (2007) used the term 'KM success' and derived their measures of KM success based on the Information System (IS) success model of DeLone and McLean (1992). Specifically, their measures of KM success included: the relationship between organisational support, Knowledge Content and KMS (KM system) quality, general perceptual measures of net benefits of IS use, and knowledge use.

While Kulkarni, Ravindran and Freeze (2007) do provide some measures of KM success, these measures are anchored around knowledge sharing and reuse and based on an IS success model, and do not portray KM success or KM effectiveness to its full extent.

More recently, Jennex, Smolnik and Croasdell (2012) used the following measures of KM success: impact on business processes, impact on strategy, leadership and knowledge content.

These measures are arguably good measures of KM success in terms of how KM has an impact on organisational performance: through leadership, business processes, strategy and knowledge content.

However, these measures do not speak to the concerns of knowledge users. That is, what employees are able to do and how they apply KM in practice. Also, identifying relevant and needed knowledge that exists within organisational boundaries is not listed in any of the measures suggested.

Taking the above measures and factors of KM success into consideration, in this research, KM effectiveness was measured as follows:

The extent to which:

- Employees have the knowledge they need to do their job.
- Employees would still have the knowledge they need to do their job, even if some employees retired or left the organisation.

If employees do not have the knowledge they need to do their job:

- they can obtain it,
- they can obtain it when they need it, and
- they can obtain it in the form they need it.

These measures speak to KM effectiveness; but also to some extent, point to KM success and organisational performance. The employees responsible for business processes, strategy, leadership and knowledge content, all need the right knowledge at the right time.

Next, I summarise this review of the literature around KM. Then, equipped with definitions of KM and KM effectiveness, I review the KI literature.

### 2.2.7. Summary of KM and KM Effectiveness

The purpose of section 2.2 was to develop an understanding of what KM is about. Literature surrounding KM was reviewed and definitions of both KM and KM effectiveness were established.

KM is defined in this thesis as: "the process whereby organisations identify and leverage knowledge assets to drive and support overall organisational performance" (Jennex, Smolnik, and Croasdell 2016; O'Dell and Grayson 1998).

KM effectiveness is defined as: "the extent to which an organisation is able to identify and leverage its knowledge assets to drive and support organisational performance".

Some KM frameworks were also examined and the link between KM and KI emerged. KI is a distinct KM process which is often depicted as one of the first KM processes to be executed in a KM initiative.

In the next section, I review relevant literature surrounding KI and the methods organisations use to practise KI.

## 2.3. Knowledge Identification (KI) and KI Effectiveness

So far in chapter two, the literature surrounding both knowledge and KM has been reviewed and the rationale for the definitions used for both knowledge and KM have been established. Table 2-3 below lists the definitions of knowledge and KM used in this research.

TABLE 2-3 DEFINITIONS USED IN THIS RESEARCH.

| Key concepts | Definitions |
|---|---|
| **Knowledge** | "facts, information and skills". |
| **Knowledge Management** | "the process whereby organisations identify and leverage knowledge assets to drive and support overall organisational performance" (Jennex, Smolnik, and Croasdell 2016; O'Dell and Grayson 1998). |

This section reviews the relevant literature surrounding the concept of Knowledge Identification (KI) - which has thus far been only briefly discussed. The objective of this section is to gain a deeper understanding of what KI is about and examine its relationship with KM.

I begin by providing a summary of what I have discussed about KI thus far. Then, before I explain KI in more detail, I point out the lack of literature around KI compared to other KM processes. Then, I examine other terms used to represent KI or that are related to KI and KI methodology and KI outcomes.

Following that, I discuss some notable methods of practising KI. Finally, I provide the definitions of KI and KI effectiveness and the measures of KI effectiveness used in this research. By the end of section 2.3, I the gaps in the literature will become clear. These gaps are listed in section 2.4 (Literature Gaps and Research Questions).

### 2.3.1. KI: Recap

Thus far, I have touched on the following key points surrounding what KI is about and the focus of this research:

- Researchers have argued that organisations should not wait for the knowledge to come pouring in knowledge repositories as is often the case for Knowledge Sharing systems, but instead should take steps to create processes where organisations go to the knowledge - in whichever form the knowledge may be and wherever the knowledge may be located (Henczel 2001; Hylton 2003).
- This process where organisations identify relevant and needed knowledge that exists within their boundaries is referred to as Knowledge Identification (KI). Other terms have been used to refer to KI. KI in its strictest form is proactive, whereas when KI is practised on a need-basis, is reactive.
- There is a difference between 'identifying knowledge that the organisation has' where the focus is on the knowledge and 'identifying who knows what in the organisation' where the focus is on the knowledge holders. While I looked at both in this research, I focused on the former - the broader picture.
- KI is depicted as a KM process in KM frameworks but also often missing entirely from the frameworks. When KI is depicted, it is either represented as (or among) the first KM process (or processes). This suggests that KI enables or improves subsequent KM processes.

In the next sub-section, I compare the volume of KI literature to that of other KM processes to demonstrate the lack of literature surrounding KI.

### 2.3.2. KI: Limited Literature

Prior to the 21st century, very little attention within the field of KM was given to KI. Many researchers and practitioners have both looked at and argued the importance of leveraging internal knowledge. However, virtually all refer to KI without researching specifically about KI.

Indeed, compared to other KM processes, KI is possibly the KM process which has gained the least traction within the KM community. This lack of interest in KI can be evidenced by the contrast between the volume of publications in KI compared to those of KM and other KM processes such as Knowledge Acquisition, Knowledge Sharing. There is considerably less discussion and research on KI.

I used Ngram Viewer, a tool also developed by Google, to show the usage of the terms KI, KM, and other KM processes in a corpus of books (up to 2008). Figure 2-12 below shows the usage of the terms KM, KI, Knowledge Acquisition, Knowledge Sharing and Knowledge Creation in the English corpus between 1950 and 2008. KI is virtually non-existent.

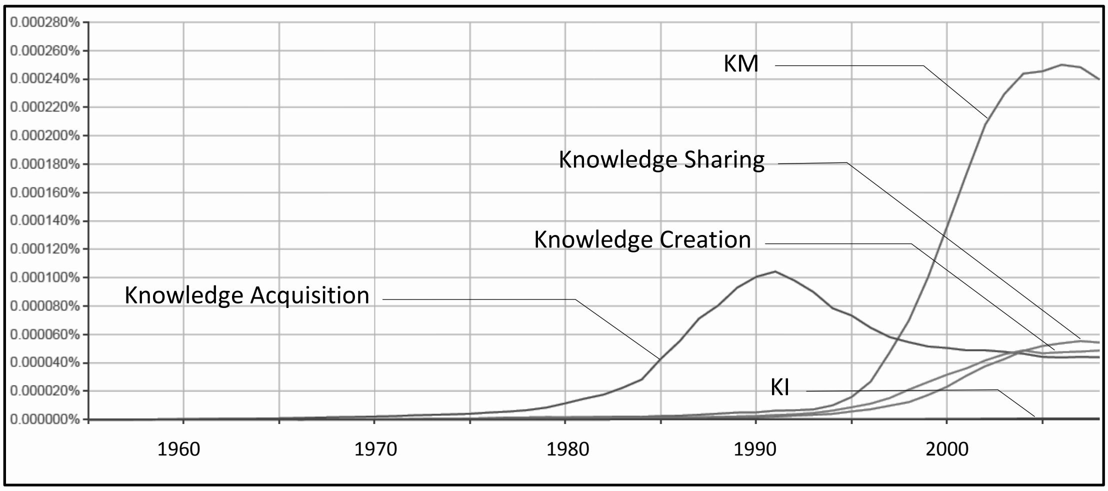



FIGURE 2-12 KM, KI, KNOWLEDGE ACQUISITION AND KNOWLEDGE SHARING.

Even when I included other terms used in the literature to refer to KI - knowledge audit (Debenham and Clark 1994) and knowledge sourcing (Gray and Meister 2004), all three terms (including KI) pale in comparison to other KM processes as shown on figure 2-13 below.

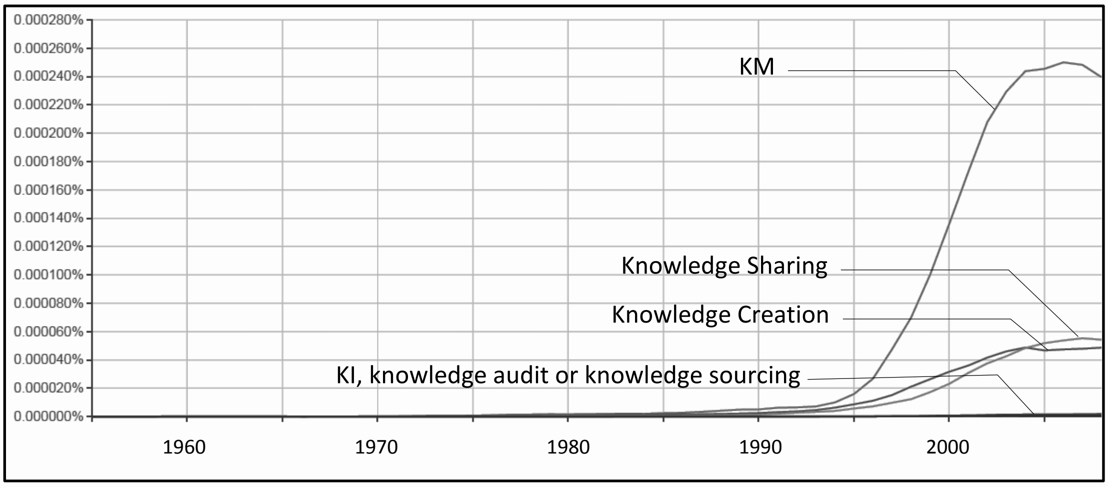



**FIGURE 2-13 KI, KNOWLEDGE AUDIT, KNOWLEDGE SOURCING AND OTHER KM PROCESSES.**

There could be a number of reasons for the lack of attention to KI. For example, it could be the lack of evidence to demonstrate the significance of KI or the lack of understanding of KI. If KI was vital; that is, had KI been proven to be vital to KM, it is likely that there would have been more interest and research surrounding KI.

According to Burnett et al. (2004), the lack of literature relating to KI practice may have discouraged implementation attempts and may even have had an impact on their success. Further, while models around KI practice are emerging, most have shortcomings (e.g. some models do not factor in the underlying business processes) (Burnett, Williams and Grinnall 2013; Burnett, Illingworth and Webster 2004).

Further, organisations may be inadequately equipped to practise KI. Organisations face a number of problems with respect to KI practices. In the later sub-sections of this chapter, I discuss some of the problems organisations face in using KI methods.

Yet another potential reason is that it can be difficult to clearly define KI as a KM process. The reason for this is that KI is virtually embedded within all KM processes (as shown in figure 2-14 on the next page); it can be difficult to delineate or disentangle KI from other KM processes. (Note that the size of the circles and the proportion of KI attached to other KM processes are not indicative.)

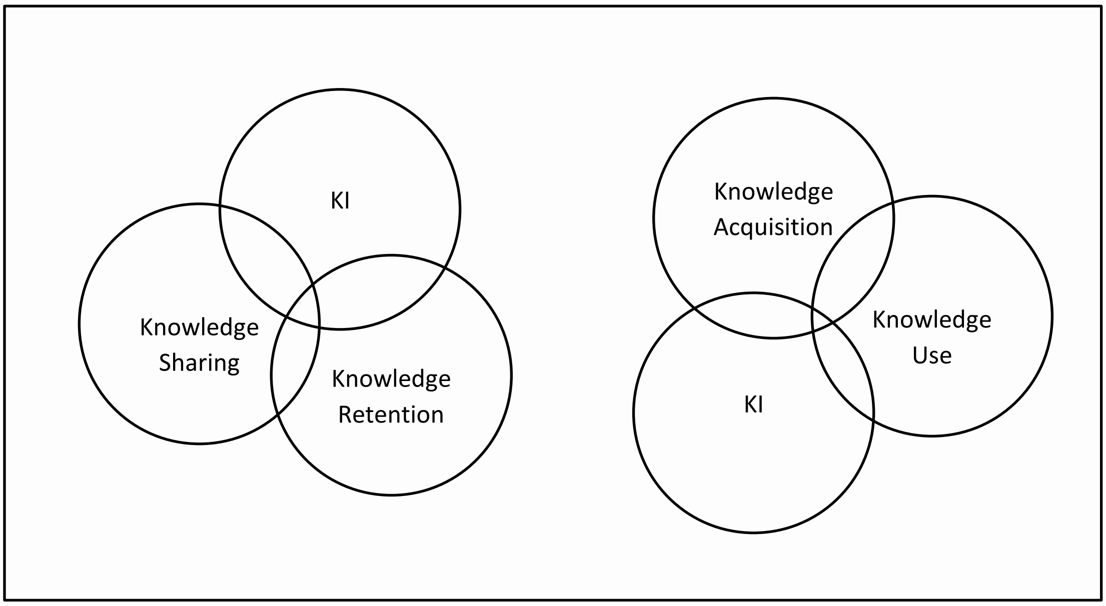



**FIGURE 2-14 KI AND KM PROCESSES.**

KI is hinted at in all KM processes but appears fully formed in none. For example, when an employee shares his or her knowledge (Knowledge Sharing), he or she implicitly first identifies what knowledge he or she wants or is meant to share. However, when describing the KM processes of Knowledge Sharing or Knowledge Retention, this step of identifying what knowledge is to be shared or what knowledge is to be retained is often overlooked or barely mentioned in the literature.

Another way to interpret this is that Knowledge Acquisition, Knowledge Sharing and Knowledge Retention can all be done without KI, if inefficiently.

In the next sub-section, I discuss KI in more detail.

### 2.3.3. KI: What KI Is (Not)

I noted earlier in chapter one (Introduction) that terms such as 'knowledge audit' (Debenham and Clark 1994) and 'knowledge sourcing' (Gray and Meister 2004) have been used to refer to the process of identifying internal knowledge. There is simply more involved in the KI process than just identifying relevant and needed knowledge that exists within the organisation. I examined those two related-to-KI terms with a view to obtain a richer understanding of what KI is (not) in this sub-section.

**Knowledge Audit and Knowledge Sourcing**

Knowledge audit and knowledge sourcing are two other terms that have been used to represent this process of identifying internal organisational knowledge. What knowledge audit and knowledge sourcing are, and how these terms differ or share similarities with KI are discussed below. The term knowledge audit is reviewed first, the term knowledge sourcing second.

The term 'knowledge audit' was referred to in chapter one, and was defined as the "accurate identification, quantification, measurement and assessment of the sum total of tacit and explicit knowledge in the organization" (Hylton 2003). However, the origin of the term goes back almost a decade earlier.

Debenham and Clark (1994) coined the term 'knowledge audit' while working with a financial organisation. They used the term 'audit' in its general sense: "an official inspection of an organization's accounts" (Oxford 2013).

Debenham and Clark (1994, p. 201) defined a knowledge audit as: "a well-defined, highly technical, structured report containing an overall, high-level description of a restricted section of an organization's knowledge resource and a description of identified individual "chunks" of knowledge in that section."

They further posited that "the basic aim of a knowledge audit is to give a deliberately approximate view of the extent and state of specified sections of knowledge in an organization." (Debenham and Clark 1994, p.202). They provided four parameters to be considered when producing the report:

- the scope of the audit,
- the granularity of the audit as well as
- the meaning given to granularity and

- the base certainty factor ("the default subjective probability level to which estimates in the audit are to be given").

While it can be argued that Debenham and Clark (1994) viewed the knowledge audit as an organisational endeavour, they did not promote the KI as an iterative process, nor the connection between a knowledge audit and (effective) KM. They viewed the knowledge audit as a report, that is, an end-product.

Debenham and Clark (1994) also focused on the explicit form of knowledge and paid little to no attention to the tacit form of knowledge. This is an immediate departure from Drucker (1967) who favoured the tacit form of knowledge.

Perhaps more importantly, there is an implicit assumption in their work that they did not know precisely what they were looking for, but they attempted to establish what knowledge exists within the organisational boundaries.

A few years later, Liebowitz et al. (2000) continued the work of Debenham and Clark (1994) by including the tacit form of knowledge and by segregating knowledge into two categories: knowledge that currently exists and knowledge that is missing.

They argued that the goal of a knowledge audit is to determine "what knowledge is needed, what is available and missing, who needs this knowledge, and how it will be applied" (Liebowitz et al. 2000, p.3).

Liebowitz et al. (2000, p.3) clearly recognised the relationship between a knowledge audit and KM. They argued that a knowledge audit "is the first part of any knowledge management strategy". They further distinguished the knowledge that they were identifying:

- needed knowledge that the organisation has,
- needed knowledge that the organisation does not have, and
- how the organisation is using that knowledge.

However, Liebowitz et al. (2000, p.3) provided no empirical evidence to support the relationship (that is to what extent the knowledge audit contributes to KM) or the extent to which the knowledge audit was practised - as did Hylton (2003). Liebowitz (2002) would subsequently akin knowledge audit to knowledge mapping and declare it as "an essential part of Knowledge Management".

This comparison between knowledge mapping is not surprising; both are similar. Knowledge mapping is defined as "the process of associating items of information or knowledge (preferably visually) in such a way that the mapping itself also creates additional knowledge." (Vail 1999, p. 10).

The outcome, a knowledge map, is a visualisation piece that portrays the sources, flows, constraints and terminations of knowledge within organisations. Knowledge maps typically point to people as well as to document and databases. Knowledge maps are thus often used in information architecture.

I provide an example of a form of knowledge map in section 2.3.5 (KI: Methods): Organisational Network Analysis. For more details about knowledge mapping, see Davenport and Prusak (1998), Grey (1999), Speel et al. (1999) and Wexler (2001).

There is no doubt that knowledge audit and knowledge mapping are related to KI. Undertaking a knowledge audit involves identifying the relevant and needed knowledge (both knowledge that employees hold between their ears and knowledge that is already captured and stored in knowledge repositories) that exists within their boundaries.

That said, two research gaps identified here are the lack of empirical evidence to support the relationship between KI and KM, and the lack of evidence surrounding the extent to which KI is practised among organisations.

Another term closely related to KI is knowledge sourcing (Gray and Meister 2006). Gray and Meister (2006, p. 142) call the ways that "employees draw on each other's expertise, experience, advice, and opinions" as knowledge sourcing.

They emphasise the difference between knowledge sourcing (KI) and accessing information in general. Note that they use the terms 'information seeking' and 'accessing information' interchangeably to mean the same thing.

Gray and Meister (2006, p. 143, emphasis in original) argue that knowledge sourcing is more than just searching for mere facts and information, but includes other things such as expertise, experiences, insights, opinions and causal maps. They explain in detail:

> "It is important to note the difference between drawing on others' knowledge and accessing information in general. Information seeking research typically does not distinguish between knowledge as the product of human thinking and facts as representations of reality. To lump all human behaviors relating to both advice and facts into the same category discounts important differences between them; one improves recipients' causal maps and helps them understand and predict future events, while the other contains nothing about causes and effects. Because the focus of KM efforts is not on the transfer of factual information (that is, mere representations of reality), we focused on individuals' *knowledge sourcing* behavior, defined as an individual's intentional actions taken to locate and access others' expertise, experiences, insights, and opinions. Organizations often support a wide variety of mechanisms for accessing others' knowledge, which range from ones recently proposed in the KM literature (e.g., knowledge repositories, virtual communities of practice) to well-established organizational practices (e.g., meetings, memos)."

Their interpretation of KM was slightly different. While they subscribed to an organisational view of KM, Gray and Meister (2006) viewed KM as an enabler for organisational learning; and they demonstrated that knowledge sourcing has the potential to affect organisational learning positively. The capacity for organisational learning is also a source of competitive advantage for organisations.

Gray and Meister (2006) investigated how access to the knowledge employees may benefit other employees in gaining knowledge. They found that knowledge sourcing explains a significant proportion of the learning outcomes of employees and that the strength of this effect is moderated by the learning orientations of employees and the degree to which they find their jobs to be intellectually demanding.

In a similar vein, Pedersen, Soo and Devinney (2011) subsequently distinguished between internal and external knowledge sourcing: the former focuses on the acquisition of knowledge from sources internal to the organisation ("colleagues within the business unit and firm") and the latter focuses on knowledge from external sources ("customers, suppliers, competitors and consultants").

This contrasts with a knowledge audit which only considers knowledge that exists within the organisation. In this research, I looked specifically at knowledge within the boundaries of organisations and viewed Knowledge Identification as internally focused.

Further, Pedersen, Soo and Devinney (2011) examined the importance of internal versus external knowledge sourcing on organisational performance which they measured in terms of: the generation of new ideas, product or service innovation, product or service enhancements, process improvements and organizational innovations and improvements.

Notwithstanding the limitations of their research, they found that "internal sources of knowledge appear extremely important to performance." External knowledge in itself on the other hand rarely determines organisational performance. To realise the full potential of external knowledge, that knowledge needs to be transformed and internalised.

To summarise, both knowledge audit and knowledge sourcing are related to KI. All three terms share similarities and differences. In this research, I looked specifically at knowledge within the boundaries of organisations, that is what Pedersen, Soo and Devinney (2011) refer to as internal sourcing.

Between the three terms, I chose to use the term Knowledge Identification in this research because:

- KI is the oldest term used in the literature. The term 'KI' appeared first, followed by knowledge audit and knowledge sourcing.
- Rather than a one-off activity or a report, KI refers to a process.
- KI is included in various KM frameworks (as depicted in section 2.2.3 above).

Further, a key knowledge gap was identified: empirical evidence to demonstrate the relationship between KI and KM. While the literature suggests that KI (including knowledge audit and knowledge sourcing) contributes to organisational performance (e.g. the findings from Pedersen, Soo and Devinney (2011) above), a lack of empirical evidence remains to demonstrate the relationship between KI and KM, and even the extent to which KI is practised among organisations.

In the next sub-section, I examine how KI is practised conceptually and look at some of the outcomes of KI.

### 2.3.4. KI: Methodology and Outcomes

There are some existing reviews of the literature surrounding KI methodology and outcomes. While some researchers focus on the methodology around KI (see Ganasan and Dominc 2009; Gourova, Antonova, and Todorova 2009; Wu and Li 2008), others focus on the outcomes and deliverables of KI (Cheung et al. 2007; Liebowitz et al. 2000). Few researchers focus on the methods used to practise KI (e.g. see Perez-Soltero et al. 2007).

This sub-section discusses both the methodology and outcomes of KI. I begin with the methodology and discuss the outcomes of KI following that. I discuss KI methods in the next sub-section (2.3.5).

**KI Methodology**

Shukor, Rahman and Iahad (2013) argue that there are a number of steps, activities or processes involved in practising KI - but without any consistency or standard. Further, most research executed thus far has investigated KI using a single organisation as the unit of analysis - rather than multiple organisations; and not all researchers take into account the aspect of practising KI regularly.

In contrast, Burnett, Williams and Grinnall (2013, p. 162) who reviewed the literature specifically around models of practising Knowledge Audit and Mapping (synonyms of KI), argue that:

> "Although differences between the models exist, these approaches broadly focus on a number of key elements: the identification of knowledge needs (through questionnaires and interviews); the discovery of the types of knowledge present and their locations; how knowledge is maintained and stored; its use and relevance; how it moves within a specific context; and the construction of a knowledge map and the development of a final report."

If we apply the explanation from Burnett, Williams and Grinnall (2013) above together with the earlier discussion on the KM frameworks, we can observe three activities that are tied to KI:

1. Identifying relevant and needed knowledge for organisational performance. This is akin to a requirement gathering or elicitation exercise (which may also include business process analysis), and is what Probst et al. (2000) refer to as Knowledge Goals.
   This is top-down (looking for knowledge for a specific purpose).
2. Identifying who has relevant and needed knowledge and where the relevant and needed knowledge is; in other words, identify what knowledge exists within the organisational boundaries. This is potentially where an assessment of the level of expertise would also take place.
   This is bottom-up (seeing what is known and then how it can be used) or on an ad-hoc basis.
3. Executing subsequent KM processes. For example, capture yet-to-be captured knowledge, use, apply the knowledge captured, share knowledge created, as such.

Conceptually, these are the three activities around KI. The first two are tightly linked. For the purpose of this research, I am primarily interested in point number two: the identification of knowledge that exists within the organisational boundaries.

Note that the order of those activities is not necessarily linear. For example, if we refer to the KM frameworks where KI is involved (e.g. figure 2-6), we can see the non-linearity of those processes: KI to Knowledge Acquisition to Knowledge Development, KI to Knowledge Development and Knowledge Utilisation, or KI to Knowledge Utilisation.

Through some examples, I next demonstrate how the sequencing of these activities is not necessarily linear and how KI is logically a significant process in KM.

At first glance, the first two activities appear to complement each other and ought to be performed sequentially. That is, to identify relevant and needed knowledge that exists within its boundaries, an organisation should first determine what knowledge is relevant and needed for its performance and then determine whether or not it has the knowledge.

For example, it is easier to find out whether or not the organisation has knowledge about subject matter X - if it is known what X is. In this sense, identifying the knowledge that the organisation needs is a precursor to identifying relevant and needed knowledge that the organisation has or does not have.

What X is, can be many things. For example, based on the work of Sveiby (1997), Wu and Li (2008) argue that there are three groups of knowledge that organisations ought to be interested in: human knowledge capital (explicit and tacit knowledge of employees), structure knowledge capital (organisational knowledge structure and organisational knowledge innovation culture and ability) and external knowledge capital (knowledge held by customers and partners).

However, either activity can be performed independently of the other. That is, an organisation can determine what knowledge is relevant and needed for its performance without having identified what relevant and needed knowledge it already has.

Granted, determining the knowledge that is relevant and needed for organisational performance is not always a straightforward or a static process and can be a reactive process rather than a proactive one: organisations become aware of what knowledge they need when the need arises.

In a similar fashion, an organisation can identify what knowledge it has without having determined what knowledge is relevant and needed for its performance. This is arguably analogous to identifying just about any knowledge (knowledge that is relevant and needed or not), but, and more importantly, this includes knowledge that the organisation may not have identified yet as relevant and needed.

In other words, this process of identifying what knowledge the organisation has can contribute to the process of identifying what knowledge is relevant and needed for organisational performance.

The best outcome is potentially achieved when both activities are conducted at the same time or in a cyclic manner. That is, the organisation identifies what knowledge is relevant and needed for its performance while identifying what knowledge it has (both from a top-down and from a bottom-up approach) - but this remains to be empirically tested.

What this implies is that KI encompasses both the process of finding out what knowledge exists and what knowledge is relevant and needed for organisation performance.

Further, this implies that KI should be practised regularly and systematically. That is, KI should not be practised just at the early stages of a KM initiative or only when needed, but is practised on an ongoing basis.

There are two key reasons for this: First, new knowledge is often created (e.g. when new employees join the organisation or when employees gain new skills and knowledge). Second, knowledge that may not perceived as relevant and needed currently, may become so at a later point in time.

**KI Outcomes**

As the KM frameworks reviewed in earlier sections show, KI is not an isolated process. KI is tied to other KM processes. KI is also one of the first KM processes to be executed in a KM initiative.

Taking the above activities or components within KI in consideration, some of the outcomes of KI are listed below:

- KI at the very least should increase exposure to internal knowledge. KI establishes an inventory of: who has what knowledge, where relevant and needed knowledge resides, and what knowledge is yet-to-be captured or missing.
- Organisations can establish knowledge gaps (knowledge that the organisation does not already have) and prioritise on them by assessing what knowledge they need and currently have and what knowledge they need but do not currently have. Figure 2-15 below depicts the context.

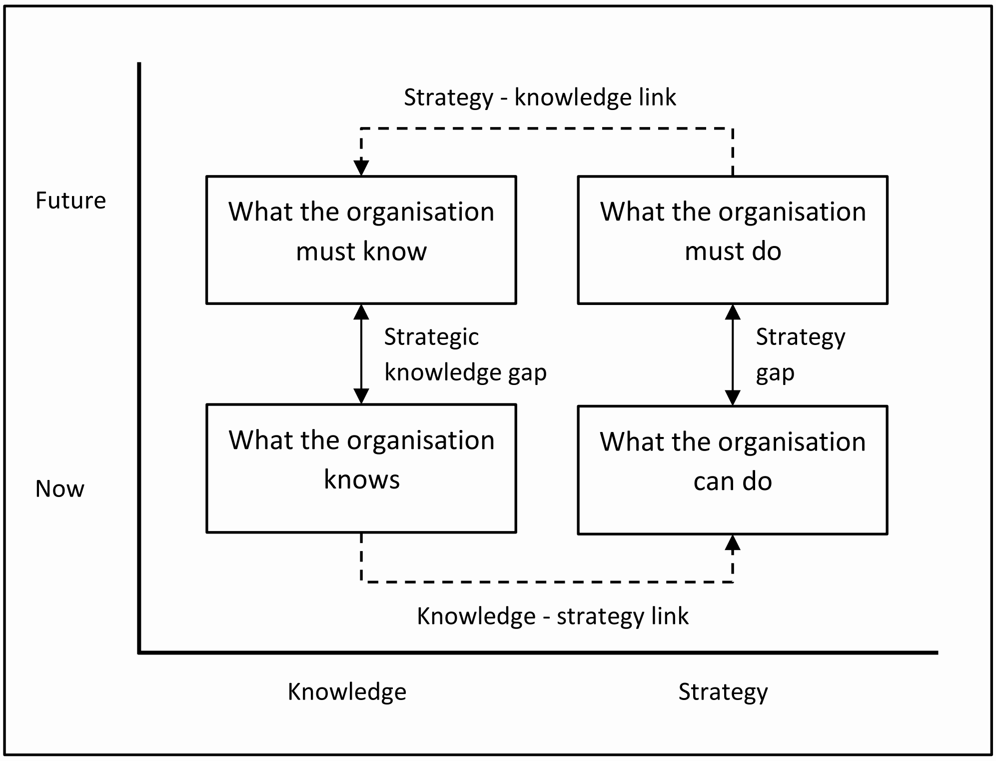



**Figure 2-15 Knowledge gap analysis (Adapted from Tiwana 2000).**

- By establishing what knowledge the organisation has, KI should enable organisations to establish what knowledge is needed. Organisations can do so by assessing whether or not the knowledge is critical to their performance.

KI potentially delivers a number of business benefits which potentially not only drive effective Knowledge Management but also organisational performance. By knowing what relevant and needed knowledge exists within their boundaries, KI makes it easier and more feasible for organisations to improve the ways that they leverage their knowledge.

In this sense, KI enables subsequent KM processes or activities; KI has positive effects on other KM processes such as Knowledge Use, Knowledge Sharing and Knowledge Retention. Specific KI benefits include (Burnett, Williams and Grinnall (2013), Jafari et al. 2009, Liebowitz et al. 2000, Wexler 2001):

- Promote knowledge re-use within the organisation, thus minimising resources wasted on re-inventing the wheel.
- Improve organisational workforce planning (e.g. by putting employees with specific and needed skills in projects which require specific skill sets).
- Mitigate the risk of knowledge loss (e.g. by capturing yet-to-be captured and needed knowledge).
- Reinforce organisational memory (e.g. by capturing lessons learnt in recently completed projects).
- Design capability and curriculum frameworks (e.g. by establishing what skills employees currently have and where they need further training).
- Re-wire how the organisation operates (e.g. by changing business processes as a result of knowing what knowledge exists within the organisation and where the knowledge gaps are).

Note that the above benefits can be achieved at a team level, at a department level or even across the organisation.

In the next sub-section, I examine how organisations put KI in practice.

### 2.3.5. KI: Operationalisation

As noted earlier in chapter one (Introduction), practising KI can take multiple form and shape: from methodology to systems and tools. In this research, I refer to the means of practising KI, including systems, technology, tools and techniques as KI methods. In this sub-section, I review some KI methods. I develop a definition of KI and justify the KI definition used in this research following that.

There are many KI methods available to assist or support organisations in identifying relevant and needed knowledge that exists within their boundaries. Some KI methods are designed specifically as KI methods. That is, they are designed and developed primarily as a KI solution. Others on the other hand serve other purposes primarily, but cover a range of capabilities that are KI-related.

Some KI methods are manual and have been around for a long time while others are relatively new, automated and more sophisticated. Some of the basic KI methods that organisations can adopt include: observing employees in their day-to-day activities, interviewing employees, using questionnaire surveys to gather information around what the employees know (see Jafari et al. 2009 and Wexler 2001) or reviewing documents and running focus groups (Shukor, Rahman, and Iahad 2013).

Some of the recent and notable KI methods include: Knowledge Sharing systems, Expert Finding systems (Nevo et al. 2009), Organisational Network Analysis (Parise et al. 2005), Knowledge Loss Risk Assessment (Jennex 2009, p. 2, 2014) and ExTra (Weber et al. 2007). These methods are discussed below.

Knowledge Sharing systems are a good example of a system primarily designed for a specific purpose but used for KI as well. The primary purpose of Knowledge Sharing systems is to provide employees with a platform for them to share knowledge.

The rationale for using those systems for KI is that by providing employees with a space where they can write down what they know, when or after the employees have written down what they know, organisations can then determine who the sources of the knowledge are and what knowledge the sources hold.

However, the problem is that knowledge sharing within organisations is not easy and this initiative has met with little success (Ruggles 1998; Thurm 2006); literature on the reasons why is extensive (see Hendriks 1999; Cross et al. 2001; Hinds and Pfeffer 2002; Mitchell 2005).

For example, according to Kluge et al. (2001, p. 25) "the right cultural context that would create and nurture reciprocal trust, openness and cooperation" for employees to share their knowledge is often not taken into account. Employees often do not find it "natural" to write down what they know (Thurm 2006).

More recently, a new breed of Knowledge Sharing systems has emerged. Compared to the traditional systems which adopt a static, knowledge-warehouse approach, the new breed adopts a more dynamic communication-based or network approach and embraces social media and the interactive web (Kuhlen 2003).

For example, Nevo et al. (2009) propose social-computing tools such as blogs, social networking sites and tagging. These social-computing tools provide employees a space to share their knowledge, like other Knowledge Sharing systems; but in contrast to vanilla Knowledge Sharing systems, they are richer in supporting "softer qualities" such as trustworthiness, communication skills and willingness to help.

Examples of such systems include InnoTube and Yammer (the latter was founded in 2008 and bought by Microsoft in 2012 for US$1.2 billion).

As noted in chapter one (Introduction), such systems have shown potential. For example, in his recent work on social media and Knowledge Acquisition in a large organisation (with over 15,000 employees), Leonardi (2015) demonstrated that exposure to the content of co-workers' messages on an enterprise social networking system is positively related to an improved accuracy of an observer's knowledge about who knows what in the same organisation.

He (2015, p. 748, citations in original) pointed out that knowledge of "who knows what" and "who knows whom" is often linked to "team performance on routine tasks (Ren et al. 2006), people's ability to recombine existing ideas into new innovations

(Majchrzak et al. 2004), reduction in work duplication across the organization (Jackson and Klobas 2008), and many more positive benefits."

Leonardi (2015, p. 760) concluded that such tools are indeed useful for knowledge sharing: "social technologies may be useful for knowledge sharing and collaboration within organizations … because they simply make the communications that people are already having visible to others throughout the organization."

Whether or not organisations which use similar social-computing tools are more effective at establishing what knowledge they have and to what extent these social-computing tools are effective as KI methods compared to other methods remain to be determined.

Note that there is a difference between saying "identifying what knowledge you have is important" (i.e. focus on the process) and "knowing who knows what is important" (i.e. focus on the knowledge). While I looked at both in this research, my focus was on the former.

Another KI method of note are search engines called Expert Finding systems or Expert Locators. Put simply, the objective of an Expert Finding system is to help locate employees with appropriate expertise in a particular area within the organisation. This new class of search engines (previously known as "Yellow Page" systems) has recently gained popularity (see Mockus and Herbsleb 2002; D'Amore 2005; Shami et al. 2008).

According to McLean, Vercoustre and Wu (2005), there are three approaches to expert finding systems: 1) a database approach (where a database is used to centrally store knowledge), 2) an evidence-based approach (where employees are given a profile each based on "electronic evidence", and 3) a referral, or social network approach that links people through a network.

To identify experts, these systems do not rely entirely on self-identification. There are typically three areas which supply data for an Expert Finding system: employee resumes, employee self-identification of areas of expertise, typically by being requested to fill out a form online, or by algorithmic analysis of electronic communications from and to the employees (KMWorld 2012).

Some systems also apply different content analysis techniques to large collections of artefacts created by employees including email (see Balog and De Rijke 2006), instant messages, documents (see De Boer 2006), briefings (Maybury 2006) and other social networking electronic communications (KMWorld 2012). For an example of an implementation of such a system, see Demartini (2007); he proposes algorithms to find experts in Wikipedia.

Using Expert Finding systems as a means to identify relevant and needed knowledge and its sources also has its problems. For example, according to Maybury (2006, p. vii), finding experts is a difficult task because "their skills and knowledge are rare, expensive, (unevenly) distributed, difficult to qualify, continuously changing [see McDonald & Ackerman, 1998, p. 4], varying in level, and often culturally isolated and oversubscribed."

Nevo et al. (2009) assert that the problem with the Expert Finding systems is that most are centrally managed efforts, thus requiring additional resources to constantly review and update the credentials of often rapidly changing positions of experts, to which few organisations commit.

Compared to Knowledge Sharing systems, Expert Finding systems are designed with KI in mind and are thus true KI methods. The use of content analysis techniques helps organisations in being proactive about identifying relevant and needed knowledge. Such systems shift the responsibility and concern of identifying relevant and needed knowledge from the employees to the organisation.

Organisational Network Analysis (ONA), championed by Parise et al. (2005), is another KI method of note. Tangentially related to the earlier discussion on the newer breed of Knowledge Sharing systems, advocates of ONA argue for the value of knowing who knows what within the organisation.

According to Parise et al. (2005, p. 2), ONA identifies employees who possess relevant and needed knowledge by "specifying unique kinds of knowledge loss that occur when people in central, broker, and peripheral network positions leave." ONA thus identifies who knows whom within the organisation, and exemplifies a proactive approach to KI.

Central to their argument for analysing organisational networks is the premise that work has become more collaborative in nature and employees possess not only skills and expertise, but also knowledge of relationships among other employees and external contacts.

With the advent of more powerful or more capable communication technologies, it is indeed common to have knowledge disseminated across a large number of employees rather than a few (Whelan et al. 2009). As example of such an analysis is shown in figure 2-16 below.

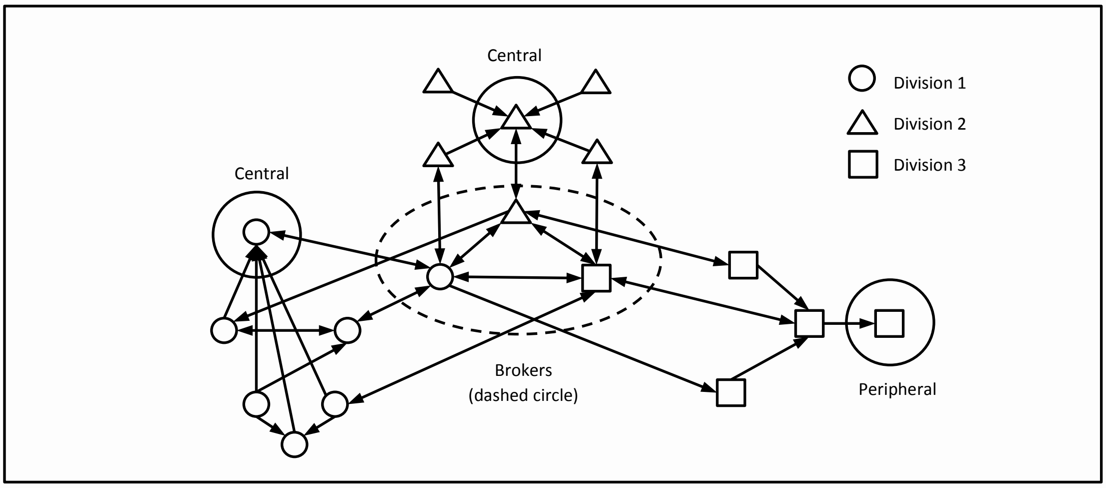



**FIGURE 2-16 ORGANISATIONAL NETWORK ANALYSIS (ADAPTED FROM PARISE ET AL. 2005, P. 18).**

The lines with arrow heads represent information regarding the relationships among employees. Employees holding 'Central' positions are highly-connected employees with a high number of direct information relationships. These are employees who are regularly sought for information.

Employees in 'Broker' positions are those who have ties across subgroups in a network and serve to integrate the entire network. The three brokers act as bridges across the three divisions. Brokers thus may not have the information personally but act as points of reference.

Finally, employees in 'Peripheral' positions are those who reside on the boundaries of a network, often seeking information from co-workers. Although they may seldom be sought for information by others, they could be employees with crucial knowledge, but which is specialised and not widely used.

Organisational Network Analysis also faces some moderate criticisms. For one, ONA suits organisations which favour collaborative work over individualistic work. Organisational Network Analysis identifies who knows whom within the organisation, but not necessarily who knows what.

Further, ONA provides only a snapshot of the current relationships among employees (Borgatti, 2005) and therefore does not provide for the constant change among employees as noted by Maybury (2006).

In contrast, in their report of applying a knowledge mapping exercise at Boeing, Kennedy-Reid and Ihrig (2013) first identify a knowledge domain at a sufficient level of clarity and then draw a list of critical knowledge assets that are performance-relevant for that particular knowledge domain. They used semi-structured interviews to conduct this exercise.

Other, newer KI methods have been promoted including: Knowledge Loss Risk Assessment (KLRA) and ExTra. Both focus on identifying key employees.

KLRA “uses interviews to determine the scope of knowledge to be captured and the actions that should be taken to capture this knowledge.” (Jennex 2009, p. 2). Who carries out the interviews, who is interviewed and how the list of interviewees is compiled are unclear.

ExTra on the other hand leverages “transfer networks” which are implemented within the different business areas of the organisation. Those transfer networks consist of local management representatives, Human Resource representatives and employees of the knowledge management department, who meet typically twice a year for compiling a list of candidates.” (Weber et al. 2007). However, again, how exactly the list of employees is compiled is unclear.

KI methods are not necessarily used individually. Some organisations have used a combination of KI methods. For example, Praxair (an industrial gases organisation based in the United States) used a combination of a Knowledge Sharing system and an Expert Finding system - and have had a positive response.

Praxair use a video management system to capture and share the knowledge of its subject matter experts, along with an “ask-an-expert” system (in the form of a

Microsoft SharePoint site) to identify areas of expertise. Participation is mandatory (a low threshold was set) and began with a set of pre-defined experts (APQC 2015b).

Such an approach is indicative of the value that the organisation sees in KI. To provide some context, management at Praxair are cognisant of the ageing workforce and are proactive in capturing relevant and needed knowledge. Perhaps more importantly, while it seems to be effective in this particular instance, it remains to be seen whether this approach is effective among different organisations.

The above review indicates a number of factors which influence the effectiveness of KI methods and possibly define the nature of KI. Which KI method or combination of methods an organisation implements and uses depends on a number of factors.

Some KI methods are more suitable in cases when the organisation has already determined what knowledge is relevant and needed for organisational performance, while others are suitable irrespective of whether the organisation has or has not yet determined what knowledge is relevant and needed for organisational performance.

Further, some KI methods target or depend on (explicit) knowledge already captured in knowledge repositories, while others target the tacit knowledge that still remains between the two ears of employees through other means, and others still target both.

Some factors to be taken into consideration therefore include: the capability to identify who knows what through means other than employee self-identification, the collaborative nature of the workplace, the dynamic nature of employees and the KI maturity of the organisation.

In the next sub-section, I provide and justify the definitions of KI and KI effectiveness that I used in this research.

### 2.3.6. KI: Definition Used in This Research

Even after reviewing the literature around KI, perhaps one of the greatest difficulties in understanding KI is defining it. Compared to KM, there are considerably fewer KI definitions that exist in the literature.

We can leverage and to some extent, extend existing definitions. To reach a definition of KI, I summarised some of the characteristics of KI:

- KI is an organisational endeavour. KI is not limited to be practised within teams, departments or divisions of organisations but can be practised across the entire organisation.
- KI is not just about the technology, but also involves processes, and takes people into account.
- KI involves identifying the relevant and needed knowledge that exists within the boundaries of organisations (both the knowledge and the sources of the knowledge).
- KI covers knowledge, irrespective of form (i.e. the knowledge identified ranges from tacit knowledge to explicit knowledge).
- KI is not a one-time activity or an end-product but a process practised regularly and systematically. KI is not done just at the early stages of a KM initiative, but is practised on an ongoing basis.
- KI encompasses both the process of finding out what knowledge exists and what knowledge is relevant and needed for organisation performance. In this thesis, needed knowledge is a subset of relevant knowledge.
- KI should be practised proactively. KI is less about passive (i.e. wait for the knowledge to come) or reactive processes (where KI is practised when the knowledge is needed).

In addition to the above, I also used some of the criteria used in defining KM:

- The overarching purpose of KI,
- What can be specifically measured in KI, and
- The clarity and succinctness of the KI definition.

Thus, in this thesis, Knowledge Identification is defined as: "the process whereby organisations identify the relevant and needed knowledge that exists within their boundaries".

This definition speaks to the core of what KI is about. Again, like the KM definition used in this research, this KI definition speaks to the what and the why, rather that the when or the how of KI.

In the next sub-section, I define KI effectiveness and look at what KI effectiveness means - that is, the measures of KI effectiveness.

### 2.3.7. KI Effectiveness: Definition Used in This Research

As I did earlier with KM, I needed to not only understand KI but also define effective KI and define measures of effective KI - both of which should be anchored to the definition of KI used in this research.

Based on the KI definition used in this research and the definition of effectiveness: "the capability of producing a desired result" (Farlex 2015), KI effectiveness is thus defined as: "the extent to which an organisation is able to identify internal sources of knowledge that are relevant and needed for organisational performance".

I next developed measures of KI effectiveness.

**Measures of KI Effectiveness**

Measures of KI effectiveness are lacking in the literature. Although many researchers have conceptualised KI and to some extent KI effectiveness, relatively few have attempted to measure it directly.

The measures of KI effectiveness developed for this research were based on the deliverables of KI discussed in section 2.3.1. They are:

The extent to which organisations have explicitly established:

- what relevant knowledge they have within their boundaries.
- what relevant knowledge their employees have.
- which knowledge has high priority or low priority for their organisational performance.
- their knowledge gaps (knowledge that they need but do not have).

I have covered the literature around KI, its methodology, its deliverables, KI methods and have established definitions of both KI and KI effectiveness. Some gaps in the literature have surfaced.

Next, I summarise the review of the KI literature. I list the literature gaps that were identified in the review of the literature on KI and draw the corresponding research questions in the following section.

### 2.3.8. Summary of KI and KI Effectiveness

The purpose of section 2.3 was to develop an understanding of what KI is about. The literature around KI and KI methods was reviewed and discussed, and definitions of both KI and KI effectiveness were generated.

In this thesis, Knowledge Identification is defined as: "the process whereby organisations identify the relevant and needed knowledge that exists within their boundaries".

Knowledge Identification effectiveness in this thesis is defined as: "the extent to which an organisation has identified internal sources of knowledge that are relevant and needed for organisational performance".

The review of the literature revealed that little is known about KI practices among organisations. Little is known about the problems organisations face with respect to

KI and in identifying sources of knowledge. More importantly, there is no concrete and empirical evidence to support the critical nature of KI to KM.

The next section lists the literature gaps identified in the review of the literature on KM and KI and draws the corresponding research questions.

## 2.4. Literature Gaps and Research Questions

Two key objectives of chapter two were to map out the conceptual landscape of this research and define the gap in the literature that this research set out to fill. Chapter two provided a review the relevant literature surrounding KM and KI in an attempt to find answers to the following questions:

Is KI critical to KM? To what extent does effective KI influence effective KM? How prevalent are KI practices among organisations? What problems do organisations face with respect to KI?

Answers to these questions have remained elusive and literature around KI has proven to be scarce. The review of literature surrounding yielded in the literature gaps listed in table 2-4 below.

**Table 2-4 Literature gaps.**

| The literature gaps identified are: |
| --- |
| 1. We know little about the extent to which organisations practise KI. If KI is practised, how well is KI practised? If KI is not practised, why not?<br>2. We know little about how organisations practise KI. In other words, what KI methods do organisations currently use?<br>3. We know little about what problems organisations have with respect to KI and KI methods. What are the factors that influence the effectiveness of KI?<br>4. We know little about whether or not effective KI influence effective KM. To what extent does KI effectiveness influence KM effectiveness? |

These literature gaps were categorised into two groups: First, the KI practices, that is the lack of research around KI. Second, KI *vis-à-vis* KM, that is, the strength of the relationship between KI and KM.

The relationship between KI effectiveness and KM effectiveness was a key literature gap. Filling the gap surrounding this relationship would establish not only whether or not KI is critical to KM, but also whether or not KI itself is critical and warrants further research.

The lack of research around KI practices among organisations was also an important literature gap to fill. A richer understanding of the KI practices among organisations would shed some light on the problems that organisations face with respect to KI and KI methods. In turn, these problems would lead to establishing the factors that influence KI effectiveness.

These were the literature gaps that this research set out to fill and formed the basis of the research questions that this research set out to answer and the sequence in which they were answered. The table below lists the research questions.

**TABLE 2-5 RESEARCH QUESTIONS.**

| The research questions are: |
|---|
| 1. To what extent do organisations practise KI?<br>2. What KI methods are currently used by organisations?<br>3. What are the problems different KM stakeholders face with respect to KI and KI methods?<br>4. What are the factors that influence KI effectiveness?<br>5. To what extent does KI effectiveness impact KM effectiveness? |

Research questions four and five are depicted in the research model in figure 2-17 on the next page. A model can be defined as "an intellectual construct in artefact form that provides an abstract, highly formalised, often visual yet simplified representation of a phenomenon and its interactions." (Coffey and Atkinson 1996).

Before continuing further to constructing the research design, a couple of terms in the research questions needed clarification: the term 'problem', and who KM stakeholders are.

With regards to what a problem is, the following definition of the term problem from Kroenke (2006) was adopted: a problem as "a perceived difference between what is and what ought to be" (Kroenke 2006, p. 31).

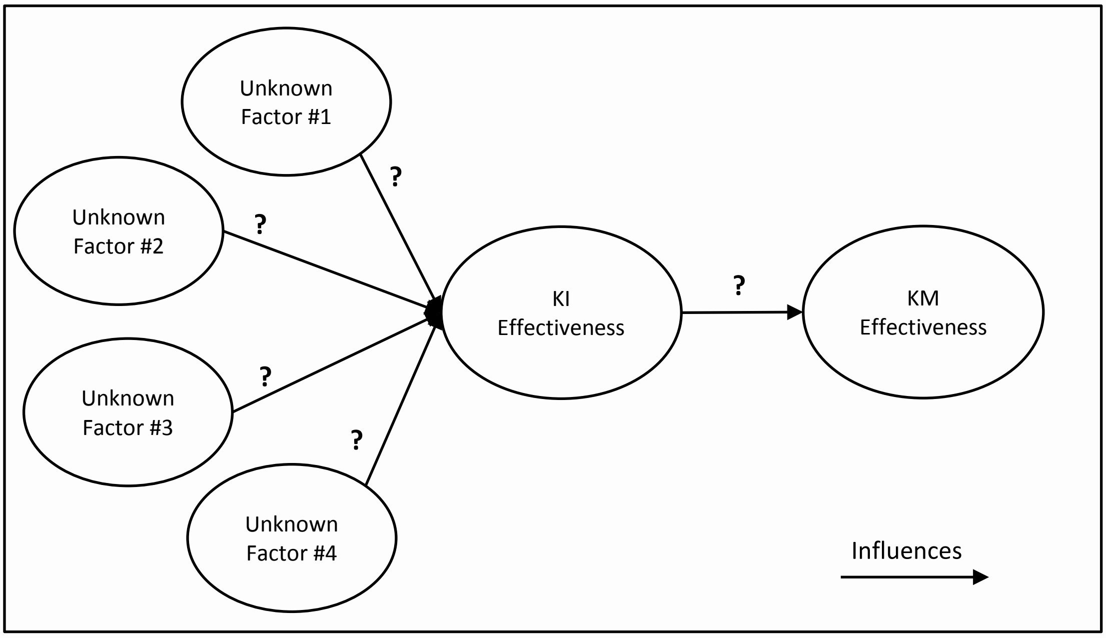



**FIGURE 2-17 RESEARCH MODEL.**

As to who KM stakeholders are, it is quite obvious that KM is an organisational endeavour involving everyone across the organisation from non-management to management (CEOs, CIOs, CKOs, Director of Human Resources, as such). Therefore, KM stakeholders in this research included: management and non-management.

That said, KM and KI are both organisational endeavours. Hence, management, employees who have a strategic overview of the KM (and KI) initiatives within their organisations (e.g. implementing a new KI method), were clearly key stakeholders.

Next, I summarise chapter two. I discuss the approach to research design and the research methods used in this research in the next chapter.

## 2.5. Chapter Summary

Some of the key take-aways from chapter two are highlighted below:

Chapter two provided a richer understanding of both KM and KI, and mapped out the conceptual landscape of this research. Chapter two yielded definitions of knowledge, KM and KI.

Whereas the definitions of knowledge and KM were derived from previous definitions in the literature, the definition of KI was constructed based on literature reviews. Table 2-6 below lists the definitions of knowledge, KM and KI used throughout this research.

**TABLE 2-6 DEFINITIONS USED IN THIS RESEARCH.**

| Terms | Definitions |
|---|---|
| **Knowledge** | "facts, information and skills". |
| **Knowledge Management** | "the process whereby organisations identify and leverage knowledge assets to drive and support overall organisational performance" (Jennex, Smolnik, and Croasdell 2016; O'Dell and Grayson 1998). |
| **Knowledge Identification** | "the process whereby organisations identify the relevant and needed knowledge that exists within their boundaries". |

Chapter two also yielded a number of literature gaps. A key literature gap surrounded the relationship between KI effectiveness and KM effectiveness. These literature gaps were developed into research questions.

In the next chapter, the approach to research design applied to obtain the answers to those research questions is discussed.

“Attempting to force one technology or tool to satisfy a particular need for which another tool is more effective and efficient is like attempting to drive a screw into a wall with a hammer when a screwdriver is at hand: the screw may eventually enter the wall but at what cost?”

Codd, Codd and Salley (1993).

# Chapter Three: Research Design and Method

In the previous chapter, I reviewed the relevant literature surrounding both concepts of Knowledge Management and Knowledge Identification. This review yielded a rich understanding of what knowledge itself means, what KM and KI are about, and how KM and KI are connected.

I established both definitions and measures of effective KM and effective KI, and identified a number of gaps in the literature surrounding KI. Those literature gaps were translated into research questions that this research set out to answer. The research questions are listed in the table below.

**TABLE 3-1 RESEARCH QUESTIONS.**

| **The research questions are:** |
|---|
| 1. To what extent do organisations practise KI?<br>2. What KI methods are currently used by organisations?<br>3. What are the problems different KM stakeholders face with respect to KI and KI methods?<br>4. What are the factors that influence KI effectiveness?<br>5. To what extent does KI effectiveness impact KM effectiveness? |

Having a list of research questions to answer, the next step was to construct a research design to answer those research questions. In other words, construct a detailed outline of how the investigation would take place.

Chapter three thus explains the rationale behind the research design constructed; the research methods used and the reasons for using them are discussed and justified.

## 3.1. Overarching Research Design

The overarching approach used to construct the research design was to match the research methods to the research questions. The research paradigm adopted was informed by the nature of the phenomena being observed. In order to learn what is relevant to the KM stakeholders, the interpretive paradigm was adopted.

How the research questions determined the research design is described below, specifically:

- whether the research was cross-sectional or longitudinal,
- whether the research was quantitative or qualitative, and
- whether the research was conducted in one phase or in multiple phases.

Research questions one and two (RQ 1 and RQ2) were straightforward questions about the extent to which KI was practised and the KI methods currently used by organisations. The unit of analysis here was the organisation.

RQs 1 and 2 demanded exploratory research. Exploratory research can be considered as "a valuable means of finding out what is happening; to seek insight; to ask questions and to assess phenomena in a new light" (Robson 2002, p. 59).

Answering RQs 3 and 4 was harder and more time-consuming. RQ 3 was about identifying the problems that different KM stakeholders face with respect to KI and KI methods, and demanded exploratory research. RQ 4 on the other hand was about identifying the factors that influence KI effectiveness and demanded explanatory research.

Both RQs examined the same domain, one in breadth (RQ 3), the other in depth (RQ 4). In practical terms, the explanatory research built on the previous exploratory research and identify the root causes - explaining why events occur, with a view to build, elaborate or extend a theory (Neuman 2006).

Once the KI landscape was defined through the exploratory research, a mix of exploratory and explanatory research was further conducted to identify the problems different KM stakeholders face with KI and the cause-and-effect relationships among factors influencing KI effectiveness. The unit of analysis here was a mix of organisational and individual level.

Finally, while RQs 3 and 4 developed the theory, the final research question, RQ 5, demanded theory-testing research to empirically validate the theory constructed (the factors identified in RQ4). The unit of analysis here was at an organisational level.

This research was thus designed to be conducted in three phases using multiple methods. I used a cross-sectional study design; I took a snapshot of the phenomenon of interest (the KI landscape) at one particular point in time.

Table 3-2 below lists the five research questions, their respective research nature (informed by Roberts and Grover 2009) and the three phases of this research. As for the specific methods used, again the nature of the research questions informed the choice of the methods used.

**Table 3-2 Phases of research.**

<table>
<tr><th>Research questions</th><th>Research nature</th><th>Research phase</th></tr>
<tr><td>1. To what extent do organisations practise KI?<br>2. What KI methods are currently used by organisations?</td><td>Exploratory. Descriptive and enumerative.</td><td>Phase one</td></tr>
<tr><td>3. What are the problems different KM stakeholders face with respect to KI and KI methods?</td><td rowspan="2">Exploratory and Explanatory. Interpretive and theory building.</td><td rowspan="2">Phase two</td></tr>
<tr><td rowspan="2">4. What are the factors that influence KI effectiveness?</td></tr>
<tr><td>Theory testing.</td><td>Phase</td></tr>
</table>

| | | |
|---|---|---|
| 5. To what extent does KI effectiveness impact KM effectiveness? | | three |

Each phase of the research is described in more detail in the following sections. I discuss the source of data, the data collection method and the method of analysis. I also discuss research quality and ethical considerations in the second last section of this chapter.

# 3.2. Phase one: Exploratory Survey

Phase one was primarily concerned with the extent to which organisations practise KI and the KI methods organisations currently use (RQs 1 and 2). The objectives of phase one were to obtain a broad brush of KI practices among organisations and initial responses to research questions three and four.

I describe the research design for phase one in more detail next.

## 3.2.1. Source of Data Collection

As indicated at the end of chapter two (Review of Relevant Literature), the source of data for all three phases of this research was KM stakeholders. KM stakeholders include: management (CEOs, CIOs, CKOs, Director of Human Resources) and non-management.

The selection of KM stakeholders in phase one was informed by Burstein et al. (2010). As noted in chapter two (Review of Relevant Literature), their survey carried out to determine who had authority over KM strategy among the top 900 organisations in Australia (ranked by profit, listed in the 'Who's Who in Business, 2005' of Dun and Bradstreet Marketing Pty. Ltd.), showed that four in five organisations have a formal position for authority over KM strategy.

Senior executives acknowledged that they have this authority. In ranking order: CEO (28%), Exec Group (24%), CIO (11%), DHR (Director of Human Resources) (7%), CKO (6%) and no formal role (24%). There was no available data to indicate the composition of the executive group "and whether this group included CKO." Burstein et al. (2010).

In other words, management is most likely to have overall knowledge of KM (and KI) initiatives in their organisations. The KM stakeholders targeted in phase one was therefore management.

The ideal population in phase one would be the management of the top 1000 largest organisations in Australia, ranked by employee number. Such a population is ideal because large organisations are more likely to have more employees and are more likely to execute or be aware of Knowledge Management initiatives within their organisations (Guthrie et al. 1999; Zhou and Fink 2003).

In this research, a list containing the top 1000 IT users (based on the number of screens) in Australia, was used. While perhaps not exactly like the ideal population, this population is likely to bear similar characteristics.

The list, purchased from a commercial list provider, contained the contact details (including title, name, contact phone, postal address and switchboard number) of C-level employees at 1000 organisations in Australia.

This list was used only once before this research (see Dell 2012); thus reducing the risk that survey fatigue being a concern in this research. The KM stakeholders in phase one consisted of management, including CIOs, IT Directors and IT managers in Australia. These stakeholders would be likely to be aware of the KI methods available and of KM initiatives within their respective organisations.

### 3.2.2. Data Collection Method

The characteristics of a large population - breadth rather than depth - were sought. Hence, a survey methodology was adopted; no other method of observation can provide this generalisation capability.

A short, paper-based questionnaire-survey was conducted. The short questionnaire included multiple choice questions and open-ended questions related not only research questions one and two but also research questions three and four. The aim of doing so was to obtain initial responses to the latter research questions.

Phase one was primarily concerned with the extent to which organisations practise KI and the KI methods organisations currently use. Some of the pertinent questions asked are listed below:

- How important is it to identify what knowledge exists within your organisation?
- To what extent does your organisation identify existing knowledge?
- To what extent has knowledge that exists within your organisation been identified?

A five-point uni-polar, Likert scale: From 'Not at All' to 'To a Great Extent', with the last option as 'Don't know' was used. A copy of the questionnaire can be found in Appendix A. Before the survey was released, the survey questions was piloted and altered accordingly to increase reliability and validity of responses.

The questionnaire was mailed to the participating organisations via post, with a prepaid return envelope. Participants were told that they would receive a copy of the survey findings as a benefit to their participation. Further, the questionnaire was personalised to improve response rates (Edwards et al. 2002).

The purpose of the survey was made clear to the participants by means of an information sheet. A copy of the information sheet can be found in Appendix A.

To address possible nonresponse bias, the questionnaire was also sent a second time to all non-respondents and second-round responses were compared to first-round responses (Armstrong and Overton 1977). Data collection was expected to take around nine months - three months for each round, with a three-month break in between.

Given the need to follow-up with non-respondents of the survey and the need for participants in later phases of the research, a non-anonymous questionnaire was used. At the end of the survey, respondents were asked: "If you would like to further share your thoughts about knowledge management, please complete the following" and space was provided to write their names and e-mail addresses.

These contact details were then used in phase two to send copies of the survey findings and invite participants for phase two.

### 3.2.3. Sample Size

The key question here is: how large of a sample is required to infer research findings back to a population? The population in question here is the 1000 organisations.

The calculation of appropriate sample size depends on multiple factors and in some instances on crude estimates. To determine the sample size required, I was informed by Cochran (1977) and Bartlett II, Kotrlik and Higgins (2001).

"One method of determining sample size is to specify margins of error for the items that are regarded as most vital to the survey." (Cochran 1977, p. 81). In this case, the extent to which organisations practise KI and the KI methods organisations currently use. The Likert scale used in the questionnaire warranted the treatment of the scale as continuous data.

Two other factors to take into account in estimating sample size include: the estimation of variance, or, standard deviation and the margin of error.

With respect to estimating variance, "one must determine the inclusive range of the scale, and then divide by the number of standard deviations that would include all possible values in the range, and then square this number". In this instance, the calculation was as follows:

$$Standard\ Deviation\ Estimate = \left(\frac{5\ (number\ of\ points\ on\ the\ scale)}{4\ (number\ of\ standard\ deviations)}\right)^2 = (1.25)^2$$

With respect to margin of error, an alpha level (the level of risk a researcher is willing to take that true margin of error may exceed the acceptable margin of error) of 0.05 was used - which represents a $t$-value of 1.96. A margin of error of 3% was used - these are acceptable values used in previous research (Krejcie and Morgan 1970).

The formula below from Bartlett II, Kotrlik and Higgins (2001) was used to determine the sample size required:

$$n = \frac{t^2 \, X \, s^2}{d^2} = \frac{(1.96)^2 \, X \, (1.25)^2}{(5 \, X \, 0.03)^2} = 266.78$$

$$n = Sample\ size\ estimate$$

$$t = value\ for\ selected\ alpha\ level$$

$$s = estimate\ of\ standard\ deviation$$

$$d = acceptable\ margin\ of\ error$$

A sample size of 267 was required.

As mentioned earlier, Burstein et al. (2010) carried out a survey to determine who had authority over KM strategy among the top 900 organisations in Australia, and obtained a response rate of 9.8 per cent, or, 88 respondents.

Zyngier (2002) also conducted a similar survey of CEOs, CIOs and Director of Human Resources of the top 1000 organisations in Australia and obtained a response rate of 15.1 per cent that is, 151 respondents.

Surveys delivered to CEOs, CIOs, Director of Human Resources and other senior executives typically have lower response rates than other surveys (Baruch 1999). Hence, the desired response rate for this research was equal or better than those two studies.

### 3.2.4. Data Analysis Method

The data collected from respondents from both rounds of survey were analysed using quantitative data analysis methods; mostly statistical, including measures of central tendency (frequencies, percentages, median and mode) and association between variables (for example organisation size, organisation industry, KI method used and organisational position). Data collected from open-ended questions were analysed using qualitative data analysis and basic descriptive statistics.

At the end of the data analysis phase, survey findings were sent out to all those respondents of the survey who had provided their contact information.

Phase one thus provided a broad brush of the KI landscape, including the extent to which KI is practised among organisations (RQ 1) and a list of KI methods used by organisations (RQ 2) and established a baseline for issues to further investigate research questions three and four in phase two.

## 3.3. Phase two: in-Depth Interviews

Phase one provided a broad brush of the KI landscape, including the extent to which KI is practised among organisations (RQ 1) and a list of KI methods used by organisations (RQ 2).

Phase two was concerned with RQs 3 and 4: What are the problems different KM stakeholders face with respect to KI and KI methods? What are the factors that influence KI effectiveness?

The objective was to identify the unknown factors in figure 3-1 below. To that aim, the plan was to follow up on the responses from the survey in phase one, particularly in relation to RQs 3 and 4, and drill down into the problems different KM stakeholders face with respect to KI and KI methods to surface the factors influencing the effectiveness of KI.

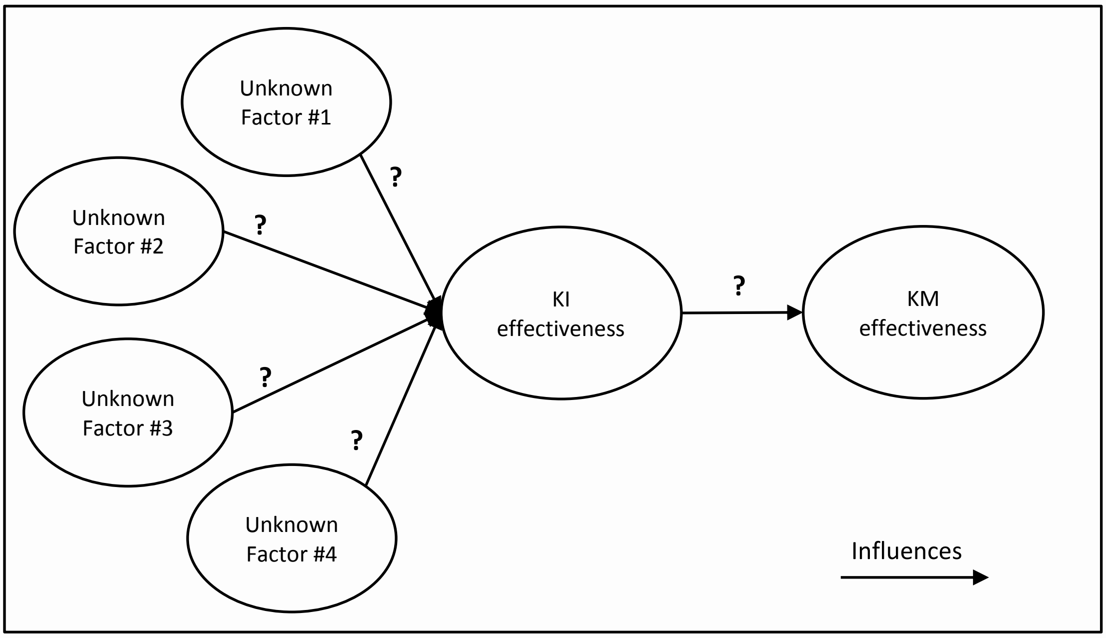



**FIGURE 3-1 RESEARCH MODEL.**

I describe the research design for phase two in more detail in the following sub-sections.

### 3.3.1. Source of Data Collection

The selection criteria for KM stakeholders for phase two was different from phase one. That is because RQs 3 and 4 required the views of different KM stakeholders to be obtained and minimise the risk of any halo effect.

In other words, the KM stakeholders in phase two were not restricted to management but included a wider range of KM stakeholders from non-management to management. Participants in phase two included both individuals with and without overall KM responsibility at their respective organisations.

Recruitment of participants was done in two ways. First, theoretical sampling was applied on the list of respondents from phase one. This was done with a view to obtain as much breadth in terms of insights as possible. Some of the considerations in doing the theoretical sampling included: the KI methods used, organisational positions, organisation size and KI effectiveness.

Second, snowball sampling was applied to participants who passed through the selection screen. The rationale behind the snowball sampling is that the participants who have been through the interviews are likely to know others who also have targeted characteristics.

To invite participants, a copy of the survey findings from phase one was e-mailed to respondents of phase one who provided their contact details (name and email address). Along with the survey findings, respondents were asked to participate in phase two:

> "… I would also like to invite you to participate in a telephone interview. You indicated that you were interested in further sharing your thoughts on Knowledge Management, and I would appreciate hearing your perspectives on the matter.
>
> Could you please give me your telephone number so I can contact you to arrange a suitable time for the interview? …"

A copy of the email sent can be found in Appendix B. After their participation, respondents were asked if they knew anybody else with similar responsibilities who may be interested in this research.

### 3.3.2. Data Collection Method

Instead of questionnaires, interviews were chosen as a method of data collection. This is because of the need for deeper responses – both in terms of clarification over the survey responses in phase one and in terms of investigating the responses in phase two. Interviews are more effective in obtaining deeper responses than questionnaires.

In-depth and semi-structured interviews were conducted. Due to limited resources available, the interviews were conducted over the telephone.

For the purpose of this research project, all interviews had to be conducted by the same person. Doing so inherently attracts some level of interviewer bias. Interviewer bias cannot be totally eliminated, but measures adopted to minimise bias include:

- Training, in the form of reading through Myers and Newman (2007),
- Sound neutral,
- Probe adequately (detailed further below),
- and analyse interview transcript to identify bias after each interview before conducting the subsequent interview.

How the interviews were conducted was informed by Spradley (1979). Rapport must be developed in the beginning of the interview process before information elicitation can begin. Interviewing requires trust between interviewer and participant, and developing this rapport with participants is a difficult process that must be tailored to each individual (Spradley 1979).

The purpose of the interviews was made clear to the participants by means of an information sheet sent to the participants prior to the interviews. A copy of the information sheet can be found in Appendix B.

The researcher also reviewed the responses provided by the respondents prior to their interviews and took some time to research the organisations the respondents work at, with a view to build a 'connection' with the respondents.

Interviews began with general, descriptive 'grand tour' questioning style in which participants are asked to describe spaces, specific time periods, events, people, activities, or objects, before becoming more and more specific (Sorrell and Redmond 1995; Spradley 1979).

Subsequent questions become more explicit; structural questions are used to organise and verify information gleaned from the informant, and to ask for explanations (Sorrell and Redmond 1995; Spradley 1979).

Finally, contrast questions, which involve asking participants to compare different terms, can be employed to help understand the meanings of key words used by participants (Sorrell and Redmond 1995; Spradley 1979).

Often, different types of questions are used concurrently. It is up to the researcher to decide when the interview should develop from one form of question to another (Sorrell and Redmond 1995; Spradley 1979). The list of questions asked can be found in Appendix B.

### 3.3.3. Sample Size

Interviews were conducted until theoretical saturation or informational redundancy (the point in time during data collection when new data no longer brought additional insights to the research questions) was reached.

In other words, the sample of interviewees was not intended to be representative in a statistical sense. The intent was to be exhaustive (i.e. reach saturation (see sub-section on sample size below)) and foster trust in the data rather than to generalise the findings.

It was difficult to estimate how long data collection would take as it depends on a number of factors including: availability of the interviewees and when saturation was reached.

For data analysis purposes, the interviews needed to be recorded. Consent was sought from the participants to record the interviews. Notes were also taken during the interviews. These interview notes and transcripts were then used for the data analysis that followed.

### 3.3.4. Data Analysis Method

A combination of domain analysis and cognitive mapping was chosen as the method of data analysis for the interview notes and transcripts.

While domain analysis, a qualitative data analysis method further explicated below, helped surface the 'units of meaning', the preliminary categories and the relationship among the preliminary categories, cognitive mapping helped focus on the cause-effect relationships among the preliminary categories.

Domain analysis was informed by Spradley (1979) and Atkinson and Abu El Haj (1996). The researcher had previous experience in domain analysis as reported in Newk-Fon Hey Tow et al. (2010).

The term 'domain' is a cover term or name for the domain. Domains are made up of three elements:

1. A cover term or name for the domain
2. Several included terms or names for all the smaller categories inside a domain
3. A semantic relationship linking the cover and included terms.

Domain analysis typically consists of three stages (Atkison and Abu El Haj 1996; Spradley 1979). The first stage segments the interview data collected into 'units of meaning'. Prior to the segmentation process, the interview data is read at least three times to ensure that the researcher is immersed in the 'flow' and interprets the data correctly.

In the second stage, the units of meaning are organised into preliminary categories. This involves the first level of abstraction. We look for patterns in the data, themes and similarities, while ensuring that sufficient information about the context from which the units of meaning were derived was included (Seaman 1999).

In the third stage, the preliminary categories are refined and consolidated to obtain a list of the dominant categories - the second level of abstraction. These dominant categories are domains and ultimately become the factors being investigated.

For quality assurance, the units of meaning are then allocated back to their respective domains and then scrutinised to identify relationships between the domains.

The relationships among the preliminary categories take various form including: 'is an example of' relationships, 'forms' relationships, 'influences' relationships, or 'causes' relationships.

In parallel with domain analysis, the research used cognitive mapping to identify the cause-effect relationships among the dominant categories and the domains. In other words, I focused on relationships that explained and demonstrated the factors influencing KI effectiveness. Examples of such relationships include: 'as a result', 'due to', 'because', 'led to', and as such.

Cognitive mapping was informed by Venable (2005). Cognitive mapping is a form of causal mapping; a diagramming technique for analysing causes and consequences of problems.

As indicated earlier, these dominant categories (or domains) become the factors influencing the KI effectiveness, and together with the relationships, generate the hypothesised model as shown in figure 3-1 above.

Phase two thus answered RQs 3 and 4, and generated a model of potential factors that influence KI effectiveness. The objective of the next phase (phase three) was to test the model.

## 3.4. Phase three: Theory-Testing Survey

While phase two answered RQs 3 and 4 around problems organisations face with KI, and yielded a model of potential factors that influence KI effectiveness, phase three was concerned with testing and if necessary, refine the model generated.

The goals of phase three were to test the model (or the theory) generated in phase two, and if necessary, refine the model based on the strength of the relationships among the various factors.

Thus, phase three not only answers research question five: "To what extent does KI effectiveness impact KM effectiveness?", but also evaluates the factors influencing KI effectiveness. Phase three as highlighted in the table below relates to RQs 4 and 5.

I describe the research design for phase three in more detail below.

### 3.4.1. Research Design

The data analysis in phase two (consisting of a combination of domain analysis and cognitive mapping) led to the development of a hypothesised model, shown in figure 3-2 on the next page.

In a number of ways, this model represents new theory. As Bollen (1989, p. 72) points out: "Any model is an approximation to [sic] reality. A theory is an abstract set of ideas that links together concepts. A model is a formal representation of a theory."

Further, as Edwards (2011, p. 370) explains, theory development "usually emphasizes the relationships among constructs, describing the direction, sign, and form of these relationships and explaining why and under what conditions these relationships occur."

In this case, the theory in question was effectively the theory of KI effectiveness. The hypothesised model portrays all the above elements from Edwards (2011), and the four elements recommended by Whetten (1989):

- the what - the factors to be considered as part of the explanation of the phenomena of interest (KI effectiveness),
- the how - how the factors identified are related to each other (the arrows and the direction of the arrows),
- the why - the underlying psychological, economic, or social dynamics that justify the selection of factors and the proposed causal relationships, and
- the who, where and when (the limitations or conditions placed on the theory).

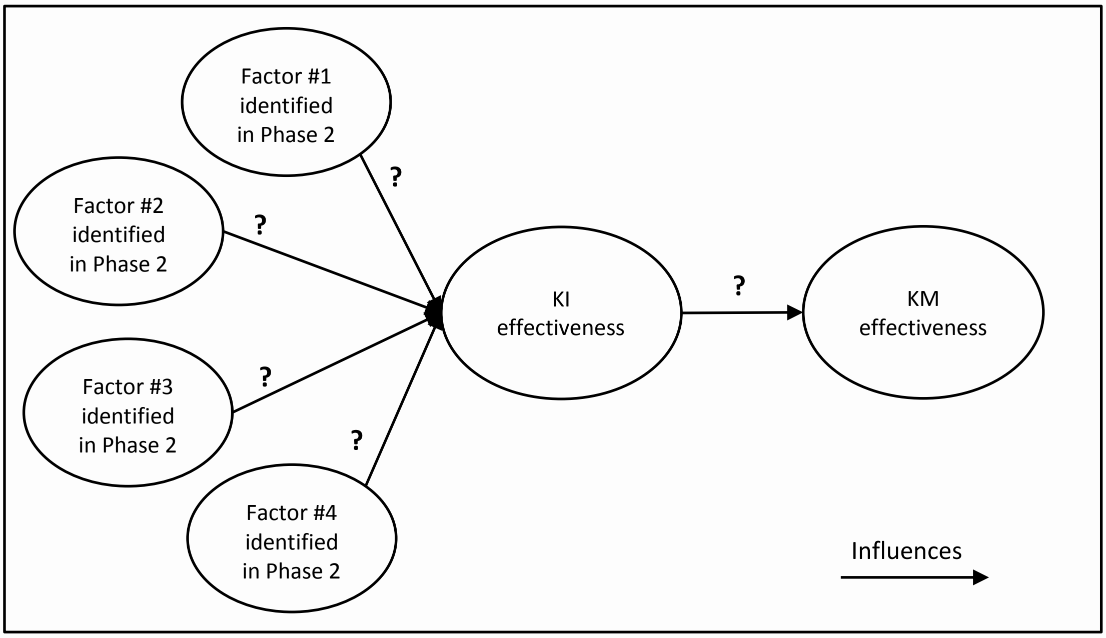



**FIGURE 3-2 HYPOTHESISED MODEL.**

Based on the above, testing the model produced in phase two was thus a theory-testing exercise. What were the theories to be tested? The theories and hypotheses underpinning the model. For example, that KI effectiveness has a positive impact on KM effectiveness. The theories to be tested included:

- KI effectiveness has a positive influence on KM effectiveness.
- The potential factors to be identified in phase two that influence KI effectiveness have a positive impact on KI effectiveness.

I discuss the theory-testing strategy adopted next.

### 3.4.2. Structural Equation Modelling (SEM)

To test the theories, I used a combination of Structural Equation Modelling (SEM) and a questionnaire survey. I describe how the SEM was developed first and then describe how the survey was designed.

SEM, often referred to as a second generation statistical technique, is an umbrella term used to describe a family of statistical methods aimed at testing preliminary or substantive theories.

The rationale for using SEM was that SEM models are carriers of causal assumptions and tools for causal inference. SEM allows for the simultaneous assessment of both the path or structural model (i.e. the relationships among the factors in the model) and the measurement model (i.e. the relationships between the factors and their respective measures), to test theoretical relationships (Edwards et al. 2000; Freeze and Rashchke 2007).

Is SEM a bullet-proof way to prove theories? No; like many others, SEM faces many criticisms. For example, there are controversies around the role of causality in SEM research (see Pearl 2012).

That said, SEM is widely applied in psychological, economic, marketing, management and information systems studies and has been demonstrated to be a powerful tools in establishing the strength of relationships in the complicated models (Bollen 1989; MacCallum and Austin 2000; Shah and Goldstein 2006).

SEM represents an extension of general linear modelling procedures, such as ANOVA and multiple regression analysis. There are various methods (or algorithms) to consider in using SEM. The three most popular classes of methods are: ordinary least squares (e.g. partial least squares (PLS) path analysis), covariance analysis and simultaneous equations regression).

The choice of covariance-based SEM and partial least squares SEM is discussed next.

### Latent Variables and Reflective Indicators

The specific SEM method used was covariance-based SEM. This choice was based on the following:

- The transformation of the model produced in phase two into an SEM was primarily guided by the theory at hand.
- The need to account for the possibility of missing factors and errors. In other words, it might be the case that a relevant or significant factor was not present in the model.
- Covariance-based SEM (CBSEM) accounts for missing factors and errors.

For further discussions on SEM and formative indicators, the interested reader is encouraged to see Edwards (2011), Hardin and Marcoulides (2011), Ringle, Sarstedt and Straub (2012) and Rönkkö and Evermann (2013).

In accordance with covariance SEM terminology, rather than the term 'factors', I used the terms 'constructs' and 'latent variables' and used 'indicators' rather than 'measures'. A latent variable can be defined as a concept that is not directly observable, or whatever its multiple indicators have in common with each other.

In terms of latent variables development, I was informed by MacKenzie, Podsakoff and Podsakoff (2011). They note:

> "many researchers think they have a clear idea of what they wish to measure, only to find out that their ideas are more vague than they thought. Frequently, this realization occurs after considerable effort has been invested in generating items and collecting data – a time when changes are far more costly than if discovered at the outset of the process." (DeVellis 1991, p. 51).

This means that researchers ought to consider having more latent variables than not enough. Taking this into account, I added a couple of latent variables based on the data analysis in phase two, to act as 'backup' variables to be used in the event that the latent variables of interest were insufficient.

In terms of the indicators, according to Diamantopoulos and Siguaw (2006, p. 265, emphasis in original), researchers can follow one of two strategies:

> "depending upon their conceptualisation of the focal construct: they can either treat the (unobservable) construct as *giving rise* to its (observable) indicators (Fornell and Bookstein 1982), or view the indicators as *defining characteristics* of the construct (Rossiter 2002)."

Given that covariance-based SEM was used, reflective indicators were developed (rather than formative indicators) as explained below:

> In reflective SEMs, "measurement items would be viewed as reflective indicators of η and conventional scale development guidelines (e.g. Churchill 1979; DeVellis 2003; Netemeyer, Bearden and Sharma 2003; Spector 1992) would be followed to generate a multi-item measure."
>
> In formative SEMs, "measurement items would be seen as formative indicators of η and index construction strategies (Diamantopoulos and Winklhofer 2001) would be applicable."

There are also various guidelines to be followed when developing reflective indicators - both at the designing stage of the research and at the analysis stage. These are listed below (adapted from Freeze and Raschke 2007):

- Direction of the relationship

Reflective indicators differ from formative indicators in terms of the direction of the relationship with their latent variables. Hence, the researcher needs to pay careful attention to the directional relationship between the latent variables and indicators.

- Misspecification

  Researchers need to clearly define the latent variable and the contextual domain of the latent variable. This will provide an understanding as to how to generate a set of measures that represent the domain of the latent variable.

  When using a latent variable from prior literature, the researcher should ensure that the theoretical reasoning of the latent variable is clearly defined as either formative or reflective.

- Identification / Number of indicators needed

  Careful consideration to the number of indicators is necessary. Bollen (1989) suggests a three-measure rule, meaning that a single latent variable should have three indicators. A latent variable with three reflective measures allows for the covariances among the measures to be used to estimate the factor loading. In this case, the reflective latent variable can be considered to be identified by its own indicators.

  That said one can have less than three indicators - the key is to statistically test whether the latent variable is under or over-identified.

- Validation

  Careful use of 'classical test theory' (Jarvis et al. 2003) to validate the latent variables. In this case, Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA) were used and the relevant battery of tests were applied: convergent and discriminant validity, reliability testing (i.e. Cronbach's Alpha), verifying model fit, variance, and common method bias.

The discussion above and the decision to use reflective indicators, justify the use of the measures developed earlier in chapter two (Review of Relevant Literature) for the KM effectiveness and KI effectiveness latent variables. To reiterate, the reflective indicators used for the KM effectiveness latent variable are:

- Employees have the knowledge they need to do their job.
- Employees would still have the knowledge they need to do their job, even if some employees retired or left the organisation.

If employees do not have the knowledge they need to do their job:

- they can obtain it,
- they can obtain it when they need it, and
- they can obtain it in the form they need it.

The reflective indicators used for the KI effectiveness latent variable are:

Organisations have explicitly established:

- what relevant knowledge they have within their boundaries.
- what relevant knowledge their employees have.
- which knowledge has high priority or low priority for their organisational performance.
- their knowledge gaps (knowledge that they need but do not have).

The reflective indicators for the remaining latent variables were created based on the analysis done in phase two and following the guidelines noted above.

The model generated in phase two was thus transformed into an SEM, with reflective indicators added to each latent variable. The resulting hypothesised model is shown on the next page.

The next sub-section discusses the development of the survey that is, how the SEM along with its indicators was operationalised, and who were the participants targeted.

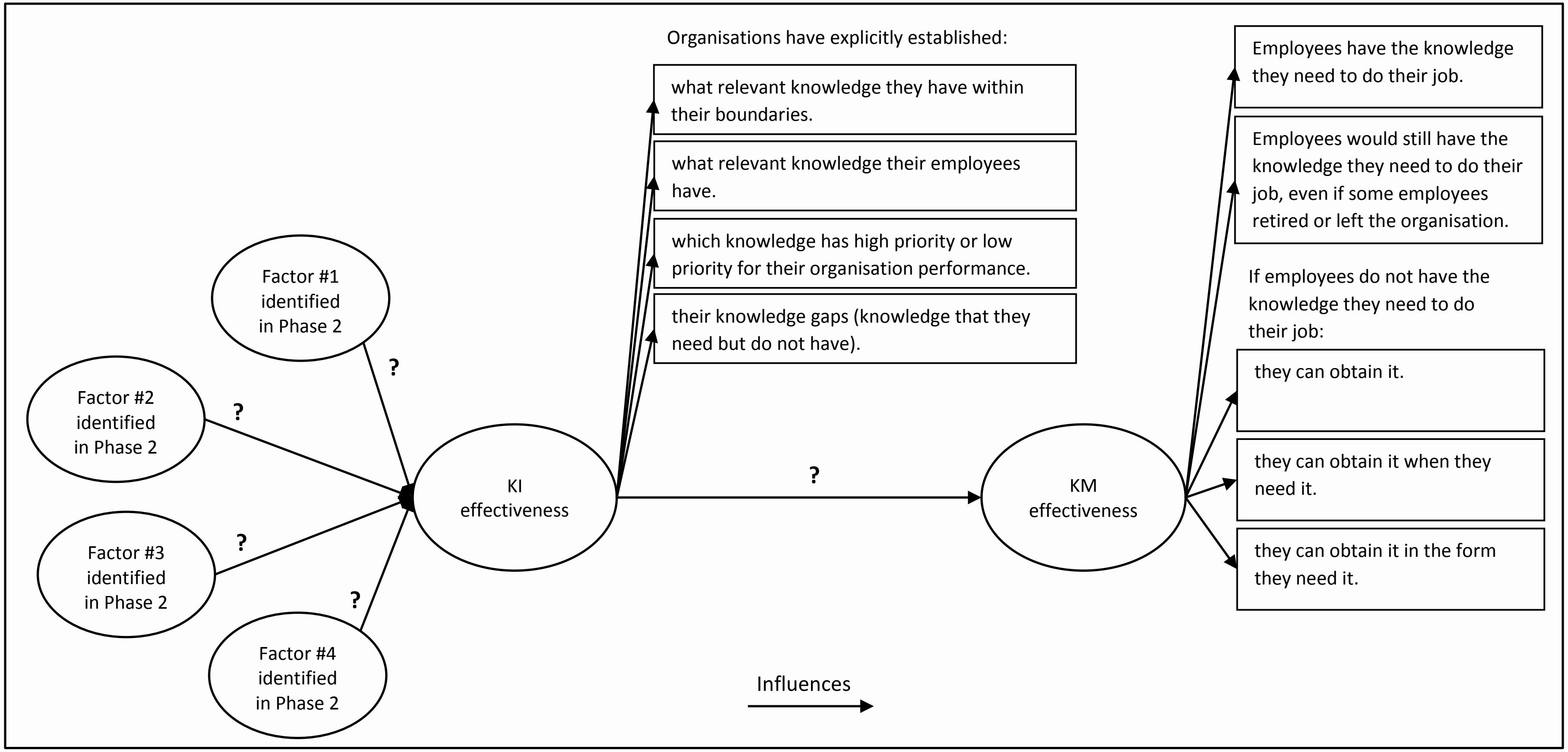



**FIGURE 3-3 HYPOTHESISED MODEL.**

### 3.4.3. Source of Data Collection

The selection criteria for KM stakeholders for phase three was different from the previous phases. The main selection criterion for KM stakeholders in phase three was: the individuals would need to have overall KM responsibility within their respective organisations. The rationale for this choice is that those individuals would be able to speak to each of the latent variables in the hypothesised model at an organisational level.

Further, while we know, based on prior research (see phase one), that management and executives have this responsibility, I also wanted to obtain the views of multiple non-management employees within the organisations.

The rationale for this is two-fold: First, to capture a richer picture of the participating organisations. Second, to reduce the impact of one employee skewing the response for that organisation - that is, lower the risk of bias.

In other words, the KM stakeholders in phase three were not restricted to only management but included individuals with or without overall KM responsibility at their respective organisations.

A survey methodology was adopted to reach a large population effectively and to increase the generalisability of findings and thus generate more robust evidence that would support the model (Herriott and Firestone 1983).

To reduce the risk of bias (including common method bias) in the survey data and to increase generalisability of findings, the reach for participants was global. The intent was to recruit participants who were not involved in the development of the model.

Participants were reached via KM-related groups on the professional networking website LinkedIn and mailing lists of KM-related Special Interest Groups including KnowledgeWorld, APQC, KM, CKO, KM Australia, actKM and NSW KM Forum.

Participants were invited through a post on the main discussion page of the relevant group or a blanket email. Depending on the group, the posts and emails were sent at different times and days of the week so as to maximise visibility of the invitation for participants across different time zones.

Examples of the survey invitations and reminders are shown in Appendix C.

There were some mechanisms that needed to be implemented to execute the strategy described above. I discuss those mechanisms next.

### 3.4.4. Data Collection Method

To execute the strategy above, a number of mechanisms were put in place. The main requirements were:

- I have one questionnaire that would be sent to participants and another version of the questionnaire that the respondents would then use to invite participants within their organisations.
- I have one questionnaire targeted at 'Responsible-for-KM' stakeholders and another questionnaire target at 'Not-responsible-for-KM' stakeholders.

The specific mechanisms used for the surveys are listed below:

- Two web-based questionnaire surveys were developed using the online survey software Qualtrics (https://www.qualtrics.com), one primary survey and one secondary survey. Each survey had its own Uniform Resource Locator (URL).

  The primary survey contained questions targeted at participants either with or without overall KM responsibility ('Responsible-for-KM' questionnaire) (see next points), while the secondary survey contained questions targeted only at participants without overall KM responsibility ('Not-responsible-for-KM' questionnaire).

- Only the URL for the primary survey was sent to the participants. This URL was the first point of contact with the participants.

- Given that I could not ascertain whether the participants had either overall KM responsibility or no KM responsibility, there was logic in the primary survey to navigate the participants to the appropriate set of questions (one set for those with overall KM responsibility and another set for those without overall KM responsibility).

  In other words, respondents were asked within the primary survey whether or not they had overall KM responsibility. The survey would display a specific set of questions depending on the answer given.

The three points below refer to the primary survey:

- At the end of the 'Responsible-for-KM' questionnaire, respondents were asked to pass on the survey (via a pre-drafted email) to non-management (and not responsible for KM) employees using the URL of the secondary survey - a strategy akin to a snowball sampling.

- At the end of the 'Not-responsible-for-KM' questionnaire, respondents were asked to pass on the survey (also via a pre-drafted email) to employees in their organisations with overall KM responsibility, using the URL of the primary survey.
  - In order to identify how many respondents were invited to respond to the survey by somebody other than myself, code was added to the survey such that I was copied in the email.

- In the event that no one had overall KM responsibility, respondents were asked to invite five or more non-management members to answer the 'Not-responsible-for-KM' questionnaire, using the secondary URL. The intent here was to collect as many responses within the organisation and aggregate the responses.

Given the global nature of the source of data collection, the likelihood of more than one participant responding from the same organisation was high. That in itself was not a problem, because should that eventuate, I would average the responses.

However, a mechanism was needed to ensure no duplicate responses from the same respondent was obtained. Given the need to ascertain whether or not respondents were from the same organisation, non-anonymous questionnaires were used.

The organisation name, the job title, and other demographic details of the respondent, along with the IP (Internet Protocol) address and contact details were used to later check for duplicated responses, intentional or accidental - which can bias the results.

The questions for the survey were developed based on the reflective indicators from the research model. For the 'Not-responsible-for-KM' questionnaire, the indicators were translated from a management (or organisational) perspective to a non-management (or individual) perspective.

More details on the reflective indicators are in chapter six (Findings from Theory-Testing Survey). The complete survey logic is drawn on the following pages.

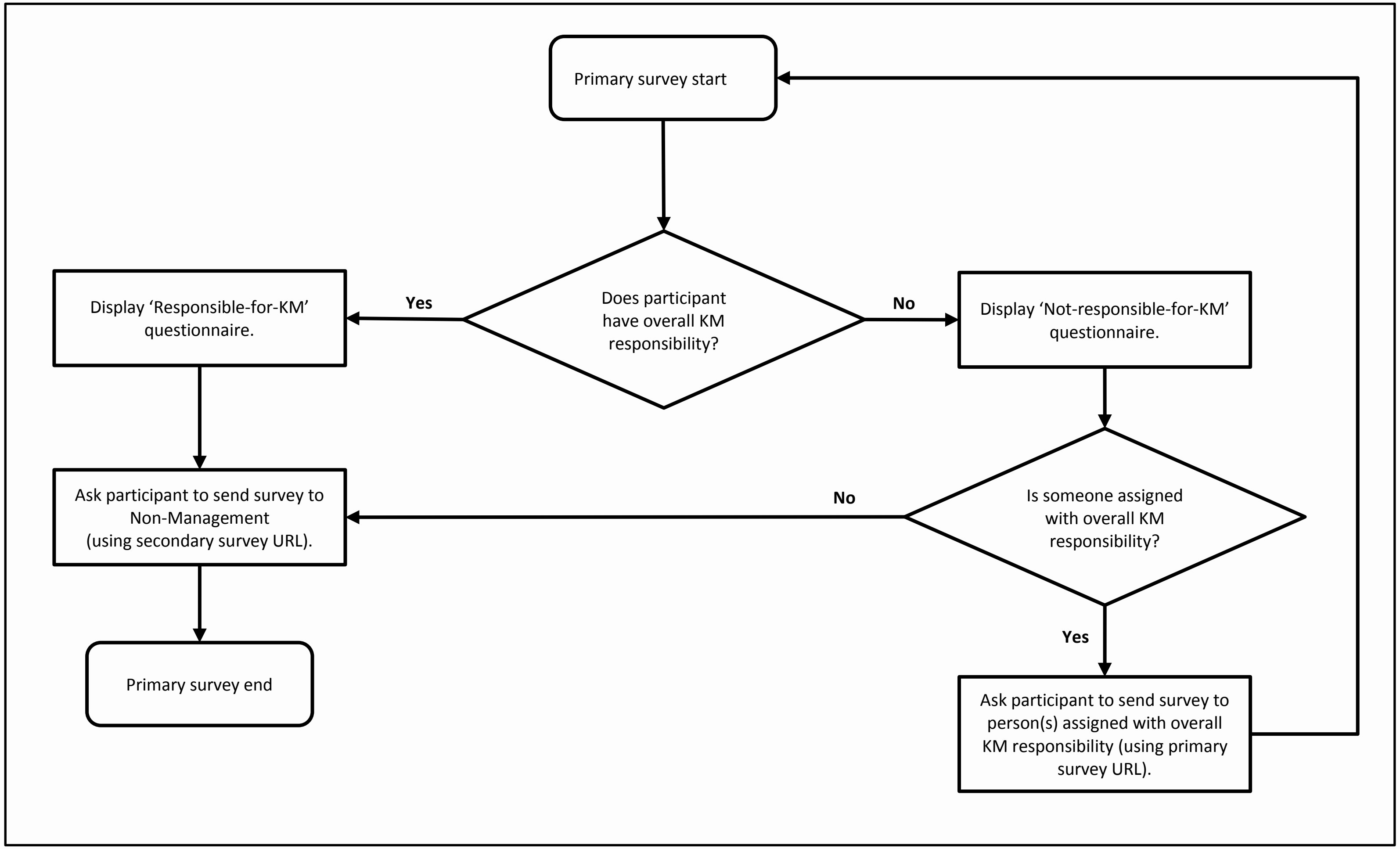



**FIGURE 3-4 SURVEY LOGIC – PRIMARY URL.**

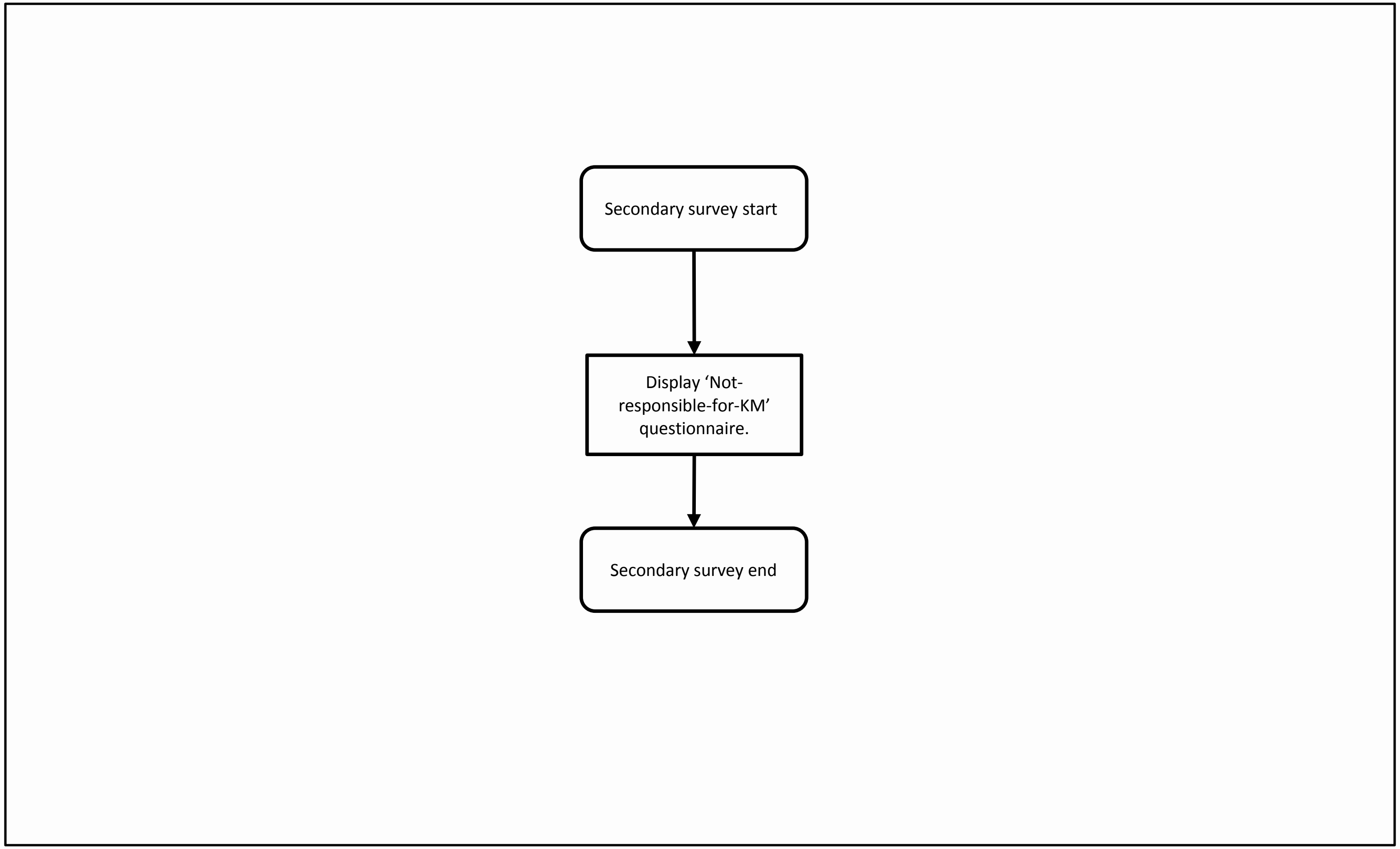



**FIGURE 3-5 SURVEY LOGIC – SECONDARY URL.**

Further, to address potential threats to the validity of the questionnaires and their corresponding findings, a number of measures were taken:

- Common method bias (CMB)

  Common method bias or variance is "variance that is attributable to the measurement method [i.e. in this case, the web-based questionnaire] rather than the constructs the measures represent." (Podsakoff et al. 2003, p. 879).

  Though there is no guaranteed way to fully address CMB yet, if not addressed to some extent, CMB can inflate (or deflate) estimates of structural parameters in the model and may lead to erroneous conclusions (see Conway and Lance 2010, Malhotra, Kim and Patil 2006 and Podsakoff et al. 2003).

  Note that according to Malhotra, Kim and Patil (2006), "common method biases in the IS domain are not as serious as those found in other disciplines."

  That said, there are several methods available to mitigate the risk of CMB. According to Podsakoff, MacKenzie and Podsakoff (2012, p. 540), "[the] major concern with measuring different constructs with the same method is the danger that at least some of the observed covariation between them may be due to the fact that they share the same method of measurement."

  One of the methods available to mitigate the risk of CMB is to use different sources of responses. The sources of responses in phase three were different from that of the previous two phases. Collecting responses from more than one individual in the organisation is also another way that this research increased the validity of the responses.

  Another is to mix the order of the questions and use different scale types. While the questions related to each latent variable were listed next to each other, the ordering of those sets of questions were set such that participants would not immediately jump to the conclusion that the questions were related.

The intent is to reduce the likelihood that the participants know what theory was being tested.

See point below on the use of different scale measurement.

Yet another method to mitigate the risk of CMB is to add an additional latent variable not related to the theory at hand. While relatively easy to implement, "[the] disadvantages are many" (Podsakoff, MacKenzie and Podsakoff 2012, p. 553). Remedies have been proposed; for example, Williams et al. (2010) propose a three-phase confirmatory factor analysis marker technique. In this research, I added a single-factor latent variable.

I also compared the 'Responsible-for-KM' responses to those from the 'Not-responsible-for-KM' responses. This was done to establish the extent to which the responses from the 'Responsible-for-KM' questionnaire regarding the dependent variable (KM Effectiveness) correlate with the responses from the 'Not-Responsible-for-KM' questionnaire from the same organisations. A low correlation would indicate a possible method bias.

I used 'organisation size' and 'organisation industry' as control variables. The underlying assumption is that larger organisations have higher number of employees and a greater amount of knowledge. The industry in which an organisation is may also have an influence on KI and KM, and is therefore considered as a control variable.

- Inattentive respondents

  The polarity of some of the questions asked was reversed half-way through the questionnaire to ensure that the respondents were reading the questions asked.

Further, every effort was made to: "keep questions simple, specific, and concise; define ambiguous or unfamiliar terms; decompose questions relating to more than one possibility into simpler, more focused questions; avoid vague concepts and provide examples when such concepts must be used; and avoid complicated syntax (see Tourangeau et al. 2000)" Podsakoff, MacKenzie and Podsakoff (2012, p. 551). This is evidenced by below:

- I did not use "Double-barrelled" questions. In other words, each question asked had only one subject.

- Scale measurement
  I used an 11-point bi-polar, Likert scale: From Completely Disagree to Neutral to Completely Agree, with the last option as: Unable to judge.

  Using a smaller scale (e.g. a 4-point scale) would minimise the degree of variance in the responses. Using a larger scale (e.g. a 13-point scale) would introduce a lot of noise (e.g. respondents would have difficulty differentiating between the $11^{th}$ and $12^{th}$ point).

- Pilot testing
  Before the survey was released, the survey questions were subjected to pre-testing and pilot-testing by a group of five KM practitioners who were not in the main sample. The survey questions were then altered accordingly to increase reliability and validity of responses.

Copies of both surveys can be found in Appendix C.

### 3.4.5. Sample Size

As Kaplan (1995, p. 117) declares, "Assessing power, therefore, must now become a routine part of establishing the statistical validity of an estimated model."

Just like in phase one, estimating sample size depends on a number of factors; in many cases, it depends on the statistical method used. In this case, given the nature of the method chosen (i.e. CBSEM), the question of appropriate sample size depended to a large extent on statistical power. Statistical power in linear regression (which underpins SEM) is a well-understood function of effect size, sample size, number of predictors (latent variables) and significance level.

The adequate sample size should therefore be sufficient to obtain necessary statistical power. The problem is that there "is no guideline backed by substantial research for choosing sample size in CBSEM." (Gefen, Rigdon and Straub 2011, p. A4).

There are web sites available to calculate the minimum sample sizes needed to achieve adequate power under different conditions in linear regression. For example, see: http://www.danielsoper.com/statcalc3/calc.aspx?id=89.

However, the parameters that are needed for this calculation include the number of latent variables, the number of observed variables, the desired statistical power level, the anticipated effect size and the probability level. These parameters (particularly the number of latent variables and observed variables (indicators)) would be available only at the end of phase two - at the end of the data analysis (domain analysis and cognitive mapping).

Thus, I needed another way to estimate the sample size. Given the situation where I do not know how many latent variables I would have, I resorted to general convention or 'rule of thumb'.

Experience argues for a practical minimum of 200 observations for a moderately complicated SEM using maximum likelihood (ML) estimation (Gefen, Rigdon and Straub 2011, p. A4). Further, in terms of statistical power, across the social sciences, convention specifies 80 per cent as the minimum acceptable power (Gefen, Rigdon and Straub 2011).

The general rule of thumb is to have 10 times the number of independent latent variables influencing a dependent latent variable (Barclay et al. 1995; Gefen et al. 2000).

Hence, the sample size desired in this research was 200 or 10 times the number of independent latent variables, whichever was greater.

### 3.4.6. Data Analysis Method

After the data collection phase, the next step was to analyse the data. Prior to analysis, survey responses were screened, verified, validated and standardised.

Survey responses checked for completeness, missing data and validity (e.g. having a respondent answering in the following pattern throughout the questionnaire: 1, 2, 3, 4, 1, 2, 3, 4). Incomplete or invalid responses were discarded and were not used for further analysis.

Once the responses were checked, the valid responses were prepared for analysis. This entailed standardising the responses, for example reversing the responses where the polarity of the measurement scale was reversed.

Given the intent of the data collection for the 'Responsible-for-KM' questionnaire, the data analysis performed on responses from the 'Responsible-for-KM' questionnaire was more extensive than the one for the 'Not-Responsible-for-KM' questionnaire. I explain the data analysis process in two parts below.

**Data Analysis for 'Responsible-for-KM' Questionnaire**

I used two types of Factor Analysis to analyse the data from the 'Responsible-for-KM' questionnaire. Given that I did not use any established scales directly from the literature (i.e. I had primary data), I had to perform an Exploratory Factor Analysis (EFA) on the data collected before doing a Confirmatory Factor Analysis (CFA).

Factor Analysis can be applied in an exploratory fashion to reveal patterns among the inter-relationships of the indicators. EFA as the name suggests, explores the data for patterns.

I used an EFA to test whether the sets of indicators designed to measure the respective latent variables do in fact reveal the hypothesised factor structure (i.e. whether the underlying latent factor truly "causes" the variance in the observed variables and how "certain" we can be about it).

EFA helped trim off some items to reduce error and increase reliability. EFA helped explore the actual (rather than just theoretical) correlations between the indicators, with a potential to reveal underlying construct that I did not intend to capture.

The tests or checks that I looked for include:

- Adequacy: Are the indicators adequately correlated to justify the use of EFA?
- Convergent validity: Do the indicators hold together where they should?
- Discriminant validity: Are the groupings of indicators separate?
- Reliability: Do the indicators move together consistently within each factor?

Next, I used a CFA to confirm what I discovered in the EFA. As Kline (2013, p. 177) explains: "The goal of this process is to "discover" a model with three properties: It makes theoretical sense, it is reasonably parsimonious, and its correspondence to the data is acceptably close."

The CFA provided additional information on the validity of the indicators beyond what an EFA can. The CFA also allowed for verifying model fit, variance, and common method bias.

Both analyses were informed by Gaskin (2014) and Kline (2010, 2013). I used IBM SPSS 22.0, with the add-on module AMOS (also version 22.0) to perform the analysis.

**Data Analysis for 'Not-Responsible-for-KM' Questionnaire**

To analyse the data collected from the 'Not-Responsible-for-KM' questionnaire, I used quantitative data analysis methods, mostly statistical, including measures of central tendency (frequencies, percentages, median and mode) and association between variables (for example comparing responses from both questionnaires).

At the end of the data analysis phase, the key survey findings were emailed to the respondents as a benefit for participating in this survey. Phase three thus answered RQs 4 and 5, testing the model generated in phase two.

# 3.5. Research Quality and Ethical Considerations

Considerations regarding research quality and ethics are described in this section.

## 3.5.1. Research Quality

The quality standards that regulate Information Systems research are varied and often contentious. In this three-phase research, I used a mix of qualitative and quantitative research methods or what Denzin (1978, p. 291) would refer to as 'triangulation': "the combination of methodologies in the study of the same phenomenon". As such, I needed to be cognisant of the quality criteria from both qualitative and quantitative research.

In terms of quality in qualitative research, I was guided by two sets of well-established frameworks: the seven principles of interpretive field research (Klein and Myers 1999) and the four criteria to evaluate qualitative research (Guba and Lincoln 1989).

Both frameworks helped across the qualitative phase of the research (phase two). For example, the principles of contextualisation, abstraction and generalisation, multiple interpretation and suspicion (Klein and Myers 1999), helped me analysis the interview data.

I also ensured that the research was as trustworthy (i.e. credibility, transferability, dependability and confirmability) as possible. For example, to ensure that the data collected was credible, I used a list that was bought from a commercial list provider and that was used before in another research. I also performed checks on the respondents by asking them about their organisations and their roles.

I also maintained field journals during the course of the research. The field journals contain my interpretation of events and other issues not captured directly from the data collection methods used during the research, including my apprehension around engaging KM stakeholders at different levels of management or the sensitive nature of the interviews. I used the field journals later to verify the data collected and where required, supplement data analysis.

Similarly, in terms of quality in quantitative research, I took into account concepts such as reliability and validity. That is, in this research, I address the replicability of results or observations and latent variables validity (Creswell and Miller 2000; Golafshani 2003; Stiles 1993). The particulars of those measures are described in the following chapters.

### 3.5.2. Ethical Considerations

I followed a strict code of ethics throughout the research. I treated the participants with courtesy and respect; physical risks were less likely. I did not coerced anyone into participating in this research. I assured the respondents that their responses would remain confidential or anonymised, and I never divulged their identities. I used name codes in this thesis to protect the identity of the respondents.

I also sought and obtained approval from the Human Research Ethics Committee of Curtin University throughout each phase of this research.

Frankel and Siang (1999) argue that researchers should maximise possible benefits and minimise harms and risks to their subjects. Again, physical risks were less likely. Respondents were provided with the outcome of the research as a benefit to their participation.

Orb, Eisenhauer and Wynaden (2000) point out that interviews often involve sharing secrets. Therefore, as a moral obligation, researchers are not to abuse of the trust gained through the relationship built between the researchers and the participants. As I demonstrate in the following chapters, I indeed gained the trust of many of the respondents. I did not to divulge anything other than what was directly related to the purpose of this research or what I told the respondents that I would – for the purpose of this research.

Further, in terms of the data collected and the analysis of the data, I reported every data manipulation activity applied from source to result in this thesis. This ensured traceability and auditability of this research.

Next, I summarise chapter three. I detail and discuss the findings from the research in the next chapter.

## 3.6. Chapter Summary

Chapter three explained the approach to research design and the research methods used to obtain the answers to the research questions. This research involved three consecutive phases using a mix of quantitative and qualitative data collection and data analysis methods.

The next four chapters discuss the research findings.

“En Afrique, quand un vieillard meurt, c’est une bibliothèque qui brûle.” –

"In Africa, when an old man dies, it's a library burning."

Bâ (1960).

# Chapter Four: Findings from Exploratory Survey

Chapter four and the following three chapters report and discuss the findings of this research. Chapter four reports the findings from phase one, chapter five phase two, and chapter six phase three. Chapter seven synthesises the findings from all three phases and concludes this thesis.

As highlighted in table 4-1 below, phase one was concerned about research questions one and two: To what extent do organisations practise KI? What KI methods are currently used by organisations?

**TABLE 4-1 PHASES OF THIS RESEARCH.**

| Research questions | Research phases |
|---|---|
| 1. To what extent do organisations practise KI?<br>2. What KI methods are currently used by organisations? | Phase one |
| 3. What are the problems different KM stakeholders face with respect to KI and KI methods? | Phase two |
| 4. What are the factors that influence KI effectiveness? | |
| 5. To what extent does KI effectiveness impact KM effectiveness? | Phase three |

The objectives of phase one were to explore the extent to which KI was practised among organisations (RQ 1), compile a list of KI methods used by organisations (RQ 2) and establish a baseline for issues to further investigate research questions three and four in phase two. The findings from phase one are discussed next.

## 4.1. The Respondents

Phase one involved two rounds of paper-based questionnaire-survey mailed to CIOs, IT Directors and IT managers of the top 1000 IT users (organisations), based on the number of screens, in Australia. As discussed above, this population segment (the executives and management) was chosen because management have authority over KM (and KI) initiatives in their organisations.

A copy of the questionnaire along with the letter of invitation to participate in the survey and the information sheet sent to the participants can be found in Appendix B.

In the first round of data collection, 973 questionnaires were mailed - 27 organisations were removed from the list, having opted out of the list from another study.

Round one ran for 10 weeks and 115 responses were obtained. Out of the 115 responses, 24 were marked 'Return to Sender', indicating a problem with the address and 5 questionnaires were incomplete. Thus, 86 valid responses were obtained, making a response rate of nine per cent (86 out of 949 participants).

In the second round of data collection, the same questionnaire was mailed to the remaining 858 (973-115) non-respondents.

Round two ran for seven weeks and 66 responses were obtained. Out of the 66 responses, 31 were marked 'Return to Sender'. Thus, 35 valid responses were obtained and a response rate of four per cent (35 out of 827 participants) was observed.

Combined, a total of 121 valid responses were received; a response rate of 11.1 per cent (121 out of 918 (973-24-31) participants) was reached. That is significantly below the desired number of respondents of 267, but higher than Burstein et al. (2010) at 9.8 per cent and lower than Zyngier (2002) at 15.1 per cent, both using a more or less similar population.

Responses from both rounds of data collection were transcribed from the surveys received in a Microsoft Excel spreadsheet for analysis.

To investigate potential non-response bias, the responses collected from both rounds were compared (Armstrong and Overton 1977). I observed no significant differences, thus indicating that response bias was unlikely to be a problem in this research.

Of the 121 valid responses, 83 (69 per cent) were from private organisations and 38 (31 per cent) were from public organisations. When asked: “To which industry does your organisation belong?”, most responding organisations were from the Public Administration and Safety industry. Figures 4-2 below shows the responses by industry. The industry grouping was based on the Australian and New Zealand Standard Industrial Classification (ANZSIC) 2006.

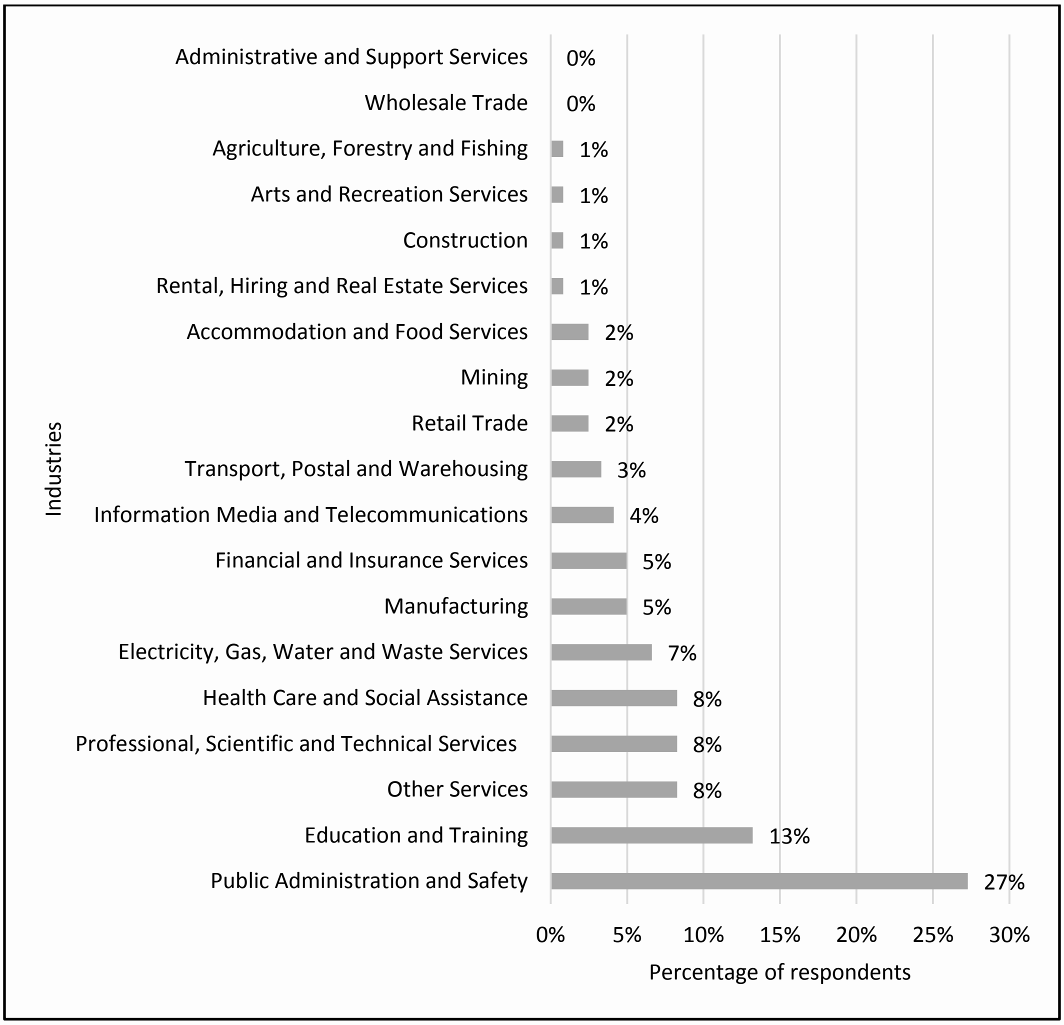



**FIGURE 4-1 DISTRIBUTION OF RESPONSES BY INDUSTRY.**

The results above indicate a bias towards the Public Administration and Safety industry.  The chart below shows the Australian workforce per industry from the Australian Bureau of Statistics (ABS) (2005).

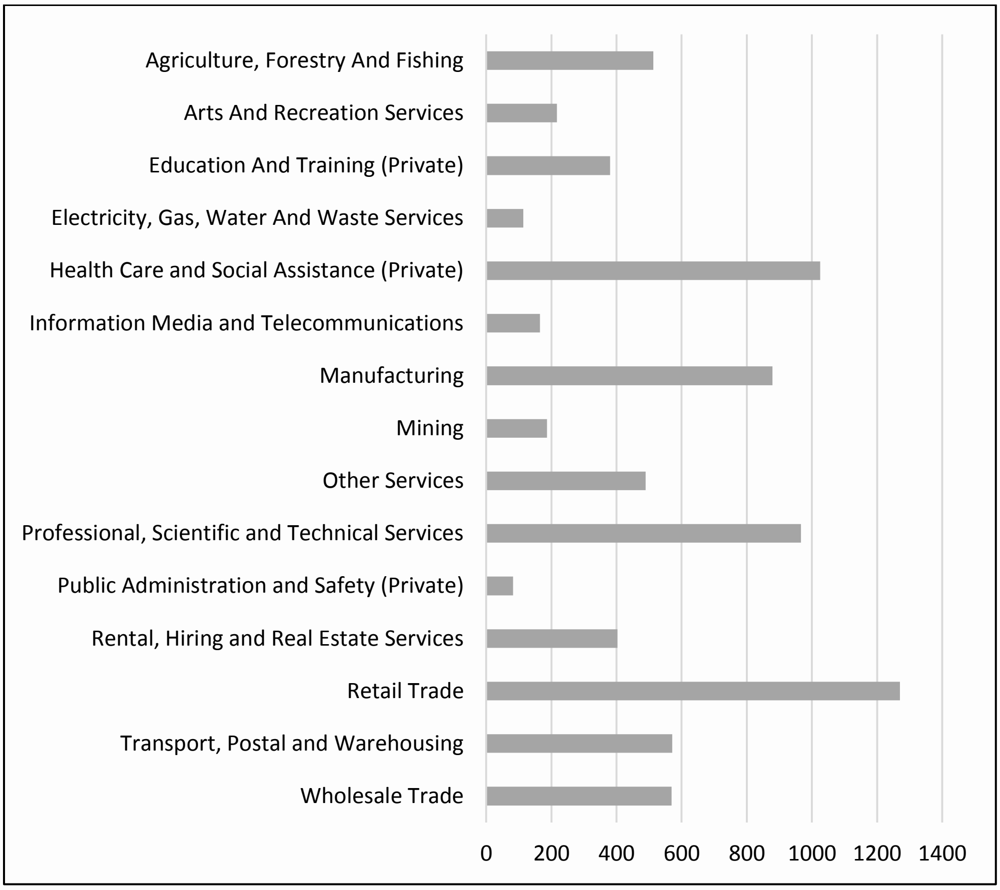



**Figure 4-2 Distribution of the Australian workforce by industry (ABS 2015).**

Geographically, 82 per cent of the responses came from the Eastern states of Australia (NSW, Vic, Qld, ACT and Tas). Figure 4-3 below shows the responses by location.

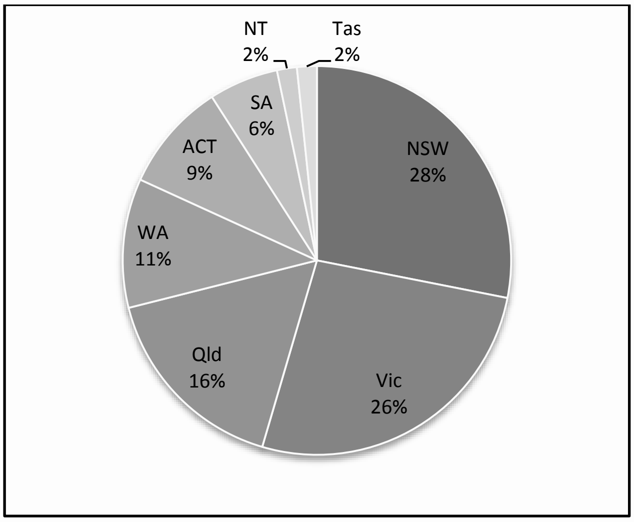



**FIGURE 4-3 DISTRIBUTION OF RESPONSES BY LOCATION.**

When asked: "Approximately how many full-time employees are there in your organisation?", the numbers ranged from 60 to around 80,000. The larger numbers may have included employees working overseas as well. The histogram below depicts the responses.

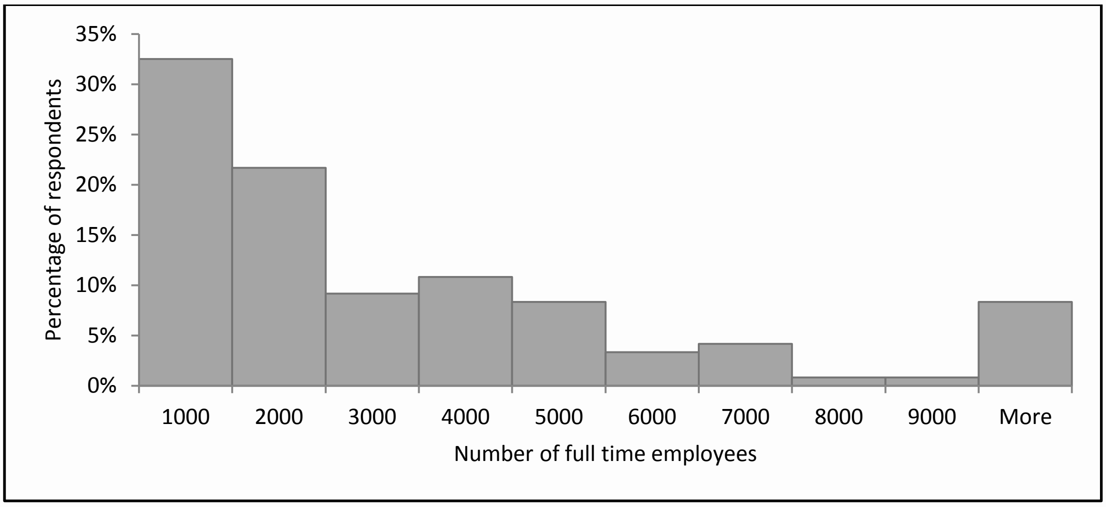



**FIGURE 4-4 DISTRIBUTION OF RESPONSES BY ORGANISATION SIZE.**

While I did not specify in the questionnaire whether or not to include international branches, the results suggest that respondents included employees overseas.

## 4.2. KM Responsibility and Experience

Respondents were asked about their positions in their respective organisations and how experienced their organisations were with KM.

When asked: "What is your job title?", responses indicated that most of the respondents (98 per cent) held managerial positions (CIO, General Manager, Manager, Director, as such). Their titles could be broadly grouped into three fields namely: 'ICT, IT or IS related' (72 per cent), 'Operations' (15 per cent) and 'Knowledge Management' (13 per cent).

When asked: "How experienced is your organisation with Knowledge Management?", on a five-point scale with one being 'Not at all' and five being 'To a great extent', results showed that the vast majority of responding organisations were experienced with KM - but not very much.

3 per cent of respondents said their organisation had no experience at all with KM, 40% of the respondents chose the second lowest point on the scale and 5 per cent chose 'To a great extent'. The median was three. The figure below depicts the responses.

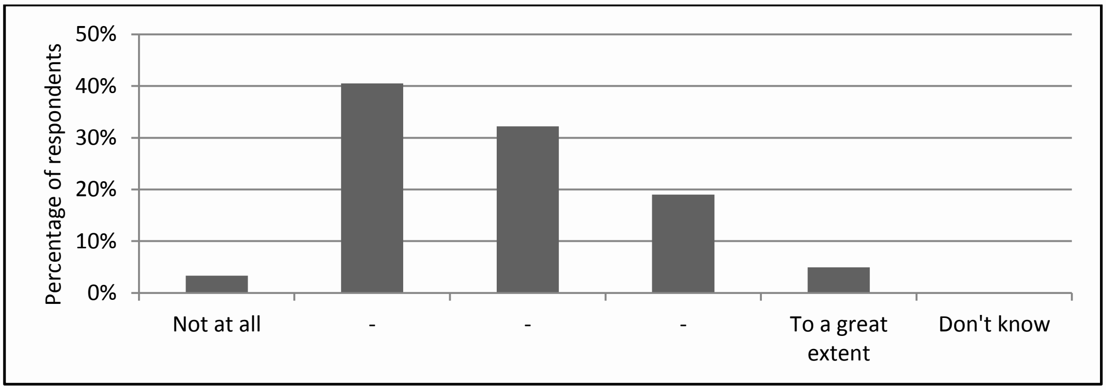



**FIGURE 4-5 KM EXPERIENCE.**

Further, when asked: "Who is responsible for the overall Knowledge Management practices in your organisation?", results varied from "*I don't know*" to no one to single position to multiple positions.

KM responsibilities are either assigned to an employee occupying a managerial position or, spread among several employees, each occupying a managerial position. 19 per cent of respondents indicated that KM responsibility was attached to more than one position. These results corroborate with those of Burstein et al. (2010).

The most popular singular position to oversee KM practices was the CIO (39 per cent), followed by the IT Manager (21 per cent). The CKO position was not as popular, with only 7 per cent of the responses. The most popular combination of positions was the CIO with the Director of Human Resources.

The reasons for having KM responsibility assigned to more than one position include: KM practices are spread across more than one function, KM practices involve more than one employee or involve senior executives who would have an overall view of how the organisation functions as a whole. Some examples of the respondent responses for this question include:

> "*There is no formal KM process or dedicated KM system currently within the organisation so ultimately the responsibility is not allocated to any one person or position.*" Respondent 5510.
>
> "*Chief Knowledge Officer. Each business unit has a person responsible for knowledge management as well.*" Respondent 5520.

The next sections reports specifically on KI practices.

## 4.3. KI Practices

The findings below answer research question one: To what extent do organisations practise KI?

The term Knowledge Identification (KI) was used in the information sheet provided, but not in the questionnaire. The reason for this is that respondents may be unfamiliar with the term KI.

To ensure that the respondents fully understand what they were being asked, KI was either explained or a simple analogy of KI was used. For example, I asked "To what extent does your organisation identify existing knowledge?" rather than "To what extent does your organisation practise KI?"

When asked: "To what extent does your organisation identify existing knowledge?", on the same five-point scale, 4 per cent of respondents chose 'Not at all', 45 per cent chose the middle point on the scale and 1 per cent chose 'To a great extent'. The median was three. The figure below depicts the responses. The figure below shows that organisations are not practising KI actively.

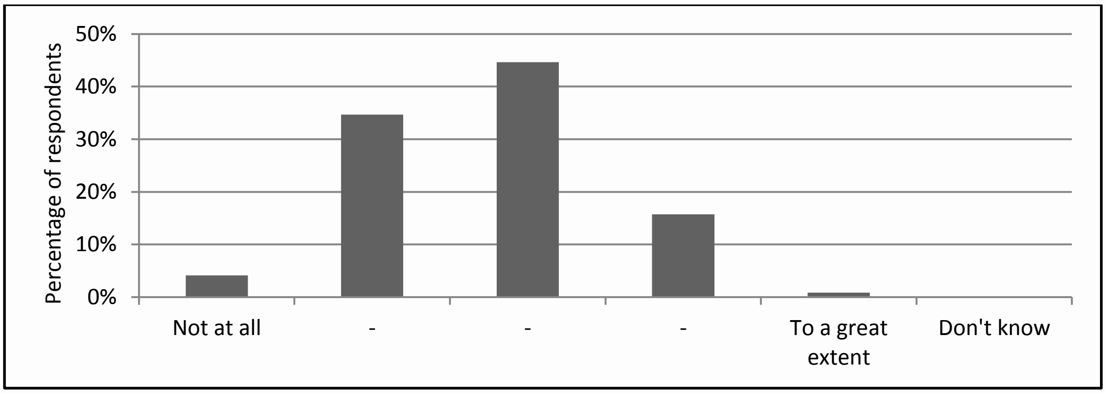



**FIGURE 4-6 EXTENT TO WHICH KI IS PRACTISED.**

Unsurprisingly, given that most of the respondents do not actively practise KI, when asked: "To what extent has knowledge that exists within your organisation been identified?", 4 per cent of respondents chose 'Not at all', 33 per cent chose the middle point on the scale and 1 per cent chose 'To a great extent'. The median was three. The figure below depicts the responses.

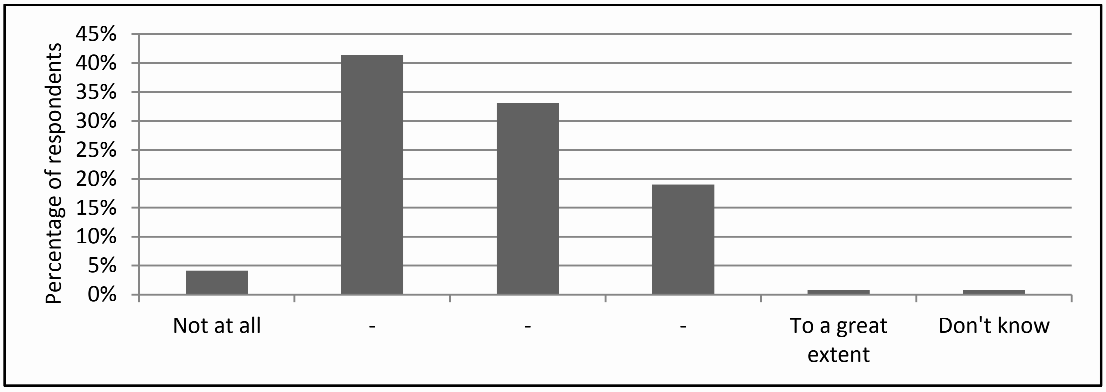



**FIGURE 4-7 EXTENT TO WHICH KNOWLEDGE HAS BEEN IDENTIFIED.**

There are a couple of implications in these results: First, the results support the argument that much of the knowledge that employees hold is yet-to-be identified and thus not used effectively (McAdam et al. 2007; Nevo et al. 2009). Second, they raise questions around how important organisations perceive KI and why. These questions are answered next.

When asked: "How important is it to identify what knowledge exists within your organisation?", respondents answered positively. 49 per cent chose 'To a great extent', while another 40 per cent chose the second highest point. The median was four. Figure 4-7 on the next page depicts the responses obtained.

The incongruence between what the importance that organisations attach to KI and how many organisations actually practise KI indicates that organisations may have problems with KI or the KI methods that organisations use are not effective.

This incongruence was not a surprise. One way to understand this incongruence is to examine the reasons why some organisations do practise KI while others do not. The open-ended question "Why does your organisation identify / not identify existing knowledge?" offered some insights.

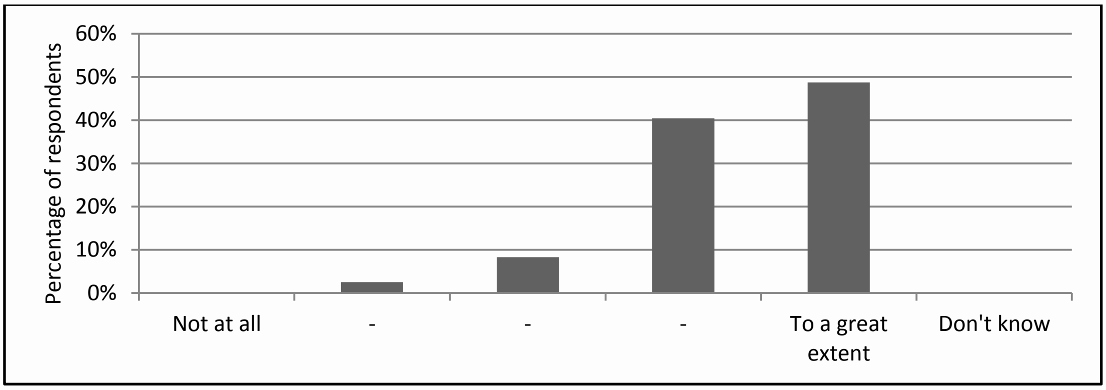



**FIGURE 4-8 IMPORTANCE ATTACHED TO KI.**

After reading through all the responses and categorising similar responses together, the reasons why organisations do or do not practise KI emerged.

Organisations which practise KI value knowledge as their *raison d'être* and as leverage to competitive advantage. They recognise the positive impact of having valuable knowledge in decision-making. Further, they practice KI to secure business continuity, by ensuring that knowledge of leaving or retiring employees is captured.

Some examples of the responses that capture those reasons include:

> "*We arre a consulting business + we sell what we know. KM is a key differentiator.*" Respondent 9510.
>
> "*Value of knowing what has been done, who is speaking to whom, who is the subject matter expert; what is the authoritative source of advice.*" Respondent 9511.
>
> "*Knowledge identification is essential in establishing lessons learned and succession plan. More work is required on this in my organisation.*" Respondent 9512.

On the other hand, the reasons why organisations do not practise KI include (from most often to least often mentioned):

- the lack of resources (time, effort and tools) to effectively practise KI,
- the low perceived value of KI,

- the difficulty or enormity of the task,
- poor understanding of the issues involved, and
- lack of a robust KM strategy.

Some examples of the responses that capture those reasons include:

> "*Priority is low among other initiatives that are driven politically or from community.*" Respondent 7511.
>
> "*High staff turnover accepted as deleting knowledge base.*" Respondent 7512.
>
> "*KM is not part of organisational culture. There is no KM training or any formal expectation of staff to actively contribute to organisational knowledge. There is no formal KM framework.*" Respondent 7513.

Next, I report on the KI methods organisations currently use and the problems that organisations have with respect to KI and KI methods.

## 4.4. KI Methods

The findings below answer research question two: What KI methods are currently used by organisations?

To identify the KI methods organisations currently use, the questionnaire contained one open-ended question and a checklist. While the open-ended question allowed the participants to describe their own KI methods, the checklist provided the participants with a list of KI methods to choose from.

The open-ended question was asked first and the checklist, second. This line of questioning ensured that the participants were given the opportunity to think about the different KI methods that they use on a regular basis before providing them with a list of KI methods.

Again, the term KI itself was not used. The open-ended question asked was: "If you need to find someone within your organisation with specific knowledge, how would you go about finding that person?" The intent was to uncover the KI methods currently used by organisations.

The KI methods recorded varied from manual and short-reach (c.f. organisation-wide) methods to computer-based and organisation-wide systems. The answers were collated and grouped. Figure 4-8 on the next page depicts the results.

Two of the methods recorded need further explanation: Asking someone and searching Knowledge Sharing systems. Knowledge Sharing systems include wikis, and document and record management systems.

Asking someone involves asking: known or personal contacts, communities of practice, informal expertise network, personal assistants, discussion boards and people who have been at the organisation for a long time or who have worked in the area required before. The means to "ask someone" included: word of mouth, email, telephone, Knowledge Sharing systems.

While the methods captured do have utility for identifying relevant and needed knowledge that exists within the boundaries of the organisation. Most methods have utility for retrieving knowledge that is already captured and stored in knowledge repositories rather than knowledge that is yet-to-be captured. Most methods focused on identifying knowledge on an as-needed basis - which is akin to searching through knowledge repositories.

The gap was therefore in the KI methods that identify knowledge that is yet-to-be captured, and that organisations use not only when required but systematically and regularly across the organisation.

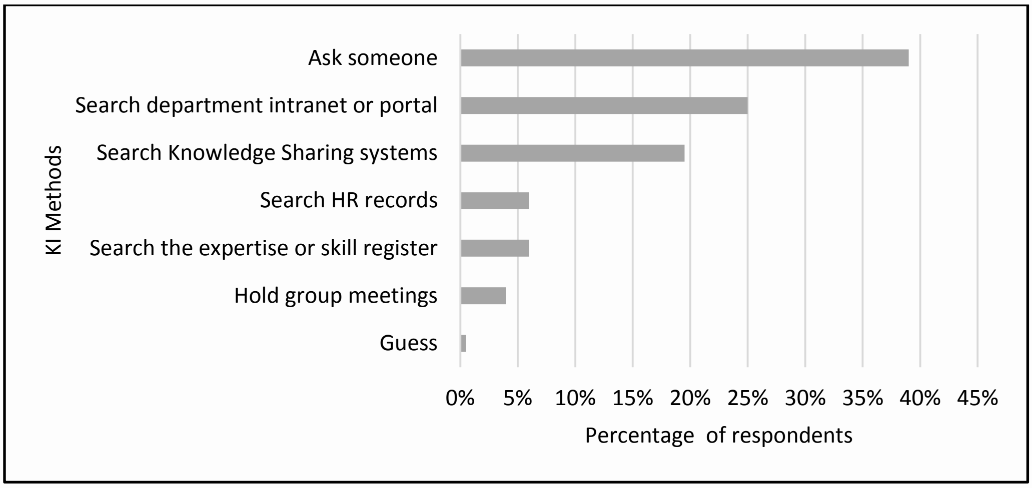



**FIGURE 4-9 METHODS OF FINDING SOMEONE WITH SPECIFIC KNOWLEDGE.**

When asked: "Among the methods above, which do you consider the most effective?" The three most popular and most effective methods according to the respondents were: ask someone, search the department intranet or portal and search Knowledge Sharing systems. Figure 4-9 below depicts the results.

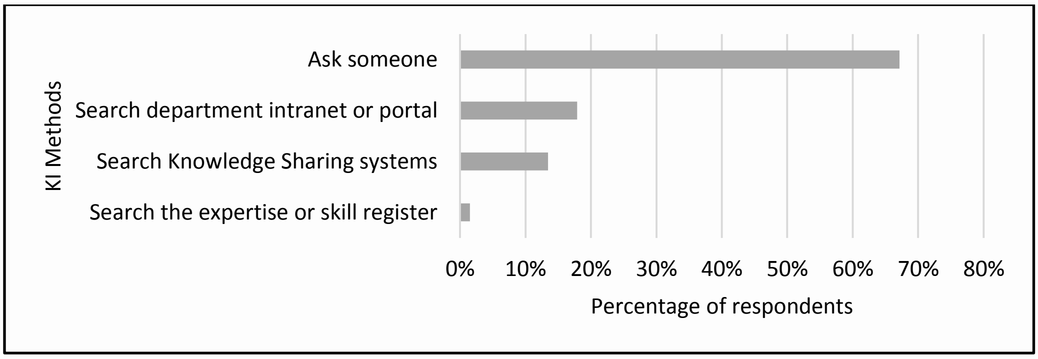



**FIGURE 4-10 MOST EFFECTIVE METHODS OF FINDING SOMEONE WITH SPECIFIC KNOWLEDGE.**

These results are consistent with previous research that showed that employees are more likely to ask their fellow colleagues for information rather than use computer-based systems.

The checklist-type question of KI methods was asked next in the questionnaire. Table 4-2 on the next page lists the KI methods from the checklist and the usage of the KI methods based on the survey responses.

Note that the some of the KI methods are similar. For example, 'Analysing the relationships among employees' is akin to 'Organisational Network Analysis'. The rationale for separating the 'proper' name of the KI method and its description is because some participants may not be familiar with the names of the KI methods.

Overall, the usage percentages on the checklist were quite low. This suggests that perhaps there are other KI methods that organisations use - which would have been already identified in the open-ended question, or more likely, organisations simply do not practise KI.

The three most commonly used KI methods according to the responses were: 'Staff self-identify their areas of expertise', 'Interviewing staff to determine what knowledge they possess' and 'Applying different content analysis techniques on existing documents'.

These results corroborate with the responses from the earlier open-ended question. For example, the two most commonly used KI methods: 'Staff self-identify their areas of expertise' and 'Interviewing staff to determine what knowledge they possess', are analogous to 'Search Knowledge Sharing systems' and 'Ask someone'.

Interestingly, the newer KI methods were not used as much nor as popular. Organisational Network Analysis and Extra (Expertise Transfer) scored the biggest 'Don't know' percentages.

TABLE 4-2 KI METHODS CHECKLIST

| KI Methods | Not used | Currently in use | Previously used | Don't know |
|---|---|---|---|---|
| Staff self-identify their areas of expertise. | 45% | **56%** | 2% | 0% |
| Applying different content analysis techniques on existing documents. | 51% | **39%** | 3% | 6% |
| Interviewing staff to determine what knowledge they possess. | 47% | **43%** | 6% | 3% |
| Analysing the relationships among employees. | 60% | **30%** | 2% | 7% |
| Having meetings among management, HR and KM departments. | 66% | **24%** | 5% | 3% |
| Expert Finding Systems | 74% | **21%** | 2% | 2% |
| Knowledge Loss Risk Assessment | 78% | **13%** | 2% | 6% |
| Organisational Network Analysis | 80% | **8%** | 2% | 10% |
| ExTra (Expertise Transfer) | 65% | **25%** | 1% | 9% |
| In-house or other methods | | **21%** | | |

(Rows do not add up to 100 per cent because respondents may choose more than one option for each method.)

At the end of the checklist, participants were then asked to describe any in-house or other methods not listed in the checklist. There were not many respondents who claimed to be using other methods. 25 responses were received. These responses were analysed and categorised in table 4-3 below.

**TABLE 4-3 KI METHODS IN-HOUSE.**

| In-house or other KI methods include: |
|---|
| • Targeted phone calls. Talk to people who may know the right person.<br>• Shadow a leaving employee to learn his/her job/skills (buddy/partnering techniques).<br>• Subject-specific discussion boards.<br>• Knowledge brokers (subject matter experts).<br>• Business unit or group meeting sessions.<br>• Cross-team management collaboration.<br>• Audit processes led by centralised KM team.<br>• Building a data warehouse to extract corporate knowledge, not that of employees. |

In contrast to the methods identified in previous open-ended question above (table 4-2), the methods identified here were more akin to proactive KI, having utility to identify knowledge that is yet-to-be captured (table 4-3). An example of such a method is: shadowing a leaving employee to learn about his or her job and skills.

Further, these methods appeared to also be less sophisticated, drawing insights from people and involving collaboration between people, rather than using a particular technology.

Having collected a list of KI methods currently used by organisations to practise or to support the practice of KI, I noted three variables that were of interest when choosing

KI methods: the type of the KI method itself, the form of knowledge being identified, and the KI approach adopted.

Depending on the form of the knowledge to be identified and the KI approach warranted, the KI method to be used can be determined. The KI approach potentially speaks to the maturity of KI in the organisation; but I would argue that there are other metrics of KI maturity, for example: whether or not the organisation knows what knowledge is relevant and needed for its performance.

Another aspect to take into account is the level of maturity around KM within the organisation: whether or not the organisation perceives its knowledge assets as key to its performance.

I report on the problems organisations face with respect to KI and KI methods in the next section.

## 4.5. KI Problems

The questionnaire also touched on the problematic aspects of KI and KI methods. That is, research questions three and four, which were: What are the problems different KM stakeholders face with respect to KI and KI methods? What are the factors that influence KI effectiveness? The findings below answer both questions.

When asked "Are the current methods of identifying who knows what within your organisation problematic?" on the five-point scale, 29 per cent of the respondents chose the highest point while 35 per cent chose the second highest point. Combined, 64 per cent indicated significant problems. The median was four. The figure below depicts the responses.

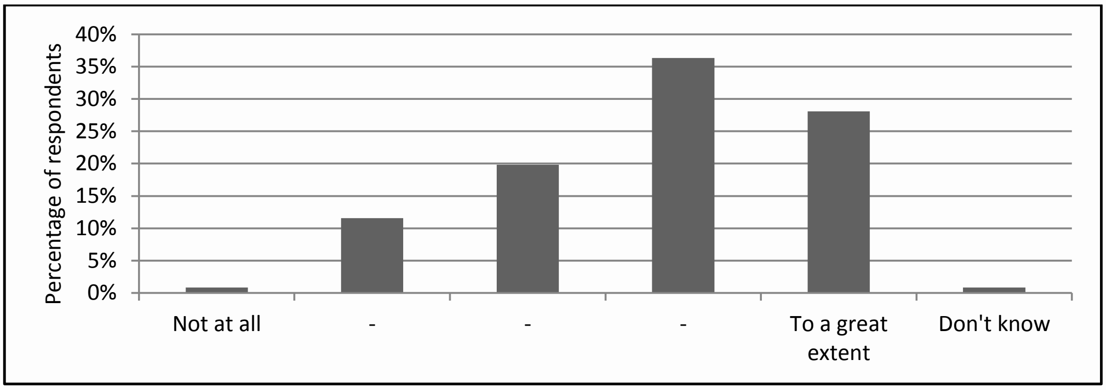



**FIGURE 4-11 KI METHODS PROBLEMATIC.**

To explore the problems that organisations may face with respect to KI and determine the potential factors that influence KI effectiveness, the questionnaire contained two open-ended questions: "What do you perceive as problematic or dislike about the methods you use?" and "If you could have whatever you wanted, what factors should be taken into account when designing methods of identifying who knows what within your organisation?".

Note that the intent was not to determine which problem or factor relates to which specific KI method but to surface some of the issues surrounding KI and KI methods. The answers obtained are presented below.

When asked: "What do you perceive as problematic or dislike about the methods you use?", responses varied from having no problem at all to problems with KI methods, problems with KI and problems with KM. The responses were analysed and grouped by association and listed in the table below.

**TABLE 4-4 PROBLEMS WITH KI METHODS.**

**Problems with KI methods**

- Lack of methods.
- Not centralised or structured enough.
- Too difficult, overly manual processes, too time-consuming, unstructured.
- Not one single consistent method. No cohesive system.
- Too personalised.
- Rely too much on self-identification or voluntary submission.
- Inconsistent, not repeatable results (maintain information accuracy).
- Searcher requires subject matter and knowledge to be able to craft queries and interpret results.
- Difficulties in adapting to changes as people learn and move.

**Problems with KM**

- There is no framework or articulated KM strategy.
- Lack of formalisation (no formal processes, no accountability).
- Limited use. Need for more consistency in use.
- Poor utilisation amongst staff, no trust in currency of information.
- Regional variations in approach (Geographically and individually separated entities).
- Lack of resources (employees to maintain and keep array of information up-to-date).

**Problems with the knowledge captured**

- Patchiness of information leads to a lack of critical mass.
- Not complete enough yet (i.e. gaps in knowledge about knowledge still exist).
- No universal taxonomy. Difficulty in getting a common understanding of the nature of such knowledge.
- Collection of information needs to be improved to simplify how the information is captured.

**Problems with meetings**

- Meetings don't capture information long term.

When asked: "If you could have whatever you wanted, what factors should be taken into account when designing methods of identifying who knows what within your organisation?", responses also varied, including capabilities of KI methods, the anatomy of knowledge sought and examples of policies and other factors that ought to be considered.

TABLE 4-5 FACTORS TO CONSIDER WHEN DESIGNING KI METHODS.

**KI methods capabilities**

- Global, single point of entry.
- Simple to use, comprehensive.
- Web-enabled.
- A usefulness ranking.
- Make it easy to provide that information to others.
- Ability to link people in real-time.
- Aggregating information from various social networks.

**KI methods capabilities**

- Keywords matching.
- An integrated HR platform that covers (HRIS, Talent management and Learning management).
- Confidentiality and privacy concerns.
- Ability to generate dynamic connection maps based on concepts appearing in documents and emails.
- Ability to enter search terms which assist in leading you to a person.
- Establishing a compelling platform and service that engages staff and draws them to use it.
- Ability to broadcast a question to the whole organisation or target audience.

**Knowledge anatomy**

- Publications, qualifications, metadata in documents.
- Industry experience, CV.
- Classification of expertise.
- Standardisation of terms.
- People will say they know stuff but to what degree and how reliable is their knowledge.
- Assessing the level of expertise.

**Policies and other factors**

- Cost/benefit.
- Need stakeholder buy-in.
- Rather than a big bang approach, consider "trapping information on the fly".
- Provide incentives for employees to update knowledge.
- Changing culture and building core competency in KM.

**Policies and other factors**

- Strategy changes constantly.
- The key is allocating time to the task across the organisation, and dedicating resources to the task.
- Have a knowledge officer permanently assigned to each area of the business.

The implications of the findings in phase one are discussed in the next section.

## 4.6. Implications of Findings

Phase one provided a broad brush of the KI landscape and answered research questions one and two: To what extent do organisations practise KI? What KI methods are currently used by organisations?

The survey findings corroborate with the literature review: organisations still do not know what they know.

While organisations are cognisant of the importance of KI, they do not practise KI actively. The incongruence between the importance that organisations attach to KI and the extent to which organisations actually practise KI can be explained by the two main reasons identified in the survey findings for why organisations practise KI:

First, the value attributed to knowledge is not shared across all organisations. Those which value knowledge highly are more likely to practise KI than those which attach a lesser value to knowledge. Second, organisations experience problems in practising KI. Practising KI is perceived as difficult, complex and requires resources which not all organisations have or see the value of investing in.

Survey findings also uncovered a number of KI methods and some of the problems organisations face with KI and KI methods.

Survey findings showed a mix of reactive and proactive KI methods. Survey findings showed little take-up of KI methods, except for Knowledge Sharing systems (56% of respondents reported that their organisations use them). However, Knowledge Sharing systems are also used downstream from KI (e.g. in knowledge distribution), so their use for KI purposes may be very limited.

While the problem is not quite the lack of KI methods – though some respondents did point out the lack of KI methods, it appears that having the right KI method or the right combination of KI methods is the key to effective KI. Some organisations seem to be inadequately equipped and guided.

Finally, some of the problems voiced by the respondents indicate an awareness that this problem is not just about KI but is symptomatic of a bigger problem: the lack of a KM strategy for example. The KM maturity of the organisation is thus an important factor here as well.

Some of the limitations of the exploratory survey include:

The sample size was quite small and not all industries were represented. However, this was expected from a survey of executives and management.

While the intent of the survey was to uncover the KI methods currently used by organisations and the distinction between KI methods which are used to identify yet-to-be captured knowledge and those that identify knowledge already captured could have been made clearer.

Due to the structure of the questionnaire, it is difficult to match accurately which problems relate to which KI methods. In the same vein, while this research surfaced some of the capabilities or features of KI methods sought after by organisations, which capabilities and features of KI methods work best in which type of organisation is also yet-to-be determined.

While some of these problems organisations face with respect to KI have emerged from the survey, it was clear that I needed richer and more meaningful data to understand and interpret those problems. The problems that organisations face with respect to KI and KI methods were further explored in phase two of the research.

In the next section, I summarise this chapter. I report on the findings from phase two in the next chapter.

## 4.7. Chapter Summary

Chapter four reported and discussed the findings from phase one, the exploratory survey. The findings provided a base line for questions to pursue in phase two. Findings from the in-depth and semi-structured interviews in phase two are reported and discussed in the next chapter.

# Chapter Five: Findings from in-Depth Interviews

This chapter examines the findings from phase two. Phase two, as shown in the table below was concerned about research questions three and four: What are the problems different KM stakeholders face with respect to KI and KI methods? What are the factors that influence KI effectiveness?

TABLE 5-1 PHASES OF RESEARCH.

<table>
<tr><th>Research questions</th><th>Research phases</th></tr>
<tr><td>1. To what extent do organisations practise KI?<br>2. What KI methods are currently used by organisations?</td><td>Phase one</td></tr>
<tr><td>3. What are the problems different KM stakeholders face with respect to KI and KI methods?</td><td rowspan="2">Phase two</td></tr>
<tr><td>4. What are the factors that influence KI effectiveness?</td></tr>
<tr><td>5. To what extent does KI effectiveness impact KM effectiveness?</td><td>Phase three</td></tr>
</table>

The goals in phase two were to two-fold. First, follow up on the responses from the survey in phase one, particularly in relation to research questions three and four, and drill down into the problems different KM stakeholders face with respect to KI and KI methods.

Second, surface the factors influencing the effectiveness of KI from these problems identified. These factors represent the unknown factors in the hypothesised model shown on the next page.

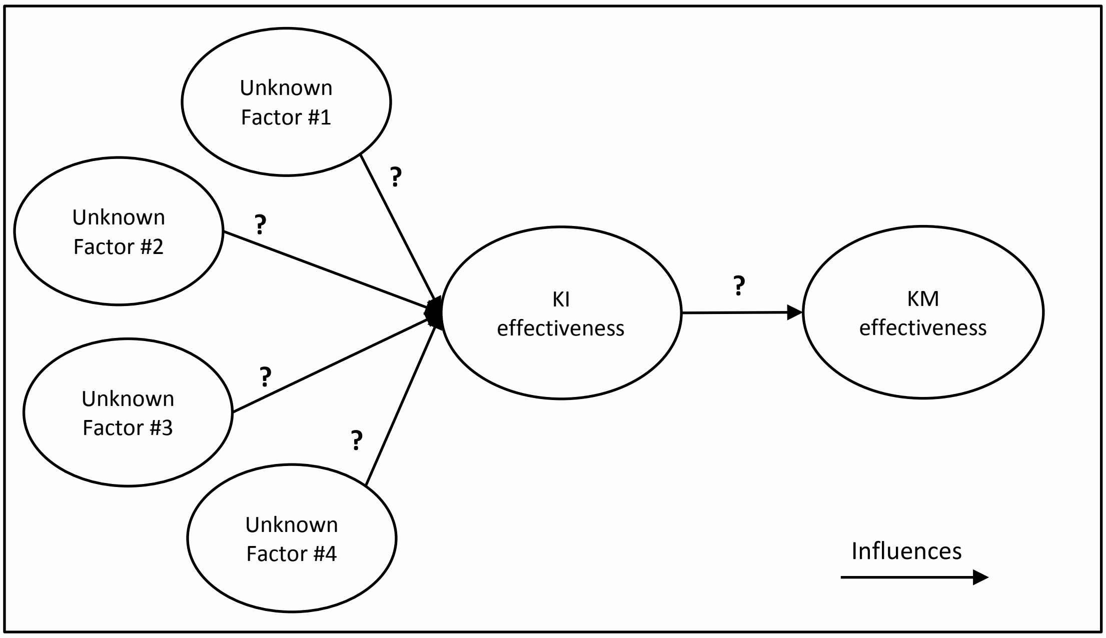



**FIGURE 5-1 RESEARCH MODEL.**

The findings from phase two are discussed next.

## 5.1. The Interviewees

Recruitment of participants in phase two was done in two ways. First, I applied theoretical sampling on the list of respondents from phase one. Some of the considerations in doing the theoretical sampling included: the KI methods used, organisational positions, organisation size and KI effectiveness.

I contacted the respondents who expressed their interest in sharing their thoughts in this area of research. These respondents provided their e-mail addresses on the questionnaire in phase one.

Second, I used snowball sampling on participants who passed through the selection screen, expecting that participants who have been through the interviews would likely know others who also have the targeted characteristics. Information sheets were e-mailed to all participants prior to the interviews.

51 (or 42 per cent) of the 121 respondents in phase one provided their e-mail addresses. Of the 51 interested participants, 12 (or 24 per cent) were interviewed. From the 12 interviewees, five referrals (snowball sample) were made. In other words, a total of 17 interviews were conducted in phase two.

Geographically, all of the interviewees were located in Australia. 59 per cent were from the Eastern states of Australia (NSW, Vic, Qld). Figure 5-2 below shows the distribution of interviewees by location.

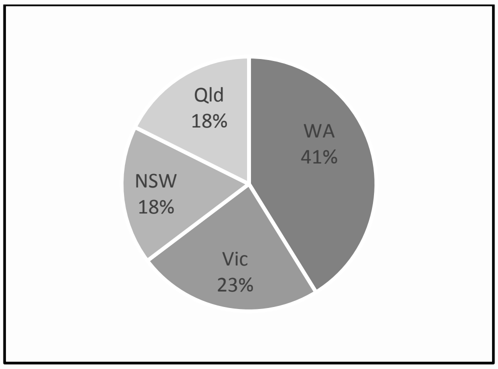



FIGURE 5-2 INTERVIEWEES BY LOCATION.

The 17 interviewees were from 17 different organisations. The 17 organisations were from various industry including (grouping based on the Australian and New Zealand Standard Industrial Classification (ANZSIC) 2006):

**TABLE 5-2 PHASE TWO INTERVIEWEES.**

| Industry | Number of interviewees | Organisation Size (Range or Approximate) |
|---|---|---|
| Mining | 4 | 3000 - 31000 |
| Professional, Scientific and Technical Services | 4 | 1700 - 118000 |
| Public Administration and Safety | 3 | 230 - 1300 |
| Electricity, Gas, Water and Waste Services | 2 | 550 - 3100 |
| Education and Training | 1 | 500 |
| Financial and Insurance Services | 1 | 4500 |
| Health Care and Social Assistance | 1 | 800 |
| Manufacturing | 1 | 1100 |

14 (or 82 per cent) out of the 17 interviewed were employees at a management level. The remaining three were non-management. Out of the five referrals, two were management and three were non-management.

Eight out of the 14 management employees (or 47 per cent of the total interviewees) had overall KM responsibility at their respective organisations. In two organisations, no one held overall KM responsibility.

I discuss the analysis of the interview data in the next section.

## 5.2. Interview Data Analysis

The duration of the interviews ranged from 22 minutes to 34 minutes for management interviewees and from 26 minutes to one hour and six minutes for non-management interviewees. The format of the interview or the questions drafted at the beginning of data collection stayed more or less the same throughout data collection.

As the interviews were conducted, the researcher was successful in building rapport with the interviewees. This is evidenced by the interviewees (i.e. the respondents) sharing internal organisational knowledge including documents such as presentation slides or information management strategies.

Transcription and analysis of the interview data began after the first interview. I used the software VideoLAN to slow down the playback speed of the audio recordings, wore a pair of headphones and typed what I heard using Microsoft Word. On average, the transcription of each recording took roughly eight to ten times the length of the recording without interruptions.

Transcription and analysis of the interview data continued throughout the data collection phase. Concurrent data analysis and collection allowed me to know when to stop data collection.

I stopped collecting data when information saturation was reached. Saturation was reached after the fifth interview, but data collection continued partly because of a lag in analysis after data collection, to ensure breadth and to be sure that saturation had actually occurred.

I checked for bias in the interviews (where certain points are raised only by certain individuals) and found none. While all interviewees agreed to follow-up interviews, no follow-up interviews were conducted.

How I analysed the data collected is described next.

Out of the 17 interviews conducted, 16 were transcribed. Due to technical issues, one of the interviews was not recorded - but notes that were taken during the interview were used in the data analysis. After each interview conducted, the interview was transcribed. The interview transcript was then analysed using a combination of domain analysis and cognitive mapping, as described in chapter three (Research Design and Method).

The first stage in the domain analysis process is to segment the data into 'units of meaning' (Atkinson and Abu El Haj 1996; Spradley 1979).

Rather than line-by-line coding or similar coding methods based on syntactic units such as sentences or paragraphs, this approach involves separating a text where the participant's purpose changes, thus taking into account Henri's (1991) observation that texts should be analysed based on their meaning, not syntactical structures.

An example of the segmenting and categorising process is provided in the table on the next page.

In the second stage of domain analysis, the units of meaning were grouped and organised into preliminary categories. This entailed looking for patterns in the data and similarities, and also making sure to include sufficient information about the context from which the units of meaning were derived (Seaman, 1999).

This was the first level of abstraction. The preliminary categories developed are listed in table 5-3 on the next page.

**Table 5-3 Segmenting and categorising responses of interviewees.**

| Interviewees | Units of meaning | Preliminary categories |
|---|---|---|
| U[1] | One of the things that's unusual about people is we often think that we are better at things than we are and we often overlook things that we are actually very good at.<br><br>So because of the self-nature of the registration, you do get some instances of more recording of what I like to do as opposed to what I can do. | Employees may not know what to share. |
| U[2] | So being a law firm, we're organised into practice groups, into interest groups, and into departments.  So each lawyer registers within interest groups, registers within practice groups.<br><br>And so, for tacit skills, the physical skills, how do I do this, how do I do you know, do a matter, the organisational structure will bring you to that skill for your particular discipline. | Organisation structure used to identify organisational knowledge. |
| T[1] | it's probably either someone new is looking after that area of expertise, or.. yeah it's an area that not many people know about. Yeah I'd say that would be the only reason for failure. | Problem with KI method. |
| V[2] | I suppose the theory being with that is the more senior that you are, the more people that you know and you interact with and you should have knowledge of all that type of stuff - it may be a false assumption as well. | "Who you know" as a KI method. |

| Interviewees | Units of meaning | Preliminary categories |
|---|---|---|
| A[1] | A lot of information is in people's head and yeah it's time consuming to actually document but I think I think one of the big problems is that, there's a lot of work in going through one organisation and identifying you know, what knowledge is important to the organisation. | Identifying what knowledge the organisation needs |

The preliminary categories were again abstracted and are listed in table 5-4 on the next page. The list of preliminary categories in table 5-4 along with the problems identified earlier in phase one answer research question three: What are the problems different KM stakeholders face with respect to KI and KI methods?

**Table 5-4 Preliminary categories.**

| Preliminary categories Level 1 | Preliminary categories Level 2 |
|---|---|
| • Knowledge stored in knowledge repositories is outdated.<br>• Searcher requires subject matter and knowledge to be able to craft queries and interpret results.<br>• Poor, inconsistent, not-repeatable search results.<br>• Patchiness of information leads to a lack of critical mass.<br>• Too much reliability on self-identification or voluntary submission. | Problems with KI methods |
| • Employees do not know what to share.<br>• Lack of incentives for employees to share their knowledge. | Problems with KI methods - specific to knowledge-sharing systems |
| • Freedom to use own knowledge-structures.<br>• Lack of control over what knowledge is shared. | Problems with KI - relating to employees not writing down what they know |
| • Not one single consistent KI method.<br>• Not knowing which KI method to use.<br>• Difficulties in adapting to changes as people learn and move.<br>• Overly complex process in how knowledge is captured and collected.<br>• Lack of formal processes, no accountability.<br>• No trust in currency of knowledge.<br>• Lack of KM policies.<br>• Lack of clear KM policies. | Problems with KI |

| Preliminary categories<br>Level 1 | Preliminary categories<br>Level 2 |
| --- | --- |
| • Weak business case for KI.<br>• Knowledge is not used as currency.<br>• Anatomy of a document is unclear.<br>• No clear knowledge needs. | Problems with KI - building the case for KI |
| • No clear organisation structure<br>• No clear organisation knowledge structure<br>• No universal taxonomy. Difficulty in getting a common understanding. | Problems with KI - relating to knowledge and organisation structure. |

As a means to organise the preliminary categories (from both levels, but mainly level 2) and identify the cause-effect relationships, cognitive mapping was used. The preliminary categories were transformed into nodes as shown in figure 5-3 on the next page. Microsoft PowerPoint was used in this exercise.

In the third stage of the interview data analysis, the nodes or preliminary categories were refined and consolidated to obtain a list of the dominant categories, or domains.

There were clearly more than one domain that deserved consideration. The difficulty in this exercise was to distinguish between dominant categories and not so dominant categories.

As Bacharach (1989) notes: "Constructs [in this case, domains] must be broad enough to reflect the domain of the phenomenon being studied, but also parsimonious enough to focus inquiry. In this research, I took all dominant categories: there were only four of them.

The domains (or dominant categories) identified are:

- Knowledge Needs Identification,
- Knowledge Recording,
- KI Methods Effectiveness, and
- KI Operationalisation.

Further, as a quality assurance check, the units of meaning from stage one were then allocated to their respective domains to ensure that every units of meaning had its respective domain and the relationships between the domains were examined again (as a sanity check).

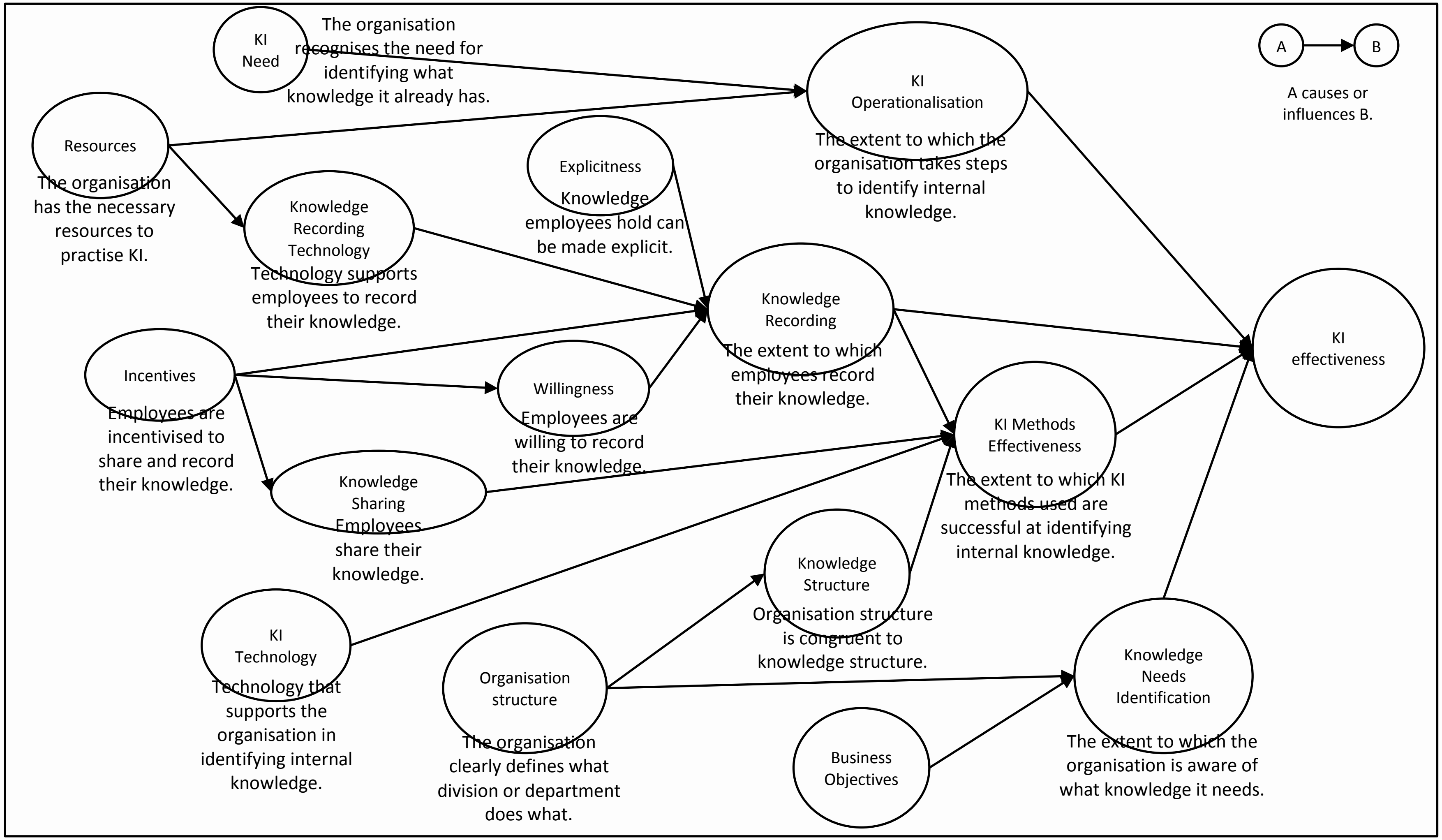



**Figure 5-3 The relationship among nodes.**

The four domains identified are the potential factors that influence KI Effectiveness. These four domains collectively answer research question four: What are the factors that influence KI effectiveness?

The next section expands on these factors to explain what these factors mean.

## 5.3. A Nascent Theory of KI Effectiveness

Analysis of the interview data, as described above, produced four domains. They are:

- Knowledge Needs Identification,
- Knowledge Recording,
- KI Methods Effectiveness and
- KI Operationalisation.

These four domains are the potential factors that influence KI effectiveness. These four domains fill the unknown factors in the initial research model as shown below.

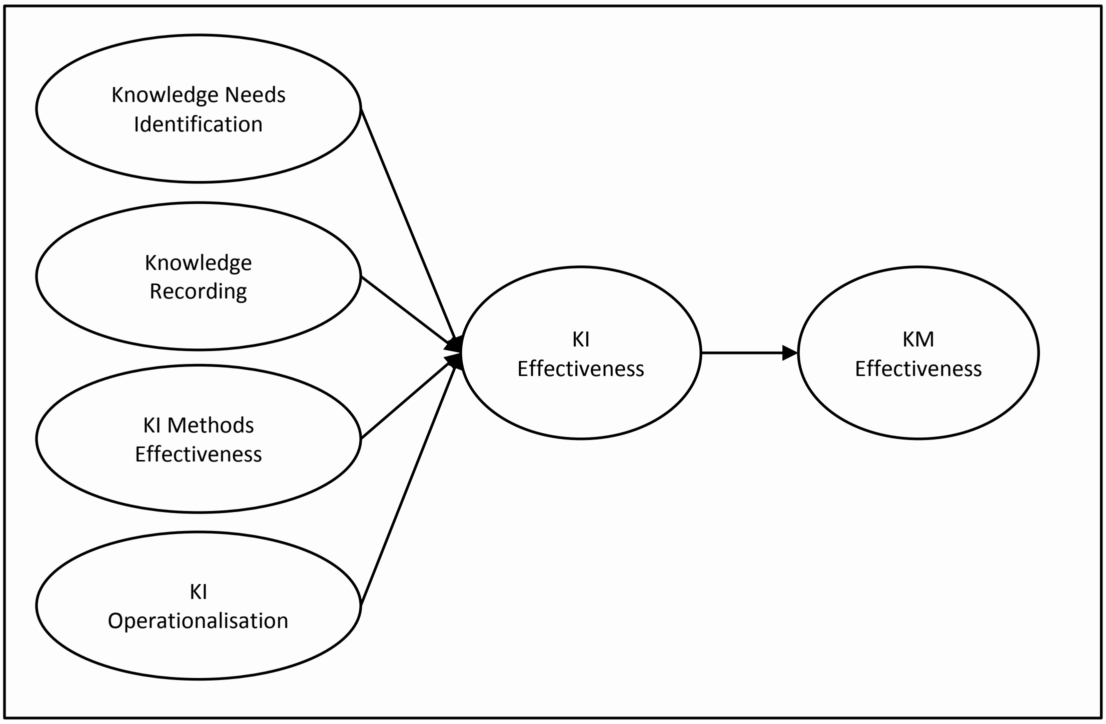



**FIGURE 5-4 A NASCENT THEORY OF KI EFFECTIVENESS.**

This section defines and discusses these four potential factors and posits them as part of a nascent (i.e. preliminary and untested) theoretical model. Given that the precise definition of each domain is an important part of theory development (Feldman 2004), I first go through the definitions of the four factors (from top to bottom) then justify why this model can be posited as a theory.

## Domain Definitions

The first factor to be defined is "Knowledge Needs Identification". This factor can be defined as: "the extent to which an organisation has established what knowledge it needs for its performance".

This factor is exemplified in the interview excerpt below:

> "*I think on the plant, which is the generators, the turbines and the cooling towers, people have an idea, cause you know who knows what.*
>
> *But it's, it's the detail knowledge of who was the last person that pulled apart that tur-bine, cause you know like, I don't know a pulveriser, a turbine, it might only be, it might have a major overhaul once every four years,*
>
> *so umm you know, it's always ideal to get the person who worked on it last time to you know, be involved because they have such detail knowledge about what might happen.*"

The explanation for this factor is that if an organisation knows what knowledge it needs, the organisation is likely to be more effective in identifying who holds the knowledge or where the knowledge resides.

This factor is of particular interest because it creates a clear delineation between itself and KI: the difference between: what knowledge an organisation needs (Knowledge Needs Identification) and what knowledge the organisation has (KI Effectiveness). In chapter two (Review of Relevant Literature), I pointed out that one may argue the case for merging the two concepts together.

That said, this factor fits well with the "Knowledge Goals" process in the KM framework of Probst et al. (2002) (see figure 5-5 on the next page).

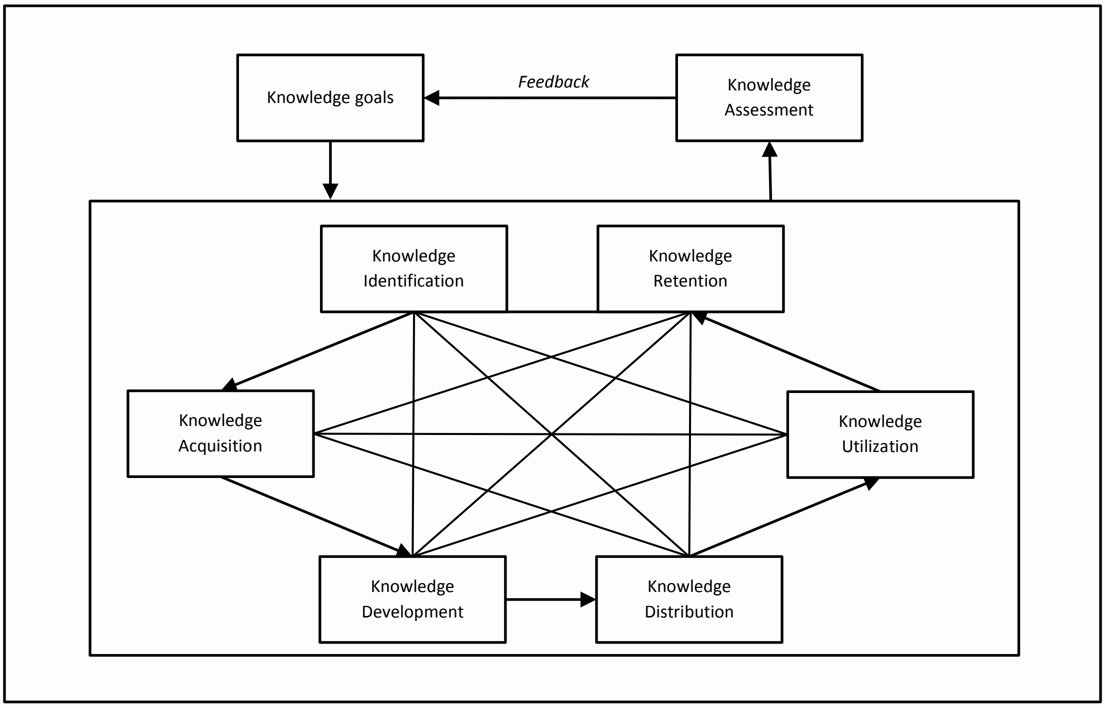



**FIGURE 5-5 KM PROCESSES (ADAPTED FROM PROBST ET AL. 2000, P. 30).**

The next factor is "Knowledge Recording". This factor can be defined as: "the extent to which employees articulate and record what they know".

This factor is exemplified in the interview excerpt below:

> *"It's all open. And that's what we wanted to do with that because we figured the best way to learn is to leave it [knowledge sharing system] open so they could put anything to it any way that they wanted and we would learn by that.*
>
> *Because what will happen is all the good stuff will eventually float to the surface and we'll share that and we'll be able to replicate that across the organisation and the stuff that doesn't work well will just fall off."*

The explanation for this factor is that if employees do write down what they know, the knowledge is then captured in knowledge repositories.

These knowledge repositories can then be used for later consumption of the knowledge. It is worth noting that knowledge repositories need to be kept up-to-date as well.

The “KI Methods Effectiveness” factor is defined as: “the extent to which the methods, tools, techniques or other means that an organisation uses to practise KI, work well”.

This factor is exemplified in the interview excerpt below:

> “*It’s also hugely interesting area because the types of document management systems that work in the commercial enterprise typically don’t work in a law firm for those sort of reasons because we have to be able to track not only where any document is at any point in time, which is what the normal commercial issue is,*
>
> *but we also have to be able to track what the entire life history of the document is, who’s ever read this document, who’s ever had access to this document, or who’s ever participated in anything having to do with this document, and those, that extra level of being able to confidently rely, is really why you’d need this sort of document management involvement.*”

The explanation for this factor is that irrespective of the KI method used, the more effective the KI method is to identify internal organisational knowledge, the more effective the organisation is at practising KI.

Finally, the “KI Operationalisation” factor is defined as: “the extent to which KI is practised proactively, and actively governed”.

This factor is exemplified in the interview excerpt below:

> “*erm.. (clears throat) it’s not straight forward. It’s complex. It’s difficult. Umm it’s umm a lot of work.. and people are busy and no one wants to put their hand up for something which is difficult and lot of work.*

> *umm and you know it's not so obvious who should bear responsibility? It's one of these things, it could be HR, it could be IT, it could be in our library or information services area, it could be.. you know a few other places."*

The explanation for this factor is that just starting is key. If the organisation does not practise KI, it is unlikely that the organisation is effective at identifying its internal knowledge when it needs it (i.e. reactive KI).

Next, I provide the justification for positing the model on figure 5-4 as a theory.

## Theory Justification

As described in chapter three (Research Design and Method), in a number of ways, this model represents new theory. Theory development "usually emphasizes the relationships among constructs, describing the direction, sign, and form of these relationships and explaining why and under what conditions these relationships occur." (Edwards 2011, p. 370).

In this case, the model is effectively a theory of KI effectiveness. The hypothesised model portrays all the above elements, including the four elements of a theory recommended by Whetten (1989):

- the what - the factors to be considered to explain KI effectiveness,
- the how - how the factors identified are related to each other (the arrows and the direction of the arrows),
- the why - the underlying psychological, economic, or social dynamics that justify the selection of factors and the proposed causal relationships (the discussion above), and
- the who, where and when (the limitations or conditions placed on the theory).

There are both implications and limitations to these findings. As Bollen (1989, p. 72) points out: "Any model is an approximation to [sic] reality. A theory is an abstract set of ideas that links together concepts. A model is a formal representation of a theory." The implications and limitations are discussed next.

## 5.4. Implications of Findings

Phase two further explored the problems different KM stakeholders face with respect to KI and KI methods. Analysis of the interview data revealed four potential factors that influence KI effectiveness, posited as a nascent theory of KI effectiveness. Figure 5-4 above depict the four factors.

Two of the four factors identified were expected, based on the review of relevant KM literature in chapter two and the findings from phase one: Knowledge Recording and KI Methods Effectiveness.

Review of relevant literature indicated that there are problems around employees articulating and recording what they know (e.g. due to the tacitness of knowledge and knowledge-hoarding behaviour). Similarly, findings from phase one showed that there are problems around the effectiveness of KI methods and having the right KI method or the right combination of KI methods may be the key to effective KI.

The other two factors are more revealing. In terms of KI Operationalisation, when it comes to identifying internal organisational knowledge, it appears that organisations have problems in practising KI, specifically in terms of ranking KI as a priority and being proactive in practising KI.

In terms of Knowledge Needs Identification, it appears that organisations experience problems in establishing what knowledge is needed for organisational performance. These findings raise further questions: Do organisations establish what knowledge they need? How? Do organisations prioritise what knowledge they have or need? How? Answering those questions go beyond the scope of this research and warrant future research.

Some limitations of the in-depth interviews in phase two include:

First, while theoretically selected for breadth, the sample was small in size and not all industries were represented, which may limit the generalisability of any findings.

Second, due to resource constraints, the research was constrained to Australian organisations, which may further limit the generalizability of any findings.

Third, and most importantly, the theory built in this research (figure 5-4 above) has not been rigorously tested. It is therefore difficult to claim this theory effectively as a grand, middle-range or situation-specific type of theory.

The next phase (phase three) tests the proposed KI effectiveness theory, to ascertain whether it applies across all industries or only some, and to evaluate whether the same factors apply in other countries, regions, and cultures than in Australia. The strengths of the relationships among the factors influencing KI effectiveness are also established.

I summarise chapter five in the next section and detail findings from phase three in the next chapter.

## 5.5. Chapter Summary

Following the findings reported from phase one, this chapter reported the findings from phase two, the explanatory research. Findings from phase two established the potential factors influencing KI effectiveness and produced a model out of those factors.

Phase three tested the theory underlying the model. Findings from the theory-testing survey in phase three are reported and discussed in the next chapter.

# Chapter Six: Findings from Theory-Testing Survey

Chapter six examines the findings from phase three of this research. The goals of phase three were to test the model generated in phase two, and if necessary, refine the model based on the strength of the relationships among the various factors.

Thus, phase three not only answers research question five: “To what extent does KI effectiveness impact KM effectiveness?”, but also evaluates the factors influencing KI effectiveness. Phase three as highlighted in the table below relates to RQs 4 and 5.

**TABLE 6-1 PHASES OF RESEARCH.**

| Research questions | Research phases |
|---|---|
| 1. To what extent do organisations practise KI?<br>2. What KI methods are currently used by organisations? | Phase one |
| 3. What are the problems different KM stakeholders face with respect to KI and KI methods? | Phase two |
| 4. What are the factors that influence KI effectiveness? | Phase two / Phase three |
| 5. To what extent does KI effectiveness impact KM effectiveness? | Phase three |

As described in chapter three (Research Design and Method), a number of steps were taken to test the model and measure the strength of the relationships among the various factors. These steps are summarised on the next page:

1. Use the model to construct an SEM.

1.1. Define the latent variables.
1.2. Develop reflective indicators for each latent variable.

2. Operationalise the SEM into a survey and send out the survey.
    2.1. Use the reflective indicators to develop survey questions.
    2.2. Implement measures to address response validity concerns.
    2.3. Develop the web-based questionnaires.
    2.4. Pilot-test the survey.
    2.5. Identify target population.
    2.6. Email or post link to survey.
3. Collect and analyse data.
    3.1. Cleanse and prepare the data collected.
    3.2. Perform Exploratory Factor Analysis.
    3.3. Refine model according to data analysis findings.
    3.4. Perform Confirmatory Factor Analysis.
4. Report on findings including limitations of the research.

In the following sections, I report on the findings from the above steps.

## 6.1. SEM: Latent Variables and Indicators

The first step was to transform the model into an SEM. This entailed using the right terminologies, establishing clear definitions and measures for each latent variable (the factors), and writing the hypotheses to be tested.

Based on the model generated in phase two, the hypotheses (H1 to H5) to be tested as shown below were:

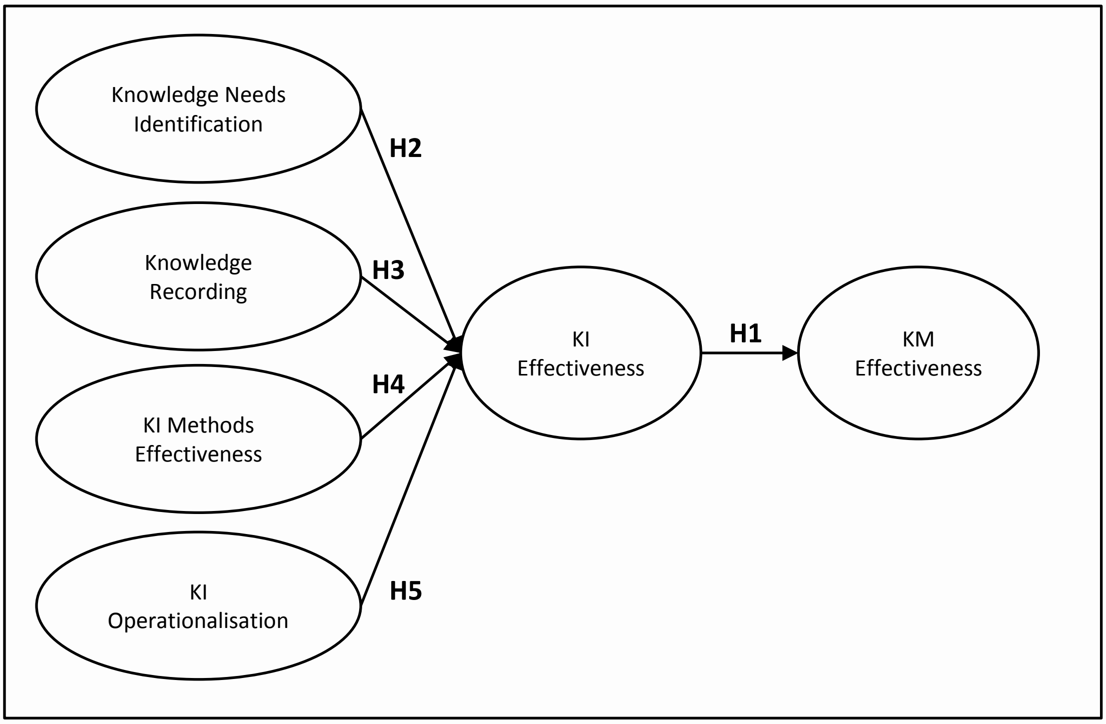



**FIGURE 6-1 HYPOTHESES TO BE TESTED.**

H1: Knowledge Identification Effectiveness (KIE) has a positive and significant influence on Knowledge Management Effectiveness (KME).

H2: Knowledge Needs Identification (KNI) has a positive and significant influence on Knowledge Identification Effectiveness (KIE)

H3: Knowledge Recording (KR) has a positive and significant influence on KIE.

H4: Knowledge Identification Methods Effectiveness (KIME) has a positive and significant influence on KIE.

H5: Knowledge Identification Operationalisation (KIO) has a positive and significant influence on KIE.

The latent variables were defined in chapter five (Findings from in-Depth Interviews) and are list on the tables on the following pages.

The next step was to develop reflective indicators for each latent variable. As per the research design described in chapter three (Research Design and Method), two sets of indicators were developed: management indicators for the 'Responsible-for-KM' questionnaire and non-management indicators for the 'Not-responsible-for-KM' questionnaire.

I followed the same guidelines used to develop the reflective indicators for KME and KIE (again see chapter three). The management indicators for the KI Effectiveness and KM Effectiveness latent variables were taken from chapter two (Review of Relevant Literature).

The domain analysis in phase two informed the development of the indicators - ensuring the indicators were grounded in theory. Where non-management indicators were not applicable, only management indicators were developed.

To ensure that I had more latent variables than not enough, and to mitigate the risk of common method bias, I added two latent variables chosen from the sub-categories from the domain analysis in phase two: Access to Knowledge and Knowledge Sharing; and two bogus indicators:

- It is easy for employees to obtain permission to access corporate financial information.

- The organisation has determined the legal regulations it needs to comply with.

The definitions and the indicators used for each of the latent variables are listed in the table on the following pages.

**Table 6-2 Latent variables and definitions.**

<table>
<tr><th>Latent Variables</th><th colspan="2">Definitions and Indicators</th></tr>
<tr><td rowspan="2">KM Effectiveness (KME)</td><td colspan="2">The extent to which an organisation is able to identify and leverage its knowledge assets to drive and support organisational performance.</td></tr>
<tr><td>Management indicators<br>• Employees have the knowledge they need to do their job.<br>• Employees would still have the knowledge they need to do their job, even if some employees retired or left the organisation.<br><br>If employees do not have the knowledge they need to do their job:<br>• they can obtain it.<br>• they can obtain it when they need it.<br>• they can obtain it in the form they need it.</td><td>Non-management indicators<br>• If I do not have knowledge I need, I can obtain it.<br>• I can obtain knowledge I need when I need it.</td></tr>
</table>

<table>
<tr><th>Latent Variables</th><th colspan="2">Definitions and Indicators</th></tr>
<tr><td rowspan="2">KI Effectiveness (KIE)</td><td colspan="2">The extent to which an organisation is able to identify internal sources of knowledge that are relevant and needed for organisational performance.</td></tr>
<tr><td>Management indicators<br><br>The organisation has explicitly established:<br><br>• what relevant knowledge it has within its boundaries.<br>• what relevant knowledge its employees have.<br>• which knowledge has high priority or low priority for its organisation performance.<br>• Its knowledge gaps (knowledge that it needs but does not have).</td><td>Non-management indicators<br><br>It is easy for me to determine:<br><br>• whether the knowledge I need is available somewhere in my organisation.<br>• who has knowledge I need to do my job.<br>• where to find the knowledge I need to do my job.</td></tr>
</table>

<table>
<tr><th>Latent Variables</th><th colspan="2">Definitions and Indicators</th></tr>
<tr><td rowspan="2">Knowledge Needs Identification (KNI)</td><td colspan="2">The extent to which an organisation has established what knowledge it needs for its performance.</td></tr>
<tr><td>Management indicators<br><br>The organisation has determined:<br><br>• the knowledge that it needs for organisation performance.<br>• the knowledge that its members need to do their job.<br>• the relative importance of the different knowledge it needs for organisation performance.<br>• the legal regulations it needs to comply with.<br>(<u>The last one is a dummy indicator</u>.)</td><td>Non-management indicators<br><br>Thinking of knowledge I use to do my job:<br><br>• I know all I need to do my job.<br>• I have all the skills I need to do my job well.<br>• I am highly skilled at doing my job.<br>• I know of knowledge that I wish I could get to do my job better.</td></tr>
</table>

<table>
<tr><th>Latent Variables</th><th colspan="2">Definitions and Indicators</th></tr>
<tr><td rowspan="2">Knowledge Recording (KR)</td><td colspan="2">The extent to which employees articulate and record what they know.</td></tr>
<tr><td>Management indicators<br><br>Employees:<br><br>• record what they know in knowledge repositories.<br>• are willing to record what they know in knowledge repositories.<br>• know what to record in knowledge repositories.</td><td>Non-management indicators<br><br>Regarding my organisation’s knowledge repositories:<br><br>• I know what I am supposed to record in them.<br>• I am willing to record what I know in them.<br>• I record what I am supposed to in them.</td></tr>
</table>

| Latent Variables | Definitions and Indicators | |
|---|---|---|
| **KI Methods Effectiveness (KIME)** | The extent to which the methods, tools, techniques or other means that an organisation uses to identify knowledge it has, work well. | |
| | *Management indicators*<br><br>The methods, tools or techniques that the organisation uses to establish:<br><br>• whether needed knowledge exists within the organisation work well.<br>• who knows what within the organisation work well.<br>• where to find needed knowledge work well. | *Non-management indicators*<br><br>This requires an organisation-wide view. |

| Latent Variables | Definitions and Indicators | |
|---|---|---|
| **KI Operationalisation (KIO)** | The extent to which KI is practised proactively, and actively governed. | |
| | *Management indicators* | *Non-management indicators* |
| | With respect to identifying knowledge that exists within the organisation:<br>• the organisation does not take formal steps to identify knowledge that exists within its boundaries.<br>• the organisation does not allocate sufficient resources to identify knowledge that exists within its boundaries.<br>• The practice of identifying what knowledge exists within the organisational boundaries is not important.<br>(Reversed polarity.) | This requires a management or an organisation-wide view. |

<table>
<tr><th>Latent Variables</th><th colspan="2">Definitions and Indicators</th></tr>
<tr><td rowspan="2">Access to Knowledge (AtK)</td><td colspan="2">The extent to which it is easy for employees on average to obtain knowledge needed or its knowledge-holder.</td></tr>
<tr><td>Management indicators<br><br>It is easy for employees to obtain permission to access:<br><br>• knowledge that the organisation has.<br>• other members of the organisation.<br>• knowledge stored in the organisation's knowledge repositories.<br>• corporate financial information.<br>(<u>The last one is a dummy indicator</u>.)</td><td>Non-management indicators<br><br>I don’t need permission or it is easy for me to obtain permission to access:<br><br>• knowledge that my organisation has.<br>• other employees.<br>• knowledge stored in knowledge repositories.</td></tr>
</table>

| **Latent Variables** | **Definitions and Indicators** | |
|---|---|---|
| **Knowledge Sharing (KS)** | The extent to which… | |
| | *Management indicators*<br>• The organisation promotes a knowledge-sharing culture among its employees.<br>• Technology effectively supports employees to share their knowledge. | *Non-management indicators*<br>• My organisation promotes a knowledge-sharing culture among its members.<br>• Technology effectively supports me to share my knowledge. |

Next, I used the indicators above to develop the two questionnaires: 'Responsible-for-KM' and 'Not-responsible-for-KM', with a total of 38 questions and 25 questions respectively.

These questionnaires were in turn used to develop two web-based questionnaire surveys: one primary survey and one secondary survey. As described in chapter three (Research Design and Method), the primary survey targeted participants either with or without overall KM responsibility, while the secondary survey targeted only participants without overall KM responsibility. Each survey had its own Uniform Resource Locator (URL).

I then pilot-tested the two web-based questionnaires with five KM practitioners, whom I knew and whom I asked to complete as honestly as possible and provide feedback mainly around the wording and structure of the questionnaire.

As a result of this process, no changes were made to the questions, but I had to add what can be described as supporting elements to the questionnaire (including extra wording to explain what 'knowledge repositories' are).

I amended the survey based on the responses received - copies of both questionnaires can be found in appendix C. As per the research design, I posted and sent the link to the primary survey to the targeted groups and mailing lists.

In the next sections, I report on the cleansing process of the survey responses (Data Preparation), then on the demographics of the survey respondents (The Respondents), and finally on findings of the data analysis for each survey - I report on the analysis from the responses from the Responsible-for-KM survey first.

## 6.2. Data Preparation

In this section, I report on the steps taken to prepare the data collected from both questionnaires below. Preparing the survey responses entails verifying and validating the survey responses.

Note that given the extensive nature of the data analysis for the 'Responsible-for-KM' questionnaire, data preparation for the responses from the questionnaire was more rigorous. In other words, there were more steps in preparing the data for the 'Responsible-for-KM' questionnaire than the 'Not-Responsible-for-KM' questionnaire.

Between May 2013 and August 2013, a total of 555 responses were collected. Out of the 555 responses, 510 individuals responded to the primary survey link and the remaining 45 individuals responded to the secondary survey.

The low participation rate for the secondary survey indicates that the snowball strategy had limited effectiveness.

Of the 555 responses, 248 (roughly 45 per cent) were valid. This includes respondents who were invited to participate to the survey by their colleagues. I was copied in 24 emails sent to others to respond to the survey. The distribution between surveys are shown the table below.

**Table 6-3 Survey tally prior to averaging responses.**

| Source | 'Responsible-for-KM' questionnaire | 'Not Responsible for KM' questionnaire |
|---|---|---|
| Primary survey link | 90 | 124 |
| Secondary survey | N/A | 34 |

After further preparation of the data (e.g. averaging responses, which I detail below), 205 responses were used. Of the 205 valid responses, 84 were from the 'Responsible-for-KM' questionnaire. The remaining 121 were from the 'Not-Responsible-for-KM' questionnaire.

The data preparation steps taken are detailed below:

- I imported the data collected from Qualtrics into an Excel spreadsheet; Microsoft Excel 2013 was used.

  I screened the data for completeness and validity. Incomplete responses and responses where the size of the organisation was lower than ten (an arbitrary value), were discarded. Where warranted, I also standardised the data for consistency (e.g. renaming USA or America to United States, renaming Brasil to Brazil, or renaming organisation names where some respondents used acronyms while others wrote the names in full.).

- Where the polarity of the indicators in the questionnaires was reversed, I reversed the polarity of the responses.

  I examined and cross-checked the scale Qualtrics uses. I used an 11-point bi-polar, Likert scale: From Completely Disagree to Neutral to Completely Agree, with the last option as: Unable to judge.

  I used the formula: 12-VALUE. Where the value was 12, I left the value as is. Table 6-3 below depicts the scales.

**TABLE 6-4 REVERSING THE QUESTIONNAIRE SCALE.**

| Sources | Scale | | | |
|---|---|---|---|---|
| **Questionnaire** | Completely Disagree | Neutral | Completely Agree | Unable to Judge |
| **Qualtrics** | 1 | 6 | 11 | 12 |
| **In reverse** | 11 | 6 | 1 | 12 |

- Next, I checked for unengaged respondents (e.g. a respondent who answered with the same value or 1, 2, 3, 4, 1, 2, 3, 4 throughout the questionnaire).

  To do so, in Excel, I inspected the responses visually and used the formula STDEV.P(RANGE), looking for responses where the standard deviation falls in the 0 – 0.5 range. I found none.

- I screened for duplicate responses from the same respondents. I used a combination of information to establish respondents who completed or started the survey more than once.

  Note, for the purpose of analysing the 'Responsible-for-KM' questionnaire data for the Exploratory Factor Analysis and Confirmatory Analysis, I needed unique organisations. Therefore, I averaged the responses - where there were more than one respondents from the same organisation. Where there were values of 12 (Unable to judge), I replaced the 12 with a zero.

  Likewise, for the 'Not-Responsible-for-KM' questionnaire, for the purpose of analysing trends across unique organisations, I averaged responses where warranted.

  I used the averaged responses for comparing the trends between responses from the 'Responsible-for-KM' and 'Not-Responsible-for-KM' questionnaires as well.

- Missing data.

  Next, from the resulting list of responses, I checked for missing data, and where possible imputed the missing values. The value '12' represents 'Unable to Judge' on the questionnaires.

  I treated those values as missing values. Where there were more than three missing values in the individual response, I discarded the response.

At the final tally, I counted six records with missing values in the 'Responsible-for-KM' survey and again six records for the 'Not-Responsible-for-KM'.

Given the low count of responses with missing values and the data being ordinal, I imputed the missing values. I followed the steps below to impute the missing values:

- I removed the '12's from the responses to represent missing values.

- I imported the data from Excel to IBM SPSS Statistics (version 22). Each indicator was given a variable name (AtK1, AtK2, as such), a type of 'Numeric', a measure-type of 'Scale' and a width of '2'.

- I checked for missing values in SPSS. In SPSS:

  ANALYSE -> DESCRIPTIVE STATISTICS -> FREQUENCIES

  (Everything else kept as DEFAULT.)

The two tables on the next page show the results obtained.

**TABLE 6-5 RESPONSES WITH MISSING DATA FOR THE 'RESPONSIBLE-FOR-KM' QUESTIONNAIRE.**

| | | Employees can access other employees in the organisation. | Organisation has established which knowledge has high priority or low priority. | Organisation has established its knowledge gaps. | If employees do not have knowledge they need, they can obtain it in the form they need it. |
|---|---|---|---|---|---|
| N | Valid | 83 | 83 | 83 | 83 |
| | Missing | 1 | 1 | 1 | 1 |

**TABLE 6-6 RESPONSES WITH MISSING DATA FOR THE 'NOT-RESPONSIBLE-FOR-KM' QUESTIONNAIRE.**

| | | I don't need permission or it is easy for me to access knowledge that my organisation has | I know all I need to do my job. | I am highly skilled at doing my job. | I can obtain knowledge I need when I need it. | I know what I am supposed to record in knowledge repositories | I record what I am supposed to record in knowledge repositories |
|---|---|---|---|---|---|---|---|
| N | Valid | 120 | 120 | 120 | 120 | 120 | 118 |
| | Missing | 1 | 1 | 1 | 1 | 1 | 3 |

- I replaced all the remaining missing values with the median (c.f. to the mean) of all points. Values for AtK4 and KNI4 which are bogus items added to address common method bias were left as-is.

  I selected the median because of measurement scale used for the indicators: the Likert scale. In SPSS:

  TRANSFORM -> REPLACE MISSING VALUES

  I replaced the same variable and did not create new variables - see the figure below.

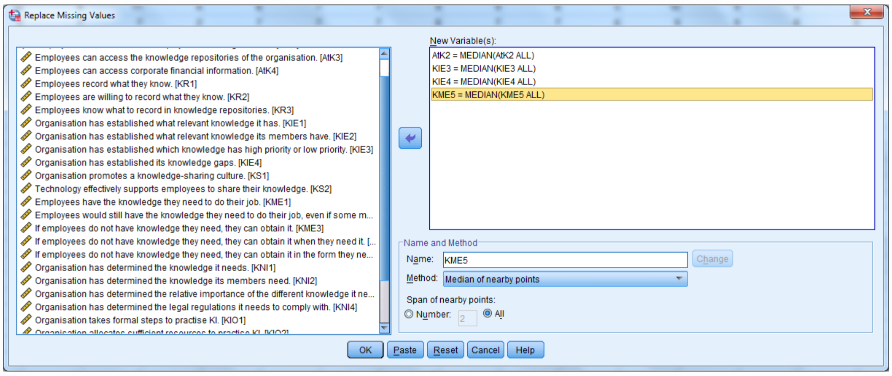



**FIGURE 6-2 REPLACING MISSING VALUES IN SPSS.**

  I applied the same steps for the missing responses from the 'Not-Responsible-for KM' questionnaire.

- Next, to ensure normality in the data among the relevant variables for the 'Responsible-for-KM' questionnaire, I checked for Skewness and Kurtosis.

  In SPSS:

  ANALYZE -> DESCRIPTIVE STATISTICS -> EXPLORE

  I put all the indicators in the Dependent List box.

Kline (2005) recommends that the skewness and kurtosis indices should not exceed an absolute value of 3 and 10 respectively. This was the case in this research as demonstrates by the abridged table on the next page. The full table is shown in appendix D.

**TABLE 6-7 SKEWNESS AND KURTOSIS STATISTICS FOR THE 'RESPONSIBLE-FOR-KM' QUESTIONNAIRE.**

| | | Statistic | Std. Error |
|---|---|---|---|
| Employees can access knowledge that the organisation has. | Skewness | -.661 | .267 |
| | Kurtosis | -.632 | .529 |
| Employees can access other employees in the organisation. | Skewness | -.948 | .267 |
| | Kurtosis | -.084 | .529 |
| Employees can access the knowledge repositories of the organisation. | Skewness | -1.292 | .267 |
| | Kurtosis | 1.785 | .529 |
| Employees can access corporate financial information. | Skewness | -.146 | .267 |
| | Kurtosis | -1.014 | .529 |
| Employees record what they know. | Skewness | -.112 | .267 |
| | Kurtosis | -.807 | .529 |
| Employees are willing to record what they know. | Skewness | -.177 | .267 |
| | Kurtosis | -.730 | .529 |
| Employees know what to record in knowledge repositories. | Skewness | -.105 | .267 |
| | Kurtosis | -.892 | .529 |
| Organisation has established what relevant knowledge it has. | Skewness | -.260 | .267 |
| | Kurtosis | -.961 | .529 |
| Organisation has established what relevant knowledge its members have. | Skewness | -.247 | .267 |
| | Kurtosis | -1.033 | .529 |
| Organisation has established which knowledge has high priority or low priority. | Skewness | -.226 | .267 |
| | Kurtosis | -1.038 | .529 |
| Organisation has established its knowledge gaps. | Skewness | .032 | .267 |
| | Kurtosis | -.888 | .529 |
| Organisation promotes a knowledge-sharing culture. | Skewness | -.815 | .267 |
| | Kurtosis | .136 | .529 |
| Technology effectively supports employees to share their knowledge. | Skewness | -.823 | .267 |
| | Kurtosis | .202 | .529 |
| Employees have the knowledge they need to do their job. | Skewness | -.489 | .267 |
| | Kurtosis | .069 | .529 |
| Employees would still have the knowledge they need to do their job, even if some members retired or left. | Skewness | -.183 | .267 |
| | Kurtosis | -.755 | .529 |
| If employees do not have knowledge they need, they can obtain it. | Skewness | -.608 | .267 |
| | Kurtosis | .214 | .529 |
| If employees do not have knowledge they need, they can obtain it when they need it. | Skewness | -.580 | .267 |
| | Kurtosis | .198 | .529 |
| If employees do not have knowledge they need, they can obtain it in the form they need it. | Skewness | -.359 | .267 |
| | Kurtosis | -.557 | .529 |
| Organisation has determined the knowledge it needs. | Skewness | -.362 | .267 |

| | | | |
|---|---|---|---|
| | Kurtosis | -.412 | .529 |
| Organisation has determined the knowledge its members need. | Skewness | -.552 | .267 |
| | Kurtosis | -.151 | .529 |
| Organisation has determined the relative importance of the different knowledge it needs. | Skewness | -.452 | .267 |
| | Kurtosis | -.764 | .529 |
| Organisation has determined the legal regulations it needs to comply with. | Skewness | -.923 | .267 |
| | Kurtosis | .302 | .529 |
| Organisation takes formal steps to practise KI. | Skewness | -.341 | .267 |
| | Kurtosis | -1.127 | .529 |
| Organisation allocates sufficient resources to practise KI. | Skewness | -.098 | .267 |
| | Kurtosis | -1.329 | .529 |
| Organisation values the practice of KI. | Skewness | -.911 | .267 |
| | Kurtosis | -.050 | .529 |
| Methods used to find needed knowledge work well. | Skewness | -.167 | .267 |
| | Kurtosis | -.373 | .529 |
| Methods used to find who knows what work well. | Skewness | -.139 | .267 |
| | Kurtosis | -.482 | .529 |
| Methods used to establish whether knowledge needed exists within the organisation work well. | Skewness | -.197 | .267 |
| | Kurtosis | -.088 | .529 |

Based on the results above, the data in this study is regarded as normal for the purposes of structural equation modelling.

Next, I report on the demographics of the respondents.

## 6.3. The Respondents

In this section, I describe the respondents of this research.

### Count

As mentioned in the previous section, a total of 555 responses were obtained. None of the 555 respondents in phase three participated in phases one or two. Of the 555 responses, 248 were valid.

As a result of further data preparation, of the 248 valid responses, 205 responses were used. 84 were from the 'Responsible-for-KM' questionnaire. The remaining 121 were from the 'Not-Responsible-for-KM' questionnaire.

I report on the 205 responses. Where averages are not permissible (e.g. 'Job category'), I will report on the 248 responses.

## Location

Respondents were asked to enter the country in which they were based. Combined, the 205 respondents were located in 49 different countries across the six continents. Note, one organisation had respondents from different countries, I considered the country where the majority of the respondents were based. Figure 6-3 below depicts the countries where the respondents were located. The scale shows the percentage of respondents.

The largest proportion of respondents (~24.9 per cent) were based in the United States, followed by Australia (~16.6 per cent), India (~7.3 per cent), the United Kingdom (~5.4 per cent) and Canada (~4.4 per cent).

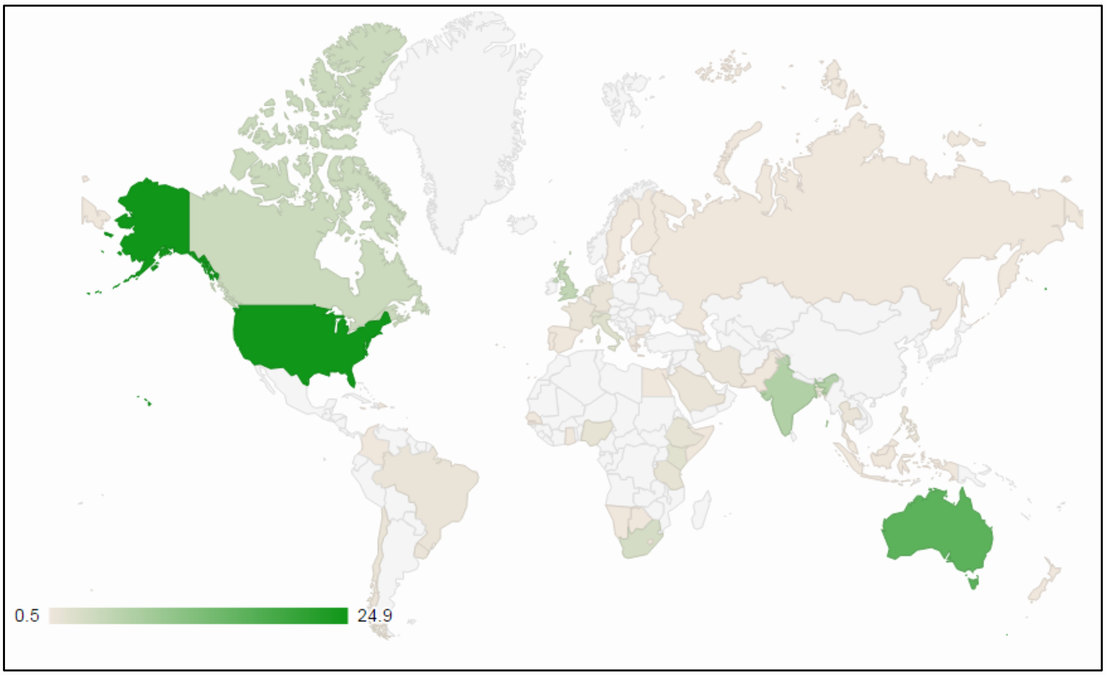



FIGURE 6-3 DISTRIBUTION OF RESPONSES BY LOCATION.

I break down the participating countries by survey on the next page.

*Responsible-for-KM survey*

The 84 respondents of the 'Responsible-for-KM' questionnaire were located in 25 different countries. The largest proportion of respondents (25.0 per cent) were from the United States, followed by Australia (~19.0 per cent), India (~9.5 per cent), South Africa (~6.0 per cent) and the United Kingdom (~6.0 per cent). The table below provides the full list.

**TABLE 6-8 RESPONDENTS FROM THE 'RESPONSIBLE-FOR-KM' QUESTIONNAIRE.**

| Countries | Proportion of Respondents (in descending order) |
|---|---|
| United States | 25.0% |
| Australia | 19.0% |
| India | 9.5% |
| South Africa | 6.0% |
| United Kingdom | 6.0% |
| Ethiopia | 3.6% |
| Singapore | 2.4% |
| The Netherlands | 2.4% |
| Switzerland | 2.4% |
| Tanzania | 2.4% |
| Canada | 2.4% |
| Philippines | 2.4% |
| Kenya | 2.4% |
| Bangladesh | 1.2% |
| Spain | 1.2% |
| Ghana | 1.2% |
| Botswana | 1.2% |
| Iran | 1.2% |
| Indonesia | 1.2% |
| Thailand | 1.2% |
| Somalia | 1.2% |
| Dominican Republic | 1.2% |
| Chile | 1.2% |
| Italy | 1.2% |
| Jamaica | 1.2% |

*Not-Responsible-for-KM survey*

The 121 respondents of the 'Not-Responsible-for-KM' questionnaire were located in 40 different countries. The largest proportion of respondents (~24.8 per cent) were from the United States, followed by Australia (~14.9 per cent), Canada (~5.8 per cent), the India (~5.8 per cent) and the United Kingdom (~5.0 per cent). The table below provides the full list.

**TABLE 6-9 RESPONDENTS FROM THE 'NOT-RESPONSIBLE-FOR-KM' QUESTIONNAIRE.**

| Countries | Proportion of Respondents (in descending order) |
|---|---|
| United States | 24.8% |
| Australia | 14.9% |
| Canada | 5.8% |
| India | 5.8% |
| United Kingdom | 5.0% |
| Italy | 3.3% |
| Nigeria | 2.5% |
| Palestine | 2.5% |
| The Netherlands | 2.5% |
| Switzerland | 1.7% |
| South Africa | 1.7% |
| Saudi Arabia | 1.7% |
| Brazil | 1.7% |
| France | 1.7% |
| Germany | 1.7% |
| Kenya | 1.7% |
| Bangladesh | 1.7% |
| Uruguay | 1.7% |
| Egypt | 0.8% |
| Senegal | 0.8% |
| Lesotho | 0.8% |
| Bulgaria | 0.8% |
| Iran | 0.8% |
| Chile | 0.8% |
| Thailand | 0.8% |
| Greece | 0.8% |
| Colombia | 0.8% |
| Pakistan | 0.8% |

| | |
|---|---|
| Singapore | 0.8% |
| Hong Kong | 0.8% |
| Sweden | 0.8% |
| Portugal | 0.8% |
| Tanzania | 0.8% |
| Republic of Trinidad and Tobago | 0.8% |
| Finland | 0.8% |
| Russia | 0.8% |
| Malaysia | 0.8% |
| Samoa | 0.8% |
| New Zealand | 0.8% |
| Namibia | 0.8% |

## Organisation Size

The 205 responses represented 194 unique organisations which employ between 10 to over 350,000 employees (Note: some respondents preferred to stay anonymous about their organisations).

The average number of employees among the ‘Responsible-for-KM’ was 12,516. That of the ‘Not-Responsible-for-KM’ respondents was 10,166. Their respective histograms with a logarithmic scale (log 10) are shown below.

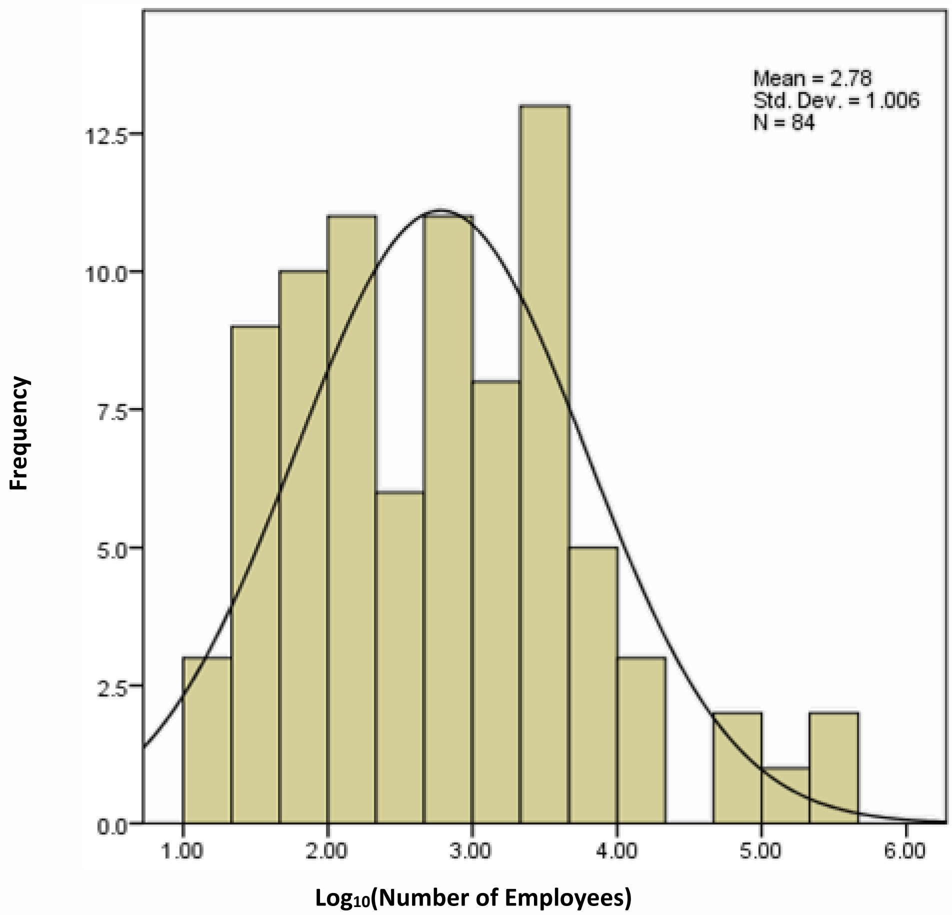



FIGURE 6-4 HISTOGRAM OF ORGANISATION SIZES OF 'RESPONSIBLE-FOR-KM' RESPONDENTS.

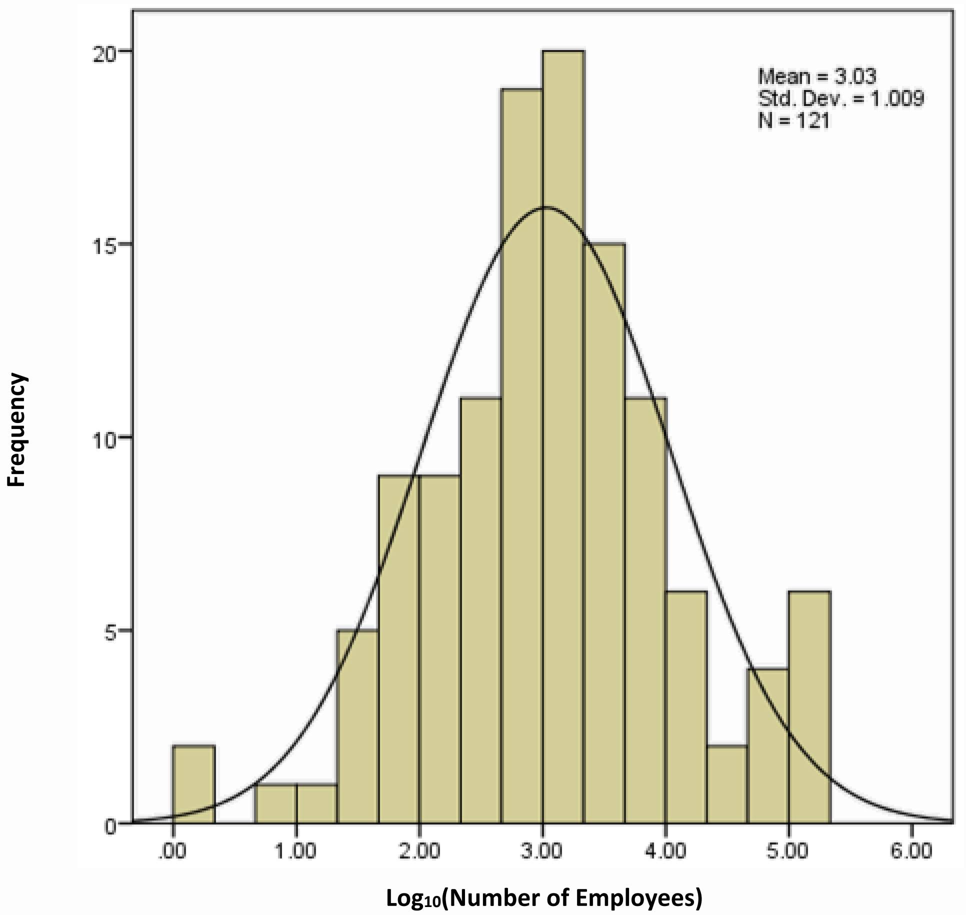



**Figure 6-5 Histogram of organisation sizes of 'Not-Responsible-for-KM' respondents.**

## Organisation Industry

The 205 responding organisations came from various industries including: agriculture, to professional, scientific and technical services, not-for-profits (NFPs) and non-governmental organisations (NGOs). The charts below depict the respondents and the industries they came from. The 'other' column represent NFPs and NGOs.

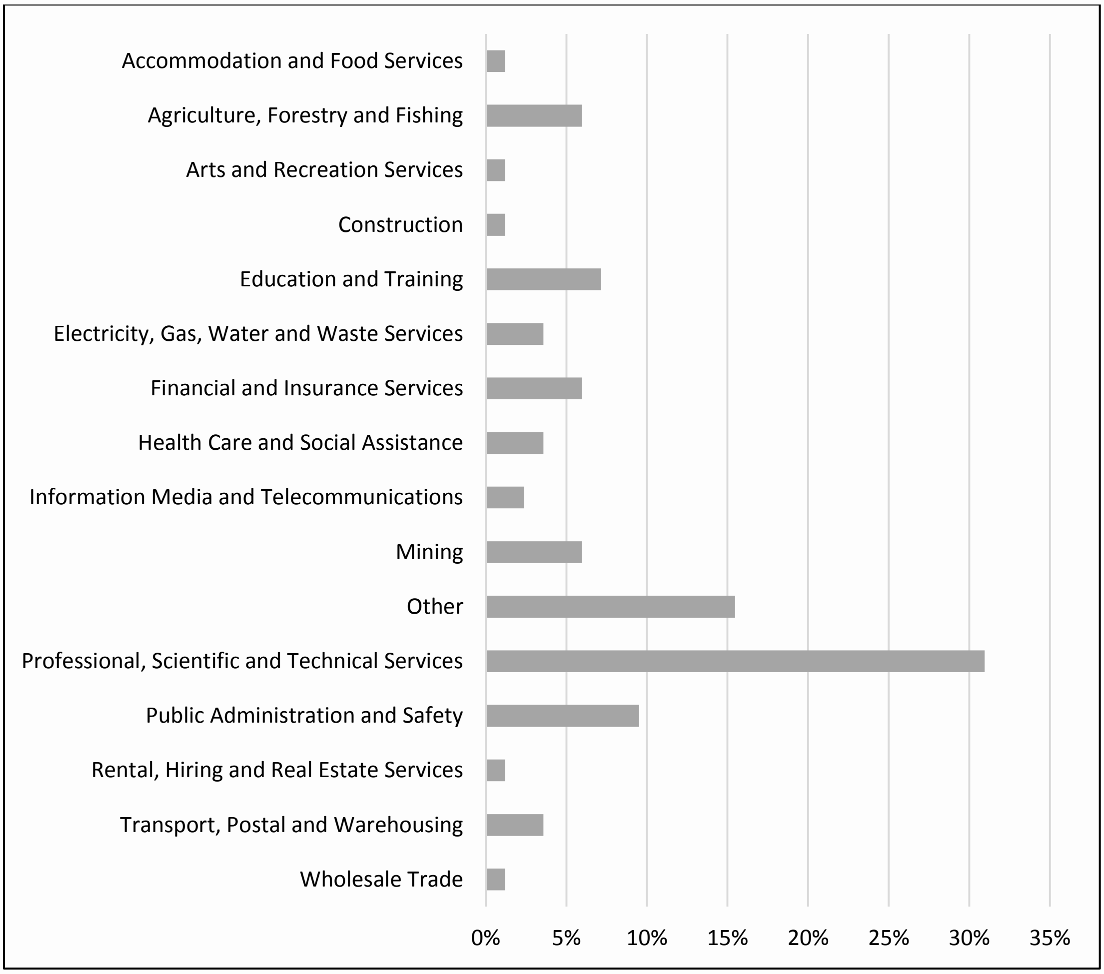



**FIGURE 6-6 DISTRIBUTION OF RESPONSES FOR THE 'RESPONSIBLE-FOR-KM' SURVEY BY INDUSTRY.**

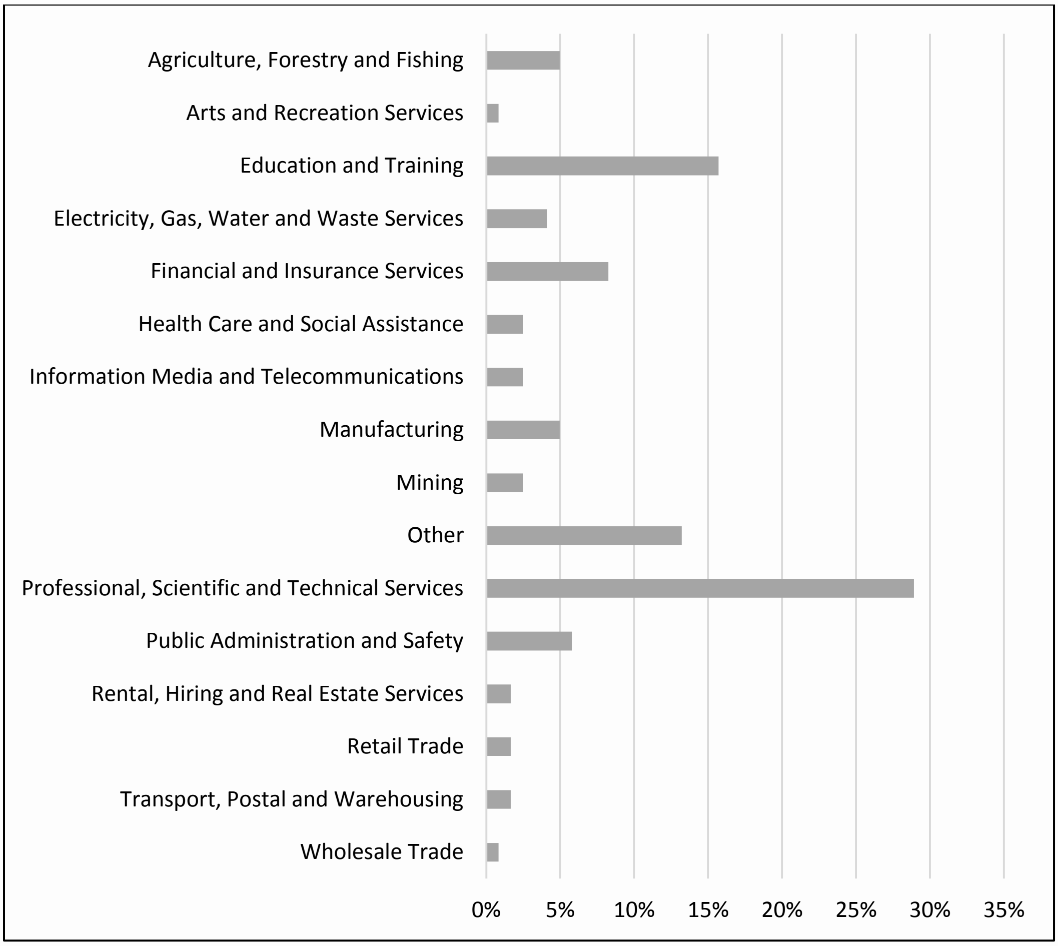



**FIGURE 6-7 DISTRIBUTION OF RESPONSES FOR THE 'NOT-RESPONSIBLE-FOR-KM' SURVEY BY INDUSTRY.**

The largest proportion of respondents (~30.95 per cent and ~28.93 per cent respectively) were from the 'Professional, Scientific and Technical Services' industry. This represents a potential bias toward this specific industry.

I say potential bias because as far as Australia is concerned (the majority of respondents are from Australia (19% and 14.9%) and United States (25% and 24.8%) from both surveys), the proportion of the workforce that work in those industries listed above are more or less the same as what can be observed from the survey responses. The chart on the next page shows the Australian workforce per industry.

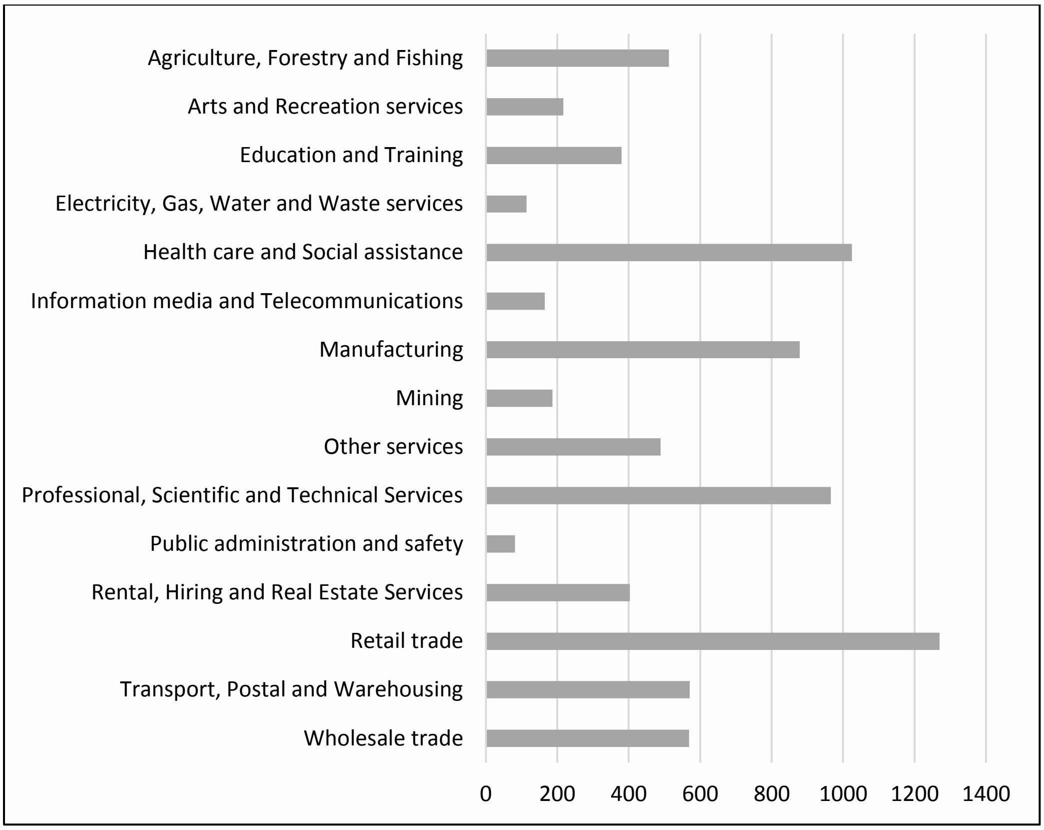



FIGURE 6-8 DISTRIBUTION OF THE AUSTRALIAN WORKFORCE BY INDUSTRY (ABS 2015).

## Time Spent at the organisation – Responsible-for-KM respondents only

Data around time spent at the organisation was collected only for the 'Responsible-for-KM' questionnaire. Answers ranged from one month to 27 years, with an average of over seven years.

## Organisation Role

The majority (61.83 per cent) of the 248 respondents (note the number of respondents) hold managerial or executive roles. The chart below breaks down the job categories and the overall KM responsibility.

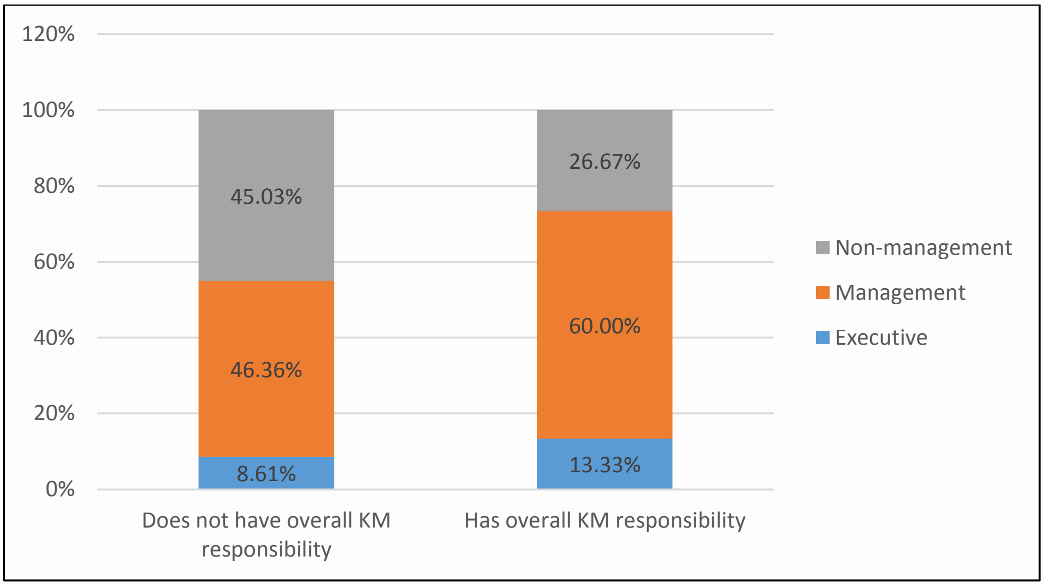



FIGURE 6-9 JOB CATEGORIES AND KNOWLEDGE MANAGEMENT RESPONSIBILITY.

Of the 248 respondents, 158 respondents (or ~63.7 per cent) do not have overall responsibility for KM and 90 respondents (or ~36.3 per cent) do.

Among the 90 respondents who had overall responsibility for KM, most (73.3 per cent) hold a managerial or executive position. A relatively small proportion (26.67 per cent), individuals from the non-management group indicated that they too share overall responsibility for KM in their organisations.

The spread of respondents in terms of overall responsibility for KM, industry and country allowed me to carry further data analysis. The next section reports on the findings from the data analysis of the responses from the 'Responsible-for-KM' questionnaire. I report on the data analysis of the responses from the 'Not-Responsible-for-KM' questionnaire following that. Note, there was no application of the demographics analysis reported above to the subsequent analyses.

# 6.4. Results from Responsible-for-KM survey

In this section, I report on the findings from the Exploratory Factor Analysis. I report on the analysis conducted on the data as-is (initial pass), the measures taken to reach a suitable level of adequacy, validity and reliability (discovery) and the results from the final run of analysis (final results).

## 6.4.1. Exploratory Factor Analysis - Initial Pass

The survey data for the 'Responsible-for-KM' questionnaire were analysed following a set of pre-defined steps as prescribed by Gaskin (2014). Having previously prepared and loaded the data in SPSS, I ran the Exploratory Factor Analysis (EFA).

In SPSS: Analyse -> Dimension Reduction -> Factor Analysis. I added the indicators for the six latent variables of concern: Knowledge Needs Identification, KI Methods Effectiveness, Knowledge Recording, KI Operationalisation, KI Effectiveness, and KM Effectiveness.

For the first run of EFA, the following parameters were used:

- Descriptives: These options were selected: Initial solution, Reproduced, KMO and Barlett's test of sphericity.

- Extraction: Method – Maximum Likelihood. This particular method is used because of the similar algorithm used in AMOS – which I used for the Confirmatory Factor Analysis.

- Rotation: Promax.
  Tabachnick and Fiddell (2007, p. 646) argue that "Perhaps the best way to decide between orthogonal and oblique rotation is to request oblique rotation [e.g., direct oblimin or promax from SPSS] with the desired number of factors

[see Brown, 2009b] and look at the correlations among factors … if factor correlations are not driven by the data, the solution remains nearly orthogonal. Look at the factor correlation matrix for correlations around .32 and above. If correlations exceed .32, then there is 10% (or more) overlap in variance among factors, enough variance to warrant oblique rotation unless there are compelling reasons for orthogonal rotation."

The choice of Promax as rotation method was information by Costello and Osborne (2005, p. 3, emphasis in original) who explain:

> "The goal of rotation is to simplify and clarify the data structure. Rotation *cannot* improve the basic aspects of the analysis, such as the amount of variance extracted from the items. … Orthogonal rotations produce factors that are uncorrelated; oblique methods allow the factors to correlate. Conventional wisdom advises researchers to use orthogonal rotation because it produces more easily interpretable results, but this is a flawed argument. In the social sciences we generally expect some correlation among factors, since behavior is rarely partitioned into neatly packaged units that function independently of one another. Therefore using orthogonal rotation results in a loss of valuable information if the factors are correlated, and oblique rotation should theoretically render a more accurate, and perhaps more reproducible, solution. If the factors are truly uncorrelated, orthogonal and oblique rotation produce nearly identical results."

They further note: "In SPSS output the *rotated factor matrix* is interpreted after orthogonal rotation; when using oblique rotation the *pattern matrix* is examined for factor/item loadings and the *factor correlation matrix* reveals any correlation between the factors. The substantive interpretations are essentially the same."

- Options: Sort by size, suppress small coefficients below absolute value of 0.2.

These parameters are shown visually on the next page.  I report on the results of the analysis next.

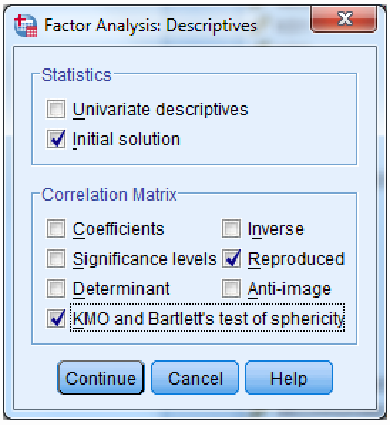



**FIGURE 6-10 EFA: DESCRIPTIVES.**

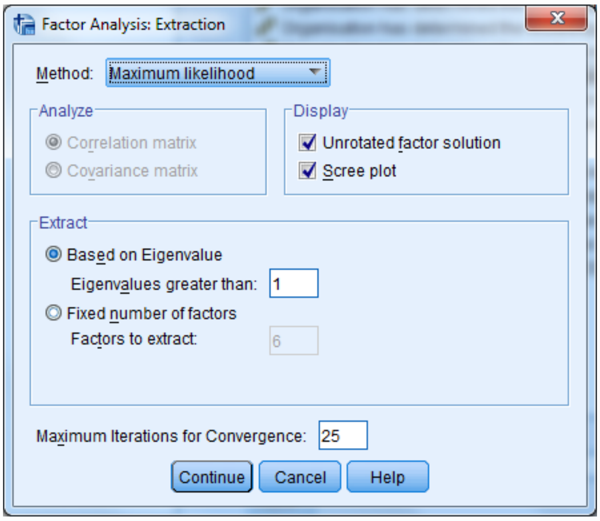



**FIGURE 6-11 EFA: EXTRACTION.**

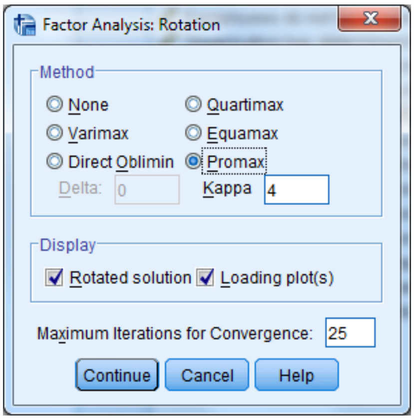



**FIGURE 6-12 EFA: ROTATION.**

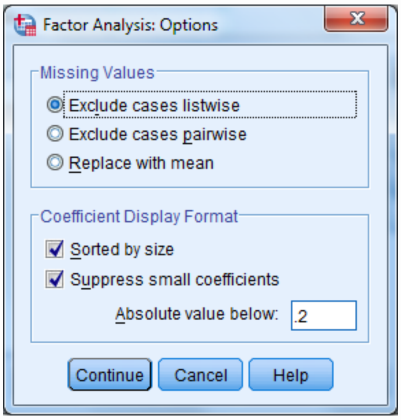



**FIGURE 6-13 EFA: OPTIONS.**

The first output from SPSS was the Kaiser-Meyer-Olkin (KMO) and Barlett's test of sphericity. These determine sampling adequacy. Sampling adequacy predicts if data are likely to factor well, based on correlation and partial correlation.

A sample adequacy of above 0.60 with a significant p-value was obtained as shown in the table below.

**TABLE 6-10 INITIAL EFA KMO AND BARTLETT'S TEST**

| | | |
|---|---|---|
| Kaiser-Meyer-Olkin Measure of Sampling Adequacy. | | .895 |
| Bartlett's Test of Sphericity | Approx. Chi-Square | 1969.209 |
| | df | 210 |
| | Sig. | .000 |

In terms of communalities (also related to adequacy, among other things), a couple of items in the "Extraction" column fell in the range of 0.0 – 0.4. They are highlighted in grey on the table on the next page.

"A communality is the extent to which an item correlates with all other items. Higher communalities are better. If communalities for a particular variable are low (between 0.0-0.4), then that variable may struggle to load significantly on any factor. ... Low values indicate candidates for removal after you examine the pattern matrix." (Gaskin 2014).

The table on the next page lists the results obtained.

**TABLE 6-11 INITIAL EFA COMMUNALITIES**

| | Initial | Extraction |
|---|---|---|
| Employees record what they know. | .805 | .661 |
| Employees are willing to record what they know. | .751 | .503 |
| Employees know what to record in knowledge repositories. | .695 | .534 |
| Organisation has established what relevant knowledge it has. | .928 | .892 |
| Organisation has established what relevant knowledge its members have. | .959 | .982 |
| Organisation has established which knowledge has high priority or low priority. | .875 | .740 |
| Organisation has established its knowledge gaps. | .798 | .636 |
| Employees have the knowledge they need to do their job. | .784 | .736 |
| Employees would still have the knowledge they need to do their job, even if some members retired or left. | .664 | .463 |
| If employees do not have knowledge they need, they can obtain it. | .834 | .811 |
| If employees do not have knowledge they need, they can obtain it when they need it. | .828 | .847 |
| If employees do not have knowledge they need, they can obtain it in the form they need it. | .684 | .655 |
| Organisation has determined the knowledge it needs. | .920 | .977 |
| Organisation has determined the knowledge its members need. | .884 | .856 |
| Organisation has determined the relative importance of the different knowledge it needs. | .856 | .808 |
| Organisation takes formal steps to practise KI. | .713 | .323 |
| Organisation allocates sufficient resources to practise KI. | .833 | .546 |
| Organisation values the practice of KI. | .692 | .333 |
| Methods used to find needed knowledge work well. | .877 | .795 |
| Methods used to find who knows what work well. | .875 | .827 |
| Methods used to establish whether knowledge needed exists within the organisation work well. | .937 | .987 |

Extraction Method: Maximum Likelihood.

a. One or more communalitiy estimates greater than 1 were encountered during iterations. The resulting solution should be interpreted with caution.

In terms of total variance explained, as the table below shows, the factors identified explain just about above 70% of the variance. However, only four factors were identified. The factor matrix, on the following page, describes the four factors. The scree plot obtained is shown on the next page.

**TABLE 6-12 INITIAL EFA TOTAL VARIANCE EXPLAINED.**

| Factor | Initial Eigenvalues | | | Extraction Sums of Squared Loadings | | | Rotation Sums of Squared Loadings[a] |
|---|---|---|---|---|---|---|---|
| | Total | % of Variance | Cumulative % | Total | % of Variance | Cumulative % | Total |
| 1 | 12.549 | 59.757 | 59.757 | 12.013 | 57.204 | 57.204 | 10.067 |
| 2 | 1.753 | 8.348 | 68.105 | 1.130 | 5.382 | 62.586 | 9.690 |
| 3 | 1.207 | 5.747 | 73.852 | .757 | 3.606 | 66.192 | 8.630 |
| 4 | 1.146 | 5.459 | 79.311 | 1.011 | 4.814 | 71.006 | 8.535 |
| 5 | .739 | 3.521 | 82.832 | | | | |
| 6 | .603 | 2.873 | 85.705 | | | | |
| 7 | .554 | 2.639 | 88.343 | | | | |
| 8 | .481 | 2.292 | 90.635 | | | | |
| 9 | .295 | 1.406 | 92.041 | | | | |
| 10 | .286 | 1.360 | 93.402 | | | | |
| 11 | .247 | 1.175 | 94.577 | | | | |
| 12 | .215 | 1.024 | 95.601 | | | | |
| 13 | .187 | .889 | 96.489 | | | | |
| 14 | .164 | .781 | 97.270 | | | | |
| 15 | .144 | .684 | 97.954 | | | | |
| 16 | .117 | .559 | 98.513 | | | | |
| 17 | .102 | .485 | 98.998 | | | | |
| 18 | .081 | .384 | 99.382 | | | | |
| 19 | .056 | .267 | 99.649 | | | | |
| 20 | .053 | .253 | 99.903 | | | | |
| 21 | .020 | .097 | 100.000 | | | | |

Extraction Method: Maximum Likelihood.

a. When factors are correlated, sums of squared loadings cannot be added to obtain a total variance.

The scree plot below shows that there are four factors identified with Eigenvalues of greater than one, but the break point where the curve flattens out is at possibly five or six.  The blue straight lines are drawn to help isolate the break point.

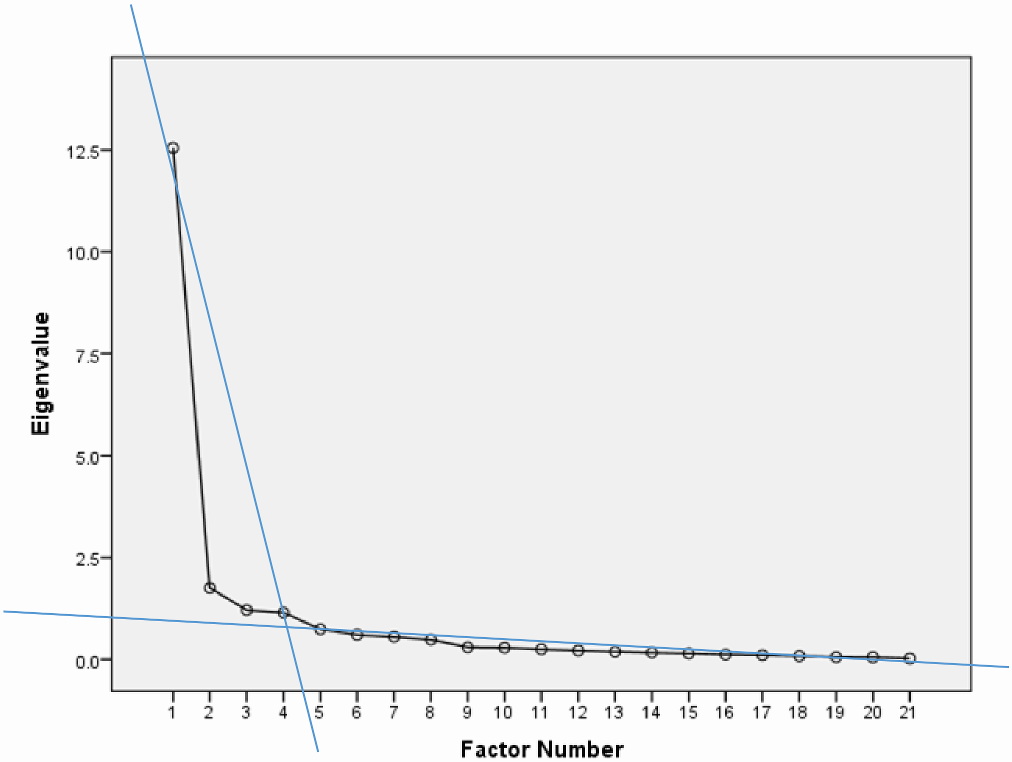



**Figure 6-14 Initial EFA scree plot.**

The table on the next page shows the factor matrix obtained.  The factor matrix shows four factors, and the respective unrotated factor loadings, which are the correlations between the indicators and the latent variable (or the factor).

The factor matrix is not particularly helpful here because the latent variables are correlated with one another.  In other words, there may be overlap in these loadings.  The subsequent pattern matrix, shown on the following pages, is designed to indicate the independent relationship between each indicator and the latent variables.

**TABLE 6-13 INITIAL EFA FACTOR MATRIX.**

| | Factor | | | |
|---|---|---|---|---|
| | 1 | 2 | 3 | 4 |
| Organisation has determined the knowledge it needs. | .899 | | -.380 | |
| Methods used to establish whether knowledge needed exists within the organisation work well. | .866 | -.479 | | |
| Organisation has determined the relative importance of the different knowledge it needs. | .860 | | | |
| Organisation has established what relevant knowledge its members have. | .848 | .473 | | |
| Methods used to find who knows what work well. | .845 | -.329 | | |
| Organisation has determined the knowledge its members need. | .838 | .223 | -.318 | |
| Organisation has established what relevant knowledge it has. | .824 | .410 | | |
| Organisation has established which knowledge has high priority or low priority. | .807 | .280 | | |
| Methods used to find needed knowledge work well. | .803 | -.361 | | |
| Organisation has established its knowledge gaps. | .784 | | | |
| Employees have the knowledge they need to do their job. | .757 | | | .388 |
| If employees do not have knowledge they need, they can obtain it when they need it. | .756 | | | .522 |
| Employees record what they know. | .731 | | .340 | |
| Organisation allocates sufficient resources to practise KI. | .730 | | | |
| If employees do not have knowledge they need, they can obtain it. | .718 | | | .530 |
| If employees do not have knowledge they need, they can obtain it in the form they need it. | .710 | | | .353 |
| Employees know what to record in knowledge repositories. | .687 | | .221 | |
| Employees are willing to record what they know. | .628 | | .299 | |
| Employees would still have the knowledge they need to do their job, even if some members retired or left. | .590 | | | .282 |
| Organisation takes formal steps to practise KI. | .528 | | | |
| Organisation values the practice of KI. | .513 | | -.205 | |

Extraction Method: Maximum Likelihood.

a. 4 factors extracted. 19 iterations required.

Given the use of Maximum Likelihood as the extraction method used, SPSS would also perform a goodness-of-fit test. The results obtained are shown in the table below.

**Table 6-14 Initial EFA Goodness-of-fit test.**

| Chi-Square | df | Sig. |
|---|---|---|
| 355.209 | 132 | .000 |

The Chi-Square value divided by the degree of freedom (df) should be between one and three optimally. I obtained 2.69.

We also want the significance value to be greater than 0.05 (i.e. rejecting the null hypothesis). I obtained 0.000.

Under the reproduced correlation table, SPSS indicated:

"Residuals are computed between observed and reproduced correlations. There are 53 (25.0%) nonredundant residuals with absolute values greater than 0.05."

This indicates that there errors should to be factored in the model.

The pattern matrix as shown on the next page shows the indicators attached to the four factors identified.

We can see various couplings among the latent variables: KI Operationalisation with Knowledge Needs Identification, and KI Effectiveness with Knowledge Recording.

The pattern matrix shows cross-loadings (indicators loading on multiple factors) on multiple factors. Based on these results, discriminant validity was not reached.

**Table 6-15 Initial EFA pattern matrix.**

| | Factor | | | |
|---|---|---|---|---|
| | 1 | 2 | 3 | 4 |
| Organisation has established what relevant knowledge its members have. | .997 | | | |
| Organisation has established what relevant knowledge it has. | .947 | | | |
| Organisation has established which knowledge has high priority or low priority. | .668 | | | .220 |
| Employees know what to record in knowledge repositories. | .568 | | | |
| Employees record what they know. | .557 | | .365 | -.239 |
| Organisation has established its knowledge gaps. | .469 | | .241 | |
| Employees are willing to record what they know. | .456 | .209 | .305 | -.245 |
| If employees do not have knowledge they need, they can obtain it. | | .946 | | |
| If employees do not have knowledge they need, they can obtain it when they need it. | | .919 | | |
| Employees have the knowledge they need to do their job. | | .722 | | |
| If employees do not have knowledge they need, they can obtain it in the form they need it. | | .652 | | |
| Employees would still have the knowledge they need to do their job, even if some members retired or left. | .331 | .475 | | |
| Methods used to establish whether knowledge needed exists within the organisation work well. | | | .976 | |
| Methods used to find needed knowledge work well. | | | .799 | |
| Methods used to find who knows what work well. | | | .780 | .205 |
| Organisation takes formal steps to practise KI. | | -.222 | .410 | .306 |
| Organisation allocates sufficient resources to practise KI. | | | .371 | .339 |
| Organisation has determined the knowledge it needs. | | | | .843 |
| Organisation has determined the knowledge its members need. | | .256 | | .686 |
| Organisation has determined the relative importance of the different knowledge it needs. | .246 | | | .558 |
| Organisation values the practice of KI. | | | .327 | .485 |

Extraction Method: Maximum Likelihood.

Rotation Method: Promax with Kaiser Normalization.

a. Rotation converged in 10 iterations.

After the initial run of the EFA, the results obtained warranted further analysis as to whether or not there are indeed four factors or five or six. The fact that several of the factors are associated with more than three indicators suggests that there are more than four factors here. These further analyses are described in the next sub-section.

### 6.4.2. Exploratory Factor Analysis - Discovery

Following the results obtained above, the next step was to work with the indicators such that the EFA would provide:

- Adequacy: Are the indicators adequately correlated to justify the use of EFA?
- Convergent validity: Do the indicators hold together where they should?
- Discriminant validity: Are the groupings of indicators separate?
- Reliability: Do the indicators move together consistently within each factor?

As noted in chapter three (Research Design and Method), the goal "of this process is to "discover" a model with three properties: It makes theoretical sense, it is reasonably parsimonious, and its correspondence to the data is acceptably close." (Kline 2013, p. 177).

I proceeded with the steps below until I reached the closest satisfactory results I could obtain (it did not have to be perfect). The steps were:

1. I forced the factor analysis to extract more than four factors (i.e. effectively taking factors with Eigenvalues of less than one.).
2. Based on the communalities, low loadings or with cross loadings over multiple factors, I would either remove or keep the indicators. For example, if the cross-loadings differ by more than 0.2, I kept the indicators as-is.
3. Repeat steps above until satisfactory results are reached.

In the following pages, I show my workings and report on my findings.

First, I forced the analysis to extract specific number of factors. I ran this through SPSS as shown below.

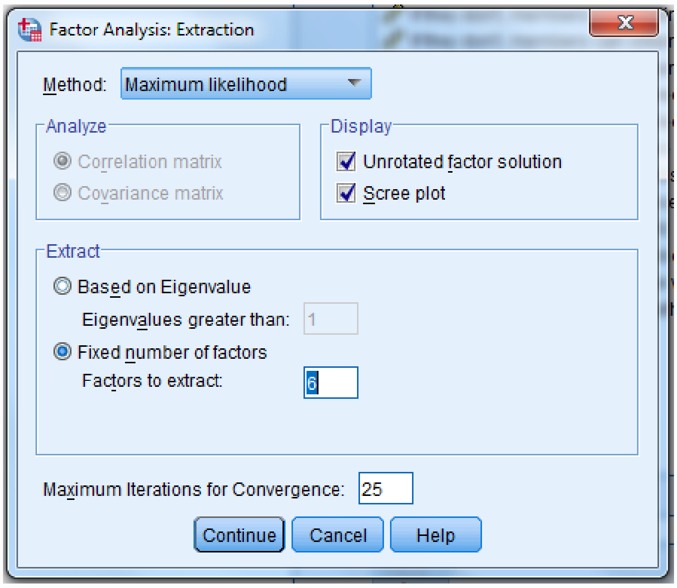



**FIGURE 6-15 FIXING THE NUMBER OF FACTORS TO EXTRACT.**

As the table below shows, even after 100 iterations, no factors were extracted.

**TABLE 6-16 FACTOR MATRIX WITH SIX FACTORS TO EXTRACT.**

**Factor Matrix**[a]

| |
|---|
| |

a. Attempted to extract 6 factors. In iteration 100, no local minimum was found. Extraction was terminated.

I repeated this process of fixing the number of factors to extract (from four to seven factors) and keeping or removing particular indicators (based on the loadings or weights obtained) until I reached a suitable model.

At the end of this discovery process, I subscribed to a revised model containing just four factors. This revised model made theoretical sense, is reasonably parsimonious, and its correspondence to the data is acceptably close (Kline 2013).

Note that while the model with six factors was statistically sound (its correspondence to the data was acceptably close), it did not make theoretical sense. For example, in the six-factor model, the latent variable 'KI Methods Effectiveness' had a negative effect on KI effectiveness. See appendix E for more detailed results.

The following indicators were dropped (struck) to obtain the four-factor model:

~~KR1 Employees record what they know.~~

~~KR2 Employees are willing to record what they know.~~

~~KR3 Employees know what to record in knowledge repositories.~~

KIE1 Organisation has established what relevant knowledge it has.

~~KIE2 Organisation has established what relevant knowledge its members have.~~

~~KIE3 Organisation has established which knowledge has high priority or low priority.~~

~~KIE4 Organisation has established its knowledge gaps.~~

~~KME1 Employees have the knowledge they need to do their job.~~

~~KME2 Employees would still have the knowledge they need to do their job, even if some members retired or left.~~

KME3 If employees do not have knowledge they need, they can obtain it.

KME4 If employees do not have knowledge they need, they can obtain it when they need it.

~~KME5 If employees do not have knowledge they need, they can obtain it in the form they need it.~~

KNI1 Organisation has determined the knowledge it needs.

~~KNI2 Organisation has determined the knowledge its members need.~~

KNI3 Organisation has determined the relative importance of the different knowledge it needs.

KIO1 Organisation takes formal steps to practise KI.

KIO2 Organisation allocates sufficient resources to practise KI.

KIO3 Organisation values the practice of KI.

KIME1 Methods used to find needed knowledge work well.

KIME2 Methods used to find who knows what work well.

KIME3 Methods used to establish whether knowledge needed exists within the organisation work well.

The implications of dropping those indicators are discussed in the sub-section 6.4.4. Before that, I report on the results obtained from the final EFA.

### 6.4.3. Exploratory Factor Analysis - Final Results

In this sub-section, I report on the complete results obtained with the revised (and computationally fixed) four-factor model. I discuss the implications of the revised results following that.

In the KMO and Bartlett's test, a sample adequacy of above 0.60 with a significant p-value was obtained as shown in the table below.

**TABLE 6-17 FINAL EFA KMO AND BARTLETT'S TEST.**

| | | |
|---|---|---|
| Kaiser-Meyer-Olkin Measure of Sampling Adequacy. | | .878 |
| Bartlett's Test of Sphericity | Approx. Chi-Square | 872.440 |
| | df | 55 |
| | Sig. | .000 |

In terms of communalities, as shown on the table on the next page all items had extraction values greater than 0.4.

However, note that the message indicating that "One or more communality estimates greater than 1 were encountered during iterations. The resulting solution should be interpreted with caution." was displayed.

**TABLE 6-18 FINAL EFA COMMUNALITIES.**

| | Initial | Extraction |
|---|---|---|
| Organisation takes formal steps to practise KI. | .648 | .704 |
| Organisation allocates sufficient resources to practise KI. | .796 | .915 |
| Organisation values the practice of KI. | .550 | .580 |
| Methods used to find needed knowledge work well. | .807 | .836 |
| Methods used to find who knows what work well. | .838 | .872 |
| Methods used to establish whether knowledge needed exists within the organisation work well. | .874 | .939 |
| If employees do not have knowledge they need, they can obtain it. | .785 | .999 |
| If employees do not have knowledge they need, they can obtain it when they need it. | .792 | .773 |
| Organisation has established what relevant knowledge it has. | .599 | .600 |
| Organisation has determined the knowledge it needs. | .840 | .848 |
| Organisation has determined the relative importance of the different knowledge it needs. | .814 | .938 |

Extraction Method: Maximum Likelihood.

a. One or more communalitiy estimates greater than 1 were encountered during iterations. The resulting solution should be interpreted with caution.

In terms of total variance explained, the four factors explained more than 80% of the variance as shown on the table on the next page. Two of the factors had Eigenvalues below 1. The corresponding scree plot obtained is shown on the following page.

TABLE 6-19 FINAL EFA TOTAL VARIANCE EXPLAINED.

| Factor | Initial Eigenvalues | | | Extraction Sums of Squared Loadings | | | Rotation Sums of Squared Loadings[a] |
|---|---|---|---|---|---|---|---|
| | Total | % of Variance | Cumulative % | Total | % of Variance | Cumulative % | Total |
| 1 | 6.939 | 63.082 | 63.082 | 4.422 | 40.202 | 40.202 | 5.509 |
| 2 | 1.227 | 11.156 | 74.238 | 3.098 | 28.165 | 68.367 | 4.777 |
| 3 | .859 | 7.812 | 82.049 | .649 | 5.898 | 74.265 | 5.494 |
| 4 | .636 | 5.783 | 87.833 | .834 | 7.581 | 81.846 | 4.739 |
| 5 | .369 | 3.356 | 91.188 | | | | |
| 6 | .331 | 3.006 | 94.194 | | | | |
| 7 | .191 | 1.739 | 95.934 | | | | |
| 8 | .149 | 1.357 | 97.291 | | | | |
| 9 | .129 | 1.170 | 98.461 | | | | |
| 10 | .090 | .820 | 99.281 | | | | |
| 11 | .079 | .719 | 100.000 | | | | |

Extraction Method: Maximum Likelihood.

a. When factors are correlated, sums of squared loadings cannot be added to obtain a total variance.

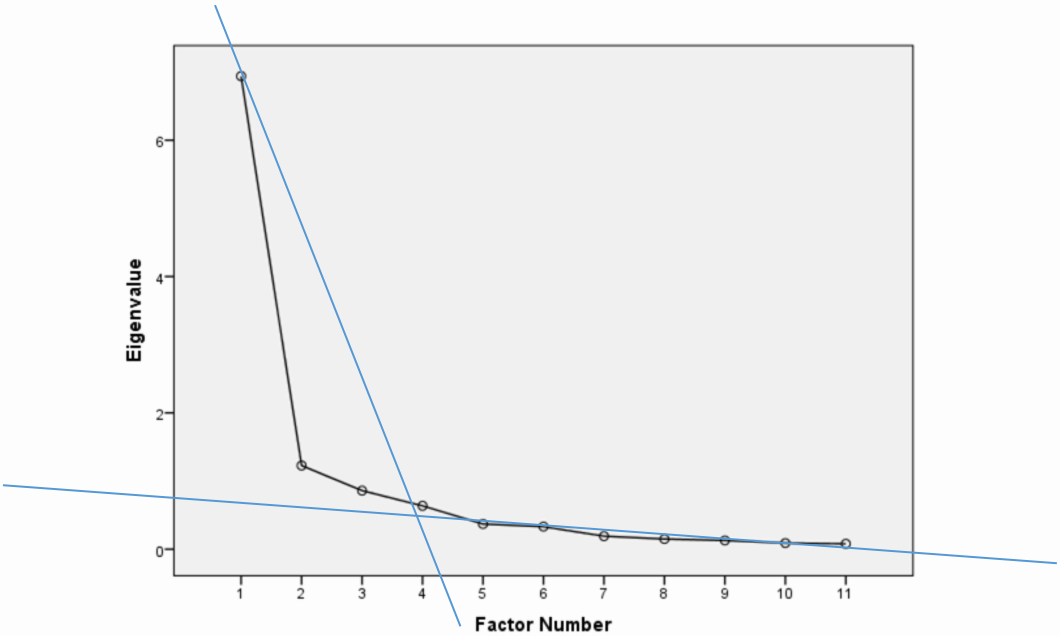



FIGURE 6-16 FINAL EFA SCREE PLOT.

The factor matrix obtained is shown on the next page. The factor matrix shows four factors. The four factors extracted required eight iterations.

As mentioned earlier, the factor matrix is not particularly helpful here because the latent variables are correlated with one another. In other words, there may be overlap in these loadings. The subsequent pattern matrix, shown on the following pages, is designed to indicate the independent relationship between each indicator and the latent variables.

**TABLE 6-20 FINAL EFA FACTOR MATRIX**

| | Factor | | | |
|---|---|---|---|---|
| | 1 | 2 | 3 | 4 |
| If employees do not have knowledge they need, they can obtain it. | .999 | | | |
| If employees do not have knowledge they need, they can obtain it when they need it. | .854 | | | |
| Organisation has determined the knowledge it needs. | .677 | .541 | .308 | |
| Methods used to find needed knowledge work well. | .611 | .574 | -.347 | |
| Organisation has determined the relative importance of the different knowledge it needs. | .607 | .577 | .455 | |
| Organisation allocates sufficient resources to practise KI. | .575 | .574 | | .505 |
| Organisation has established what relevant knowledge it has. | .571 | .434 | .291 | |
| Methods used to find who knows what work well. | .552 | .688 | -.201 | -.230 |
| Methods used to establish whether knowledge needed exists within the organisation work well. | .593 | .688 | -.305 | |
| Organisation takes formal steps to practise KI. | .282 | .594 | | .521 |
| Organisation values the practice of KI. | .319 | .534 | | .436 |

Extraction Method: Maximum Likelihood.

a. 4 factors extracted. 8 iterations required.

The goodness-of-fit test obtained is shown in the table below. The Chi-Square value divided by the degree of freedom (df) should be between one and three optimally. I obtained 0.818.

We also want the significance value to be greater than 0.05 (i.e. rejecting the null hypothesis). I obtained 0.674.

**TABLE 6-21 FINAL EFA GOODNESS-OF-FIT TEST.**

| Chi-Square | df | Sig. |
|---|---|---|
| 13.907 | 17 | .674 |

Under the reproduced correlation table, SPSS indicated that residuals are computed between observed and reproduced correlations. There were 0 (0.0%) non-redundant residuals with absolute values greater than 0.05. We want the percentage of non-redundant residuals above 0.05 to be under 50%.

The pattern matrix as shown on the table on the next page indicates that I obtained discriminant validity. There are no cross-loadings that differ by less than 0.2. The loading greater than 1.0 is explained by the rotation method used: Promax (which can occur in Promax, or any oblique rotation).

As Jöreskog (1999, emphasis in original) explains: "if the factors are *correlated* [which are in this care] (oblique), the factors loadings are *regression coefficients and not correlations* and as such they can be larger than one in magnitude."

The results also indicate convergent validity given that each factor is represented by loadings all above 0.5 and the average loading for each factor is greater than 0.7.

**TABLE 6-22 FINAL EFA PATTERN MATRIX.**

| | Factor | | | |
|---|---|---|---|---|
| | 1 | 2 | 3 | 4 |
| Methods used to establish whether knowledge needed exists within the organisation work well. | .939 | | | |
| Methods used to find who knows what work well. | .887 | | .200 | |
| Methods used to find needed knowledge work well. | .883 | | | |
| Organisation takes formal steps to practise KI. | | .898 | | |
| Organisation allocates sufficient resources to practise KI. | | .846 | | |
| Organisation values the practice of KI. | | .756 | | |
| Organisation has determined the relative importance of the different knowledge it needs. | | | 1.039 | |
| Organisation has determined the knowledge it needs. | | | .736 | |
| Organisation has established what relevant knowledge it has. | | | .619 | |
| If employees do not have knowledge they need, they can obtain it. | | | | 1.069 |
| If employees do not have knowledge they need, they can obtain it when they need it. | | | | .689 |

Extraction Method: Maximum Likelihood.

Rotation Method: Promax with Kaiser Normalization.

a. Rotation converged in 5 iterations.

Based on the results above, the resulting four factors are:

- Factor 1: KI Methods Effectiveness,
- Factor 2: KI Operationalisation,
- Factor 3: KI Effectiveness, and
- Factor 4: KM Effectiveness.

Finally, the factor correlation matrix obtained is shown below. The correlations (the amount of variance explained in one factor by another factor) obtained are all above 0.3 and below or around 0.7.

**TABLE 6-23 FINAL EFA FACTOR CORRELATION MATRIX.**

| Factor | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| 1 | 1.000 | .633 | .693 | .637 |
| 2 | .633 | 1.000 | .630 | .521 |
| 3 | .693 | .630 | 1.000 | .693 |
| 4 | .637 | .521 | .693 | 1.000 |

Extraction Method: Maximum Likelihood.

Rotation Method: Promax with Kaiser Normalization.

The figure on the next page illustrates the indicators grouping in a 3D graph - though difficult to read on a 2D paper.

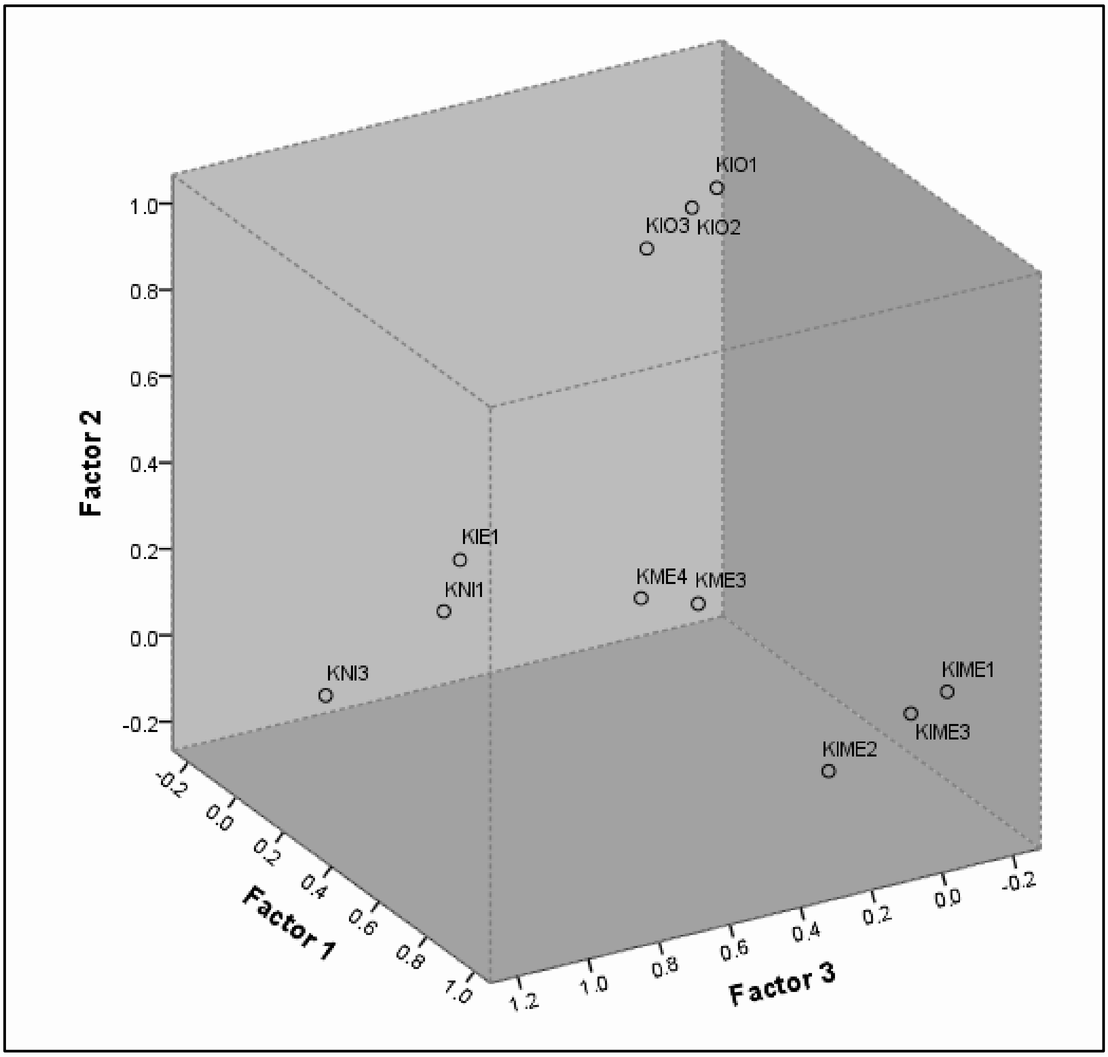



**FIGURE 6-17 FINAL EFA FACTOR PLOT.**

The next step was to check for reliability (i.e. Do the indicators move together consistently within each factor?). This is done by checking the values for the Cronbach's alphas. I report on the reliability check next.

In SPSS: Analyse -> Scale -> Reliability Analysis.

I ticked the check box "Scale if item deleted" to see what the Cronbach's alpha value would be if an item were deleted.

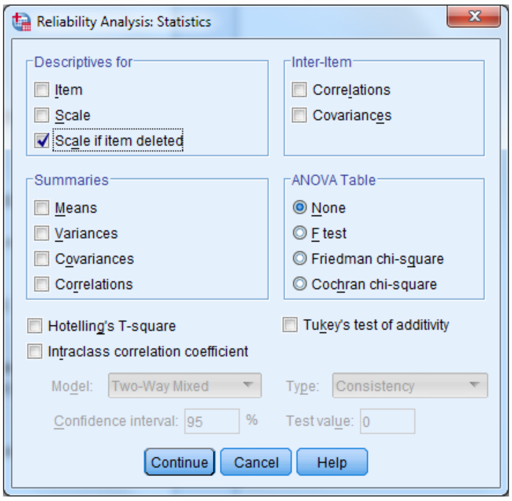



**FIGURE 6-18 RELIABILITY ANALYSIS.**

I selected the indicators for one latent variable, ran the analysis and repeated for each latent variable. All Cronbach's alpha values were above 0.7. The results obtained are shown on the following pages.

The tables below show the results for: KI Methods Effectiveness.

**Table 6-24 KI Methods Effectiveness reliability statistics.**

| Cronbach's Alpha | N of Items |
|---|---|
| .951 | 3 |

**Table 6-25 KI Methods Effectiveness Item-Total Statistics.**

| | Scale Mean if Item Deleted | Scale Variance if Item Deleted | Corrected Item-Total Correlation | Cronbach's Alpha if Item Deleted |
|---|---|---|---|---|
| Methods used to find needed knowledge work well. | 13.25 | 22.142 | .876 | .944 |
| Methods used to find who knows what work well. | 13.49 | 21.771 | .888 | .936 |
| Methods used to establish whether knowledge needed exists within the organisation work well. | 13.33 | 22.394 | .929 | .906 |

The tables below show the results for: KI Operationalisation.

**TABLE 6-26 KI OPERATIONALISATION RELIABILITY STATISTICS.**

| Cronbach's Alpha | N of Items |
|---|---|
| .877 | 3 |

**TABLE 6-27 KI OPERATIONALISATION ITEM-TOTAL STATISTICS.**

| | Scale Mean if Item Deleted | Scale Variance if Item Deleted | Corrected Item-Total Correlation | Cronbach's Alpha if Item Deleted |
|---|---|---|---|---|
| Organisation takes formal steps to practise KI. | 14.33 | 32.538 | .764 | .824 |
| Organisation allocates sufficient resources to practise KI. | 15.12 | 30.805 | .815 | .776 |
| Organisation values the practice of KI. | 13.40 | 36.991 | .714 | .868 |

The tables below show the results for: KI Effectiveness.

**TABLE 6-28 KI EFFECTIVENESS RELIABILITY STATISTICS.**

| Cronbach's Alpha | N of Items |
|---|---|
| .910 | 3 |

**TABLE 6-29 KI EFFECTIVENESS ITEM-TOTAL STATISTICS.**

| | Scale Mean if Item Deleted | Scale Variance if Item Deleted | Corrected Item-Total Correlation | Cronbach's Alpha if Item Deleted |
|---|---|---|---|---|
| Organisation has established what relevant knowledge it has. | 14.35 | 29.217 | .754 | .929 |
| Organisation has determined the knowledge it needs. | 13.61 | 29.735 | .865 | .838 |
| Organisation has determined the relative importance of the different knowledge it needs. | 13.62 | 28.263 | .849 | .846 |

The tables below show the results for: KM Effectiveness.

**TABLE 6-30 KM EFFECTIVENESS RELIABILITY STATISTICS.**

| Cronbach's Alpha | N of Items |
|---|---|
| .918 | 2 |

**TABLE 6-31 KM EFFECTIVENESS ITEM-TOTAL STATISTICS.**

| | Scale Mean if Item Deleted | Scale Variance if Item Deleted | Corrected Item-Total Correlation | Cronbach's Alpha if Item Deleted |
|---|---|---|---|---|
| If employees do not have knowledge they need, they can obtain it. | 7.42 | 4.607 | .849 | . |
| If employees do not have knowledge they need, they can obtain it when they need it. | 7.69 | 4.674 | .849 | . |

The table on the next page shows the pattern matrix together with the Cronbach's alpha for each factor.

**TABLE 6-32 PATTERN MATRIX WITH CRONBACH'S ALPHA.**

| | Factor | | | |
|---|---|---|---|---|
| | KI Methods Effectiveness | KI Operation-alisation | KI Effectiveness | KM Effectiveness |
| Cronbach's Alpha | 0.951 | 0.877 | 0.910 | 0.918 |
| Methods used to establish whether knowledge needed exists within the organisation work well. | .939 | | | |
| Methods used to find who knows what work well. | .887 | | .200 | |
| Methods used to find needed knowledge work well. | .883 | | | |
| Organisation takes formal steps to practise KI. | | .898 | | |
| Organisation allocates sufficient resources to practise KI. | | .846 | | |
| Organisation values the practice of KI. | | .756 | | |
| Organisation has determined the relative importance of the different knowledge it needs. | | | 1.039 | |
| Organisation has determined the knowledge it needs. | | | .736 | |
| Organisation has established what relevant knowledge it has. | | | .619 | |
| If employees do not have knowledge they need, they can obtain it. | | | | 1.069 |
| If employees do not have knowledge they need, they can obtain it when they need it. | | | | .689 |

Extraction Method: Maximum Likelihood.

Rotation Method: Promax with Kaiser Normalization.

a. Rotation converged in 5 iterations.

Next, I discuss the implications of the results reached so far.

### 6.4.4. Implications

As a result of the discovery process, I produced a four-factor model rather than a six-factor one. The revised model is shown below.

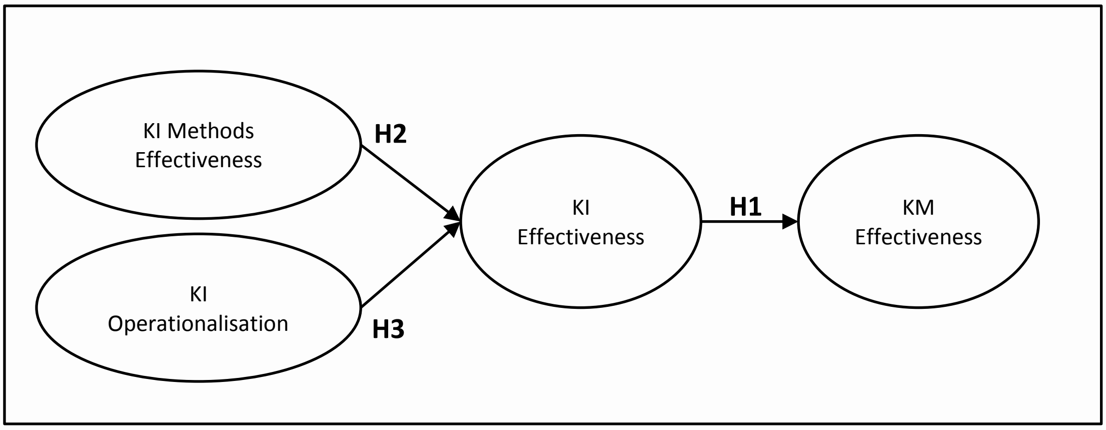



**FIGURE 6-19 HYPOTHESES TO BE TESTED.**

I dropped the latent variable Knowledge Recording and combine the latent variables Knowledge Needs Identification and KI Effectiveness into one latent variable: KI Effectiveness.

The revised KI Effectiveness latent variable with its revised measures represent the key improvement from the analysis. While the results obtained from the analysis showed that the four-factor model was statistically sound, more importantly, does it makes theoretical sense?

The revised KI Effectiveness with the three indicators are listed below:

- Organisation has determined the relative importance of the different knowledge it needs.
- Organisation has determined the knowledge it needs.
- Organisation has established what relevant knowledge it has.

KI is defined as "the KM process whereby organisations take steps to identify the relevant and needed knowledge that exists within their boundaries". This definition implies a mixture of establishing knowledge needs and establishing what knowledge exists within organisation boundaries. The revised measures make theoretical sense.

The four-factor model also had an impact on hypothesis-testing. The revised set of hypotheses to be tested are listed below and drawn on the next page.

H1: Knowledge Identification Effectiveness (KIE) has a positive and significant influence on Knowledge Management Effectiveness (KME).

H2: Knowledge Identification Methods Effectiveness (KIME) has a positive and significant influence on KIE.

H3: Knowledge Identification Operationalisation (KIO) has a positive and significant influence on KIE.

Finally, the latent variable KM Effectiveness has less than three indicators. Is that a problem? No, while using only a single indicator may be problematic, the "best few" or new and "clean" indicators are suitable (Hayduk and Littvay 2012). Hayduk and Littvay (2012) argue that a single indicator-latent variable may be used when adding redundant indicators provides no or little research benefit.

Next, I report on the results from the Confirmatory Factor Analysis.

### 6.4.5. Confirmatory Factor Analysis - Structural Model

In this sub-section, I report on the results from the Confirmatory Factor Analysis (CFA).

I linked the data in IBM SPSS AMOS and drew the latent variables and their respective indicators. Next, I shifted the default regression weight constraint (with a value of 1) on each of the indicators, from the indicators to the latent variables.

Shifting this constraint allows for equal covariance between the indicators - which is what I am looking for. If I did not put a constraint on all of the latent variables, AMOS will display the message: "The model is probably unidentified. In order to achieve identifiable, it will probably be necessary to impose 1 additional constraint."

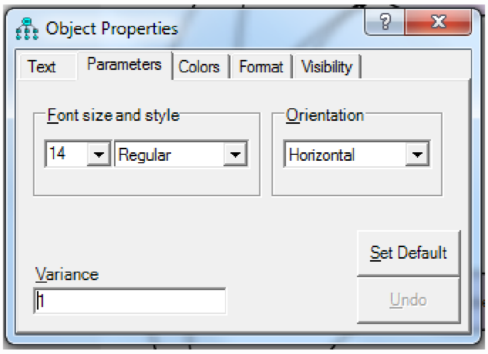



**FIGURE 6-20 SETTING A VARIANCE OF 1 FOR EACH LATENT VARIABLE.**

The figure on the next page shows the resulting model.

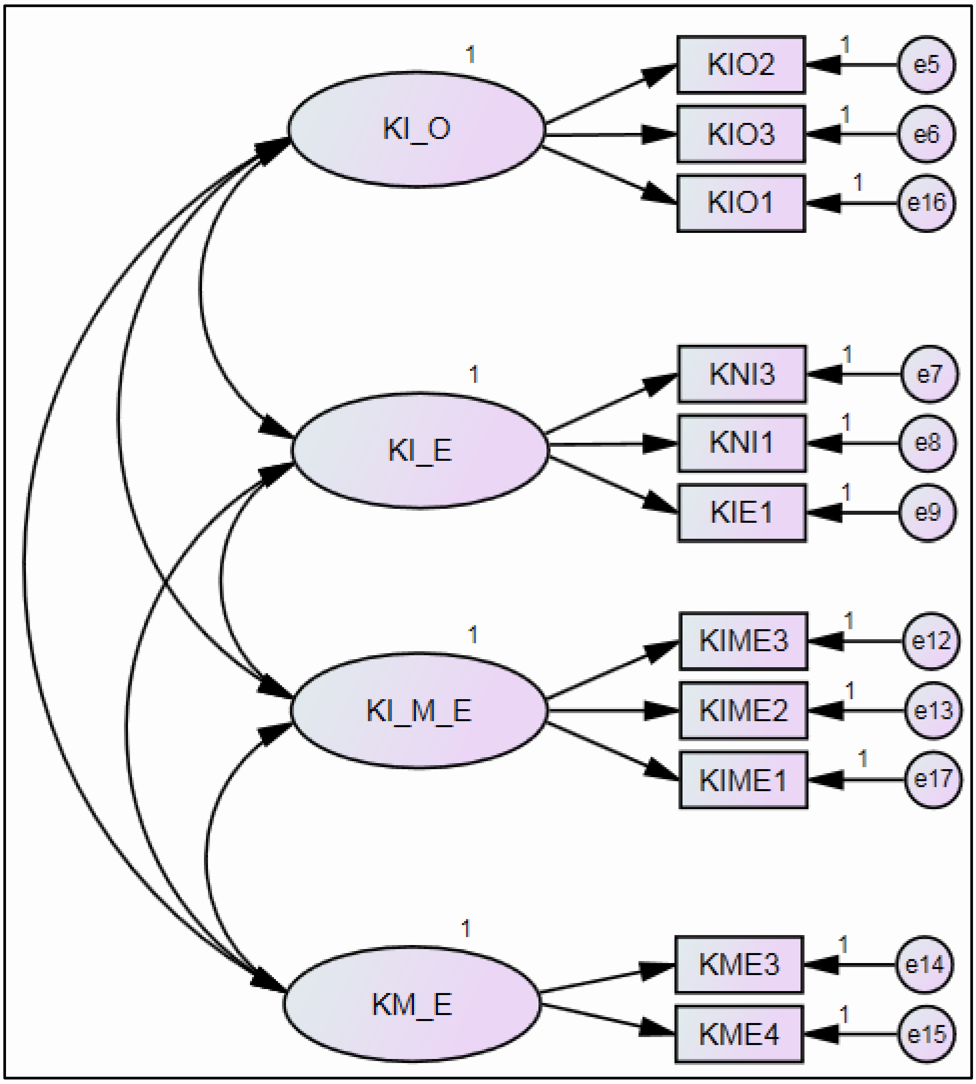



**FIGURE 6-21 CFA MODEL.**

Then, I ran the analysis. The analysis properties set are shown in the figure below. These options will provide a correlation matrix and provide for assessing model fit.

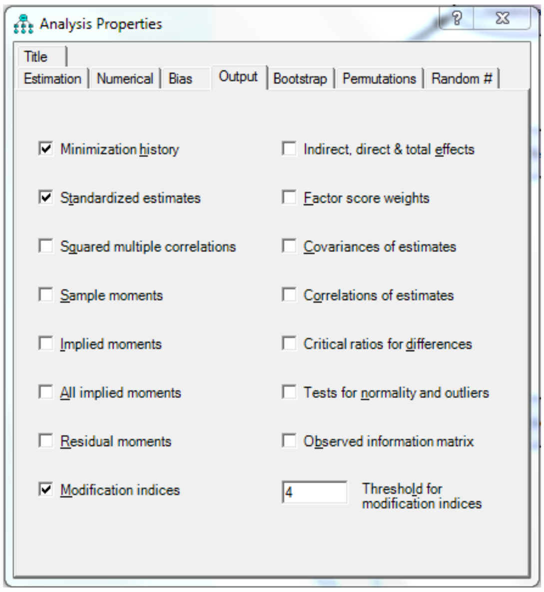



**FIGURE 6-22 ANALYSIS PROPERTIES.**

The following results were obtained:

Minimum was achieved

Chi-square = 51.501

Degrees of freedom = 38

Probability level = .071

The figure on the next page shows the standardised estimates.

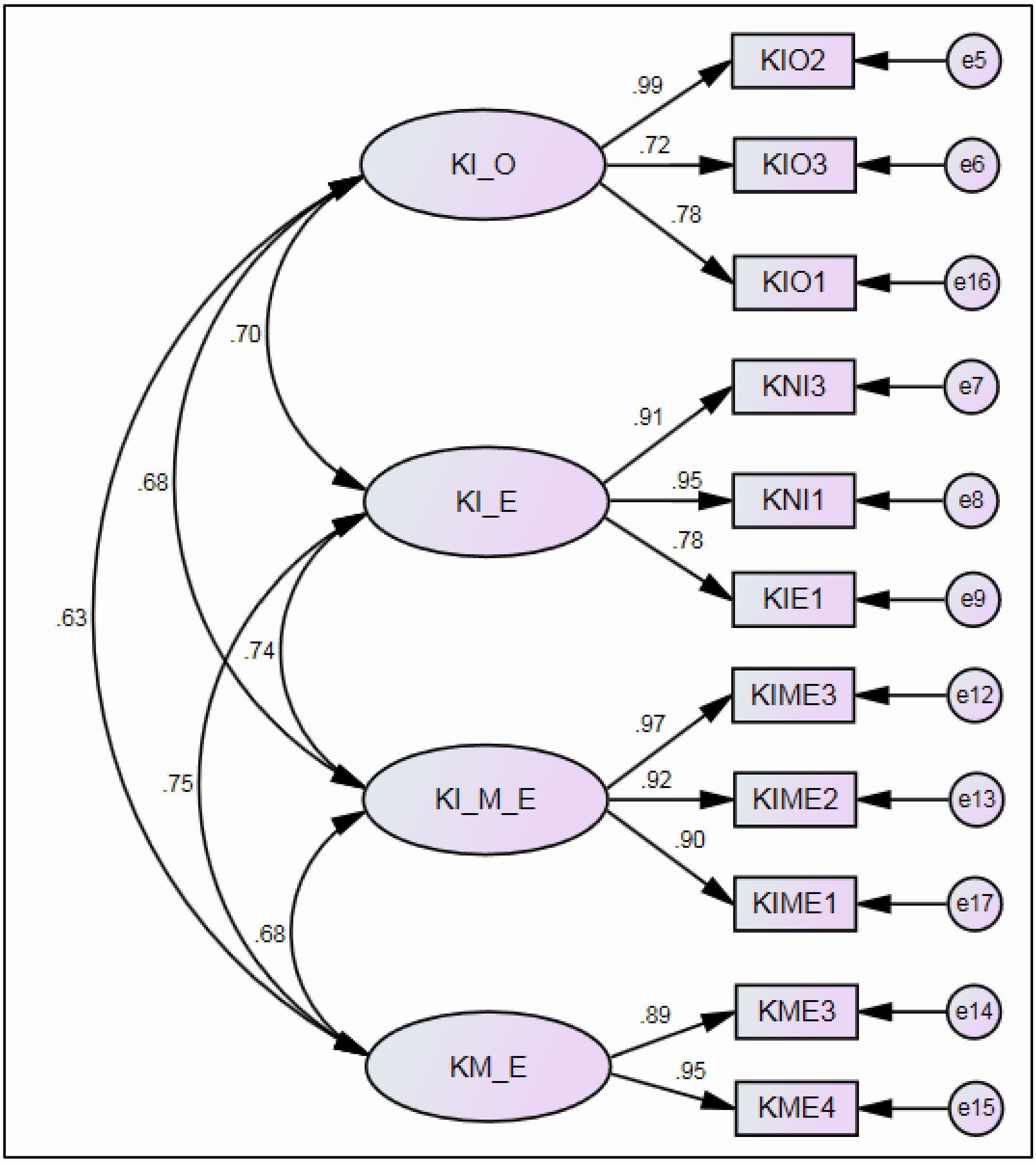



**FIGURE 6-23 INITIAL CFA MODEL WITH LOADINGS.**

As the figure above shows, the correlation between the latent variables are not higher than 0.82 correlations (Gaskins 2015). The indicator loadings (between latent variables and indicators) are greater than 0.7 on average.

Next, I used the Excel StatTools provided by Gaskin (2015) to check for discriminant validity. To do so, I needed the two tables below. The two tables below show the correlations values and the standardised regression weights obtained - both for the default model.

**Table 6-33 Correlations.**

| | | | Estimate |
|---|---|---|---|
| KI_O | <--> | KI_E | .704 |
| KI_O | <--> | KI_M_E | .684 |
| KI_O | <--> | KM_E | .633 |
| KI_E | <--> | KI_M_E | .743 |
| KI_E | <--> | KM_E | .753 |
| KI_M_E | <--> | KM_E | .680 |

**Table 6-34 Standardised regression weights.**

| | | | Estimate |
|---|---|---|---|
| KIO2 | <--- | KI_O | .986 |
| KIO3 | <--- | KI_O | .719 |
| KNI3 | <--- | KI_E | .913 |
| KNI1 | <--- | KI_E | .952 |
| KIE1 | <--- | KI_E | .783 |
| KIME3 | <--- | KI_M_E | .972 |
| KIME2 | <--- | KI_M_E | .921 |
| KME3 | <--- | KM_E | .895 |
| KME4 | <--- | KM_E | .948 |
| KIO1 | <--- | KI_O | .779 |
| KIME1 | <--- | KI_M_E | .904 |

The actual check for discriminant validity is shown on the next page.

According to many scholars, comparing MSV (Maximum Shared Squared Variance) with AVE (Average Variance Extract) is the only true way to establish discriminant validity (Gaskin 2015). MSV should be less than AVE - which is what the results obtained below show.

**TABLE 6-35 COMPARING MSV WITH AVE.**

| | CR | AVE | MSV | Check | ASV | KI_M_E | KI_O | KI_E | KM_E |
|---|---|---|---|---|---|---|---|---|---|
| **KI_M_E** | 0.953 | 0.870 | 0.552 | ✔ | 0.494 | 0.933 | | | |
| **KI_O** | 0.872 | 0.699 | 0.496 | ✔ | 0.455 | 0.684 | 0.836 | | |
| **KI_E** | 0.916 | 0.784 | 0.567 | ✔ | 0.538 | 0.743 | 0.704 | 0.886 | |
| **KM_E** | 0.919 | 0.850 | 0.567 | ✔ | 0.477 | 0.680 | 0.633 | 0.753 | 0.922 |

Next, I checked for model fit. For this exercise, I was informed by Kline (2013, p. 195). I apologise for the lengthy quote:

> "The *Steiger-Lind root mean square error of approximation* (RMSEA) is a parsimony-corrected index that in computer output is usually reported with a 90% confidence interval, which takes account of sample size. Unlike $X_M^2$, the RMSEA theoretically follows a *noncentral chi-square distribution* that allows for a certain degree of discrepancy between population and sample models. The best result is *RMSEA* = 0, and higher values indicate increasingly worse fit of the model to the data. If the value of the upper bound of the confidence interval based on the RMSEA exceeds .10, then problematic model-data correspondence may be indicated. The *Bentler comparative fit index* (CFI) is an incremental fit index that measures the relative improvement in fit of the researcher's model over that of a baseline model that assumes uncorrelated indicators. Like the RMSEA, the CFI allows for some discrepancy between population and sample models. Values of the CFI range from 0–1.0 where 1.0 is the best result. The *standardized root mean square residual* (SRMR) is a measure of the mean absolute residual correlation, so values close to 0 are a better result. Ideally, the value of the CFI should exceed .95 or so, and the value of the SRMR should be < .10."

The tables below list the results obtained.

CMIN/DF should be between 1 and 3. I obtained 1.355.

**Table 6-36 Initial CMIN/DF.**

| Model | NPAR | CMIN | DF | P | CMIN/DF |
|---|---|---|---|---|---|
| Default model | 28 | 51.501 | 38 | .071 | 1.355 |
| Saturated model | 66 | .000 | 0 | | |
| Independence model | 11 | 922.452 | 55 | .000 | 16.772 |

CFI should be above 0.95. I obtained 0.984.

**Table 6-37 Initial Baseline Comparisons.**

| Model | NFI Delta1 | RFI rho1 | IFI Delta2 | TLI rho2 | CFI |
|---|---|---|---|---|---|
| Default model | .944 | .919 | .985 | .977 | .984 |
| Saturated model | 1.000 | | 1.000 | | 1.000 |
| Independence model | .000 | .000 | .000 | .000 | .000 |

RMSEA should be less than 0.1, I obtained 0.065.

**Table 6-38 RMSEA.**

| Model | RMSEA | LO 90 | HI 90 | PCLOSE |
|---|---|---|---|---|
| Default model | .065 | .000 | .107 | .276 |
| Independence model | .436 | .411 | .461 | .000 |

SRMR should be less than 0.10. Using the AMOS Standardised RMR plugin, I obtained a value of Standardised RMR of 0.0394 as shown below.

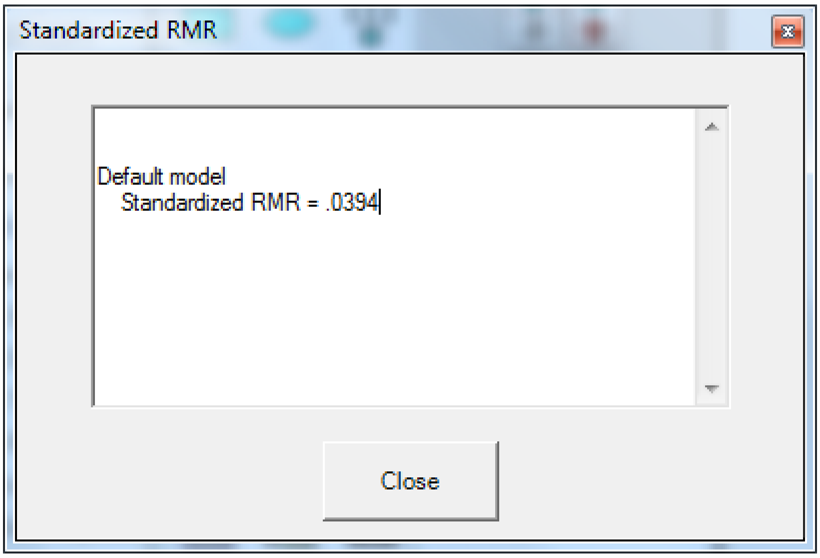



**Figure 6-24 SRMR value.**

The results above indicate that I have model fit. In the next sub-section, I go through the common method bias check.

### 6.4.6. Confirmatory Factor Analysis - Common Method Bias

In this sub-section, I detail the analysis done to check for common method bias. As indicated in chapter three (Research Method and Design), there are various methods to detect common method bias.

First, I used Harman's single factor test. In SPSS:

ANALYSE -> DIMENSION REDUCTION -> FACTOR

I added all the indicators as per the model in figure 6-20.

I set the Extraction options with a Maximum likelihood as Method and a fixed number of factors of one as shown in the figure below.

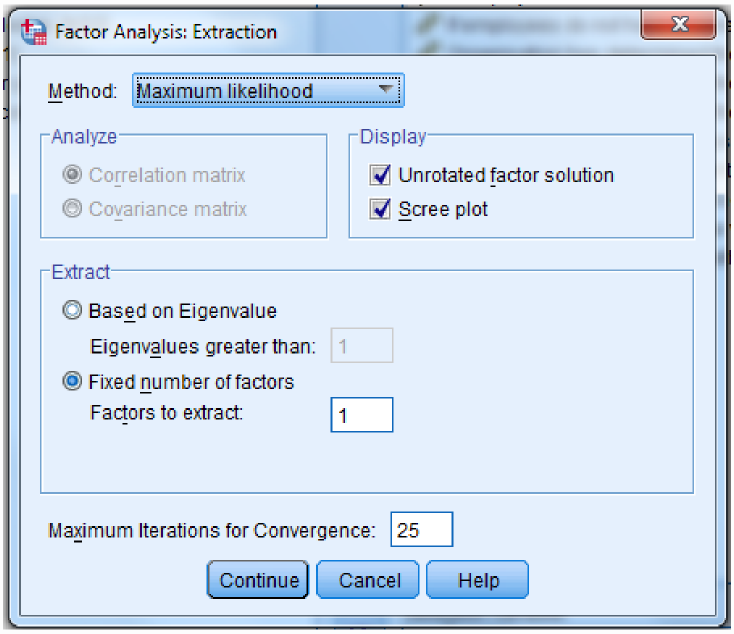



**FIGURE 6-25 EXTRACTION OPTIONS.**

The table on the next page shows the results obtained. The results shows more than 50% of variance (59.330%) can be explained by one factor, which indicates possible common method bias.

**TABLE 6-39 TOTAL VARIANCE EXPLAINED. COMMON METHOD BIAS.**

| Factor | Initial Eigenvalues | | | Extraction Sums of Squared Loadings | | |
|---|---|---|---|---|---|---|
| | Total | % of Variance | Cumulative % | Total | % of Variance | Cumulative % |
| 1 | 6.939 | 63.082 | 63.082 | 6.526 | 59.330 | 59.330 |
| 2 | 1.227 | 11.156 | 74.238 | | | |
| 3 | .859 | 7.812 | 82.049 | | | |
| 4 | .636 | 5.783 | 87.833 | | | |
| 5 | .369 | 3.356 | 91.188 | | | |
| 6 | .331 | 3.006 | 94.194 | | | |
| 7 | .191 | 1.739 | 95.934 | | | |
| 8 | .149 | 1.357 | 97.291 | | | |
| 9 | .129 | 1.170 | 98.461 | | | |
| 10 | .090 | .820 | 99.281 | | | |
| 11 | .079 | .719 | 100.000 | | | |

Extraction Method: Maximum Likelihood.

However, as Podsakoff et al. (2003) explain, this claim is likely to be incomplete because Harman's single factor test is insensitive. "It is unlikely that a single-factor model will fit the data, and there is no useful guideline as to what would be the acceptable percentage of explained variance of a single-factor model." (Chang, van Witteloostuijn and Eden 2010, p. 181).

Besides, given that the theoretical model that I am testing only has few factors, one would probably expect the variance explained by a single factor to be higher.

Next, I used a common factor test, in AMOS. In AMOS, I added a common latent variable, set its variance to 1, and added regression lines to every indicator on the model as shown on the figure on the next page.

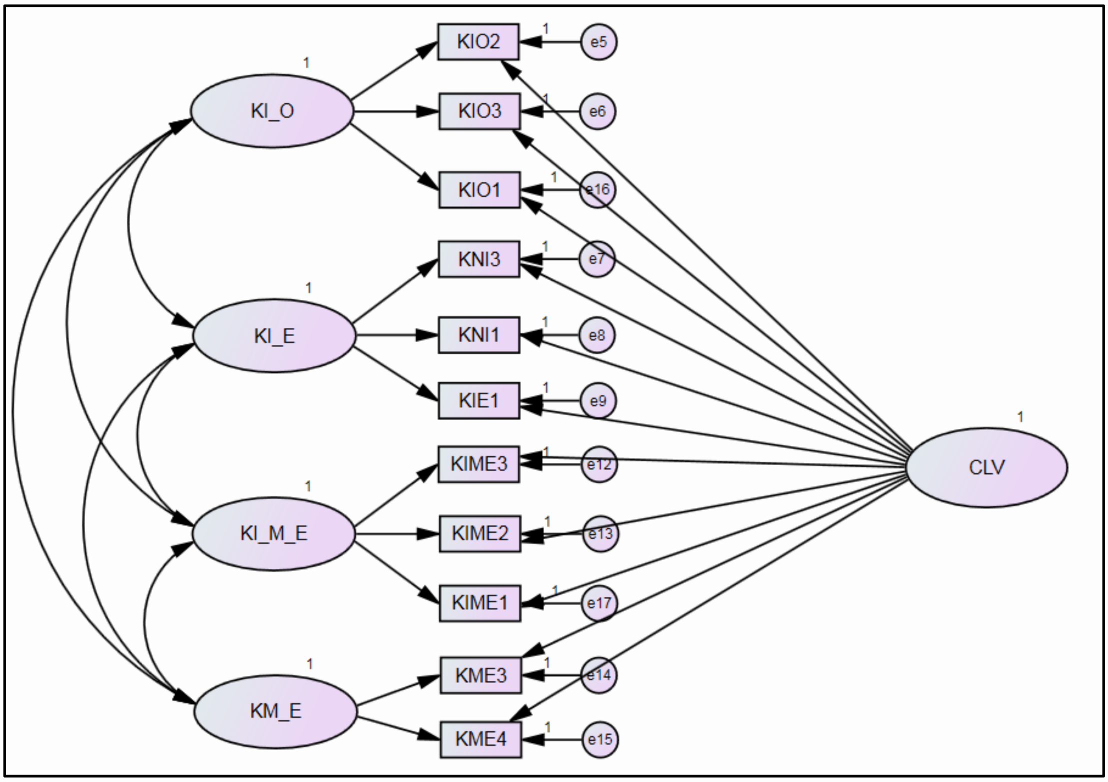



FIGURE 6-26 COMMON LATENT VARIABLE.

I then ran the analysis and the notes below were obtained:

The following variances are negative. (Group number 1 - Default model)

| | e14 |
|---|---|
| | -1.507 |

The following covariance matrix is not positive definite (Group number 1 - Default model)

TABLE 6-40 COVARIANCE MATRIX.

| | KM_E | KI_M_E | KI_E | KI_O |
|---|---|---|---|---|
| KM_E | 1.000 | | | |
| KI_M_E | -.719 | 1.000 | | |
| KI_E | -1.123 | -.181 | 1.000 | |
| KI_O | -.825 | .040 | -.280 | 1.000 |

The results obtained are shown on the figure below.

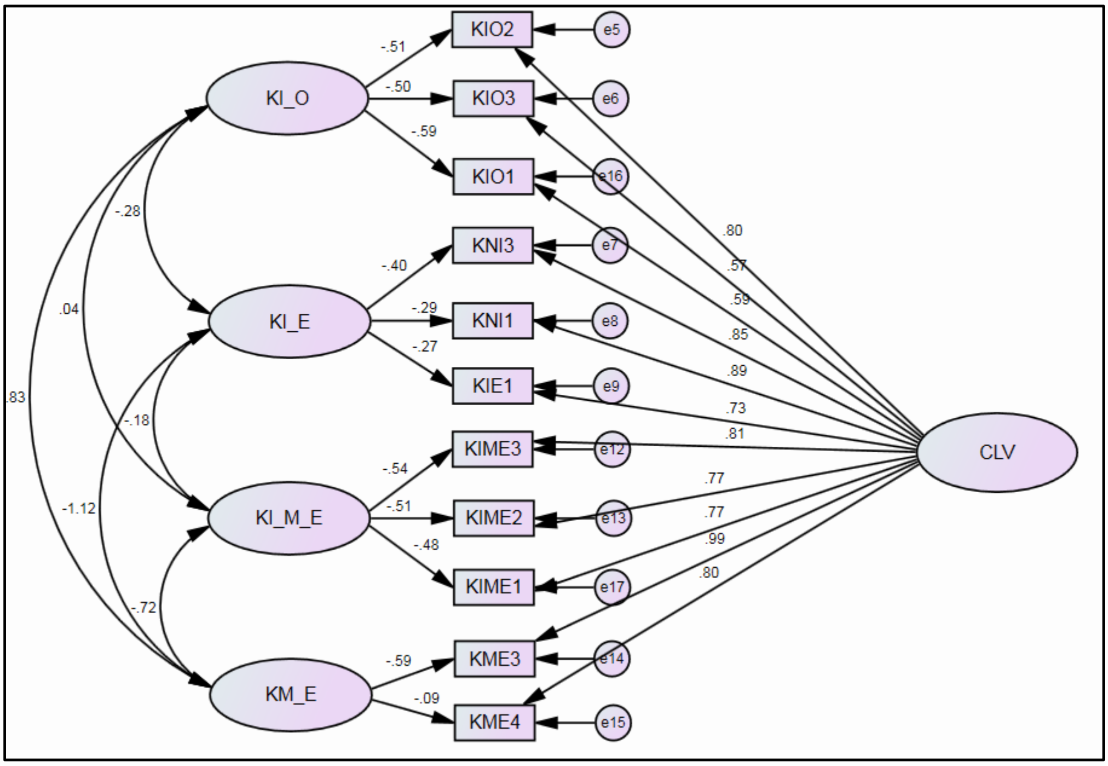



**FIGURE 6-27 COMMON METHOD BIAS WITH COMMON LATENT VARIABLE.**

The analysis ran but only poorly. If it did run successfully, I would have compared the results obtained here with the results obtained without the common latent variable. Based on this comparison, I would then evaluate whether or not this research was affected to some degree by common method bias.

Nevertheless, based on the results above, I would argue that this research was not affected by common method bias. I would argue that since the model with the common latent variable does not 'fit', common method bias is not a concern in this research.

As a final check, I proceeded to compare the results obtained between the two questionnaires. The intent was to compare what the responses from respondents who have overall KM responsibility to those who do not within the same organisation. The comparison was done through a series of bar charts depicting trends.

There were only eight such comparisons. Where there were multiple responses from one group (i.e. responsible or not responsible), I averaged the responses. The results are on the next page.

Further, the standard deviation between those who have and those who do not have overall responsibility over KM was low (less than two). This suggests that common method bias is not an issue in this research.

Based on these results, I proceeded to develop the measurement (or causal) model without a common latent variable attached to the model. I report on the analysis of the measurement model in the next subsection.

Not Responsible
Responsible
KS1
KS2
AtK1
AtK2
AtK3
KIE1
KIE2
KIE3
KNI1
KNI2
KNI3
KNI4
KM1
KM2
KR1
KR2
KR3


15
10
5
0
KS1
KS2
AtK1
AtK2
AtK3
KIE1
KIE2
KIE3
KNI1
KNI2
KNI3
KNI4
KM1
KM2
KR1
KR2
KR3
Not Responsible
Responsible

### 6.4.7. Confirmatory Factor Analysis - Measurement Model

Using AMOS again, to create the measurement (or path) model, I firstly created composites through the Data Imputation analysis. This imputation was done using regression imputation.

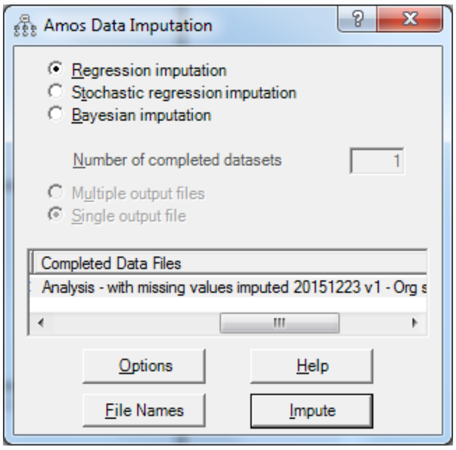



FIGURE 6-28 AMOS DATA IMPUTATION.

Next, I created the path model as shown below.

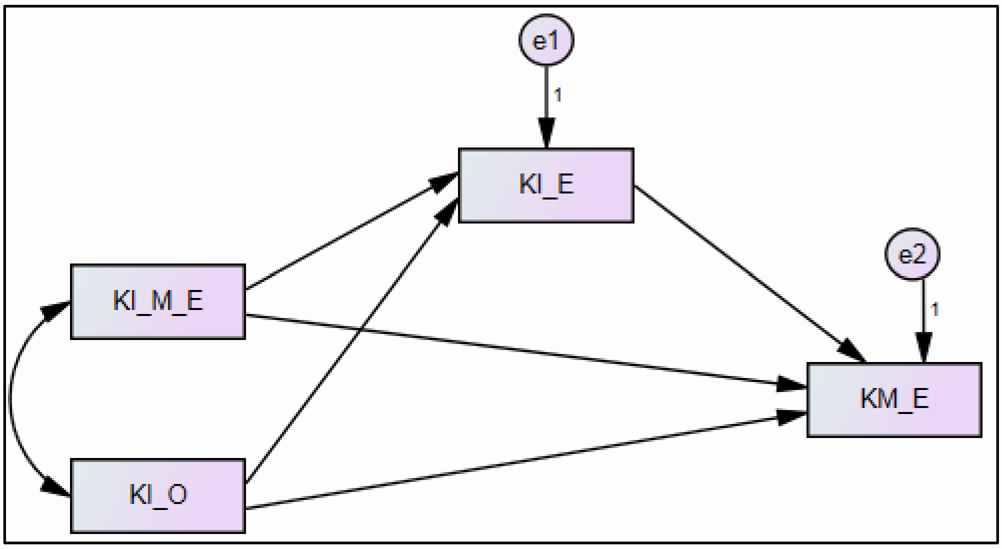



FIGURE 6-29 MEASUREMENT MODEL.

Next, I ran the analysis. The options below were set before running the analysis.

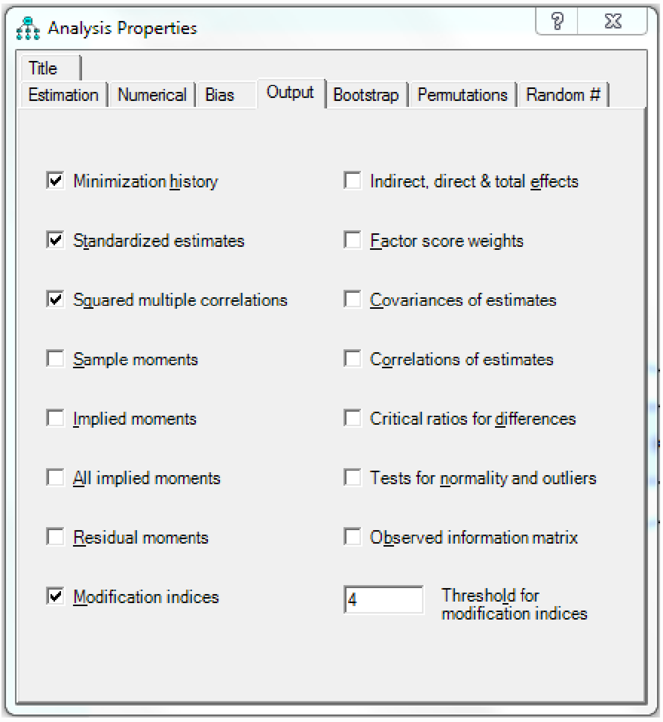



**FIGURE 6-30 ANALYSIS OPTIONS.**

The following results were obtained:

Minimum was achieved
Chi-square = .000
Degrees of freedom = 0
Probability level cannot be computed

In this instance, the model should fit the data perfectly, and the chi-square statistic should be zero, and consequently, no probability level can be assigned to the chi-square statistic.

The model and the results obtained are shown on the figure on the next page. The figure shows the regression weights.

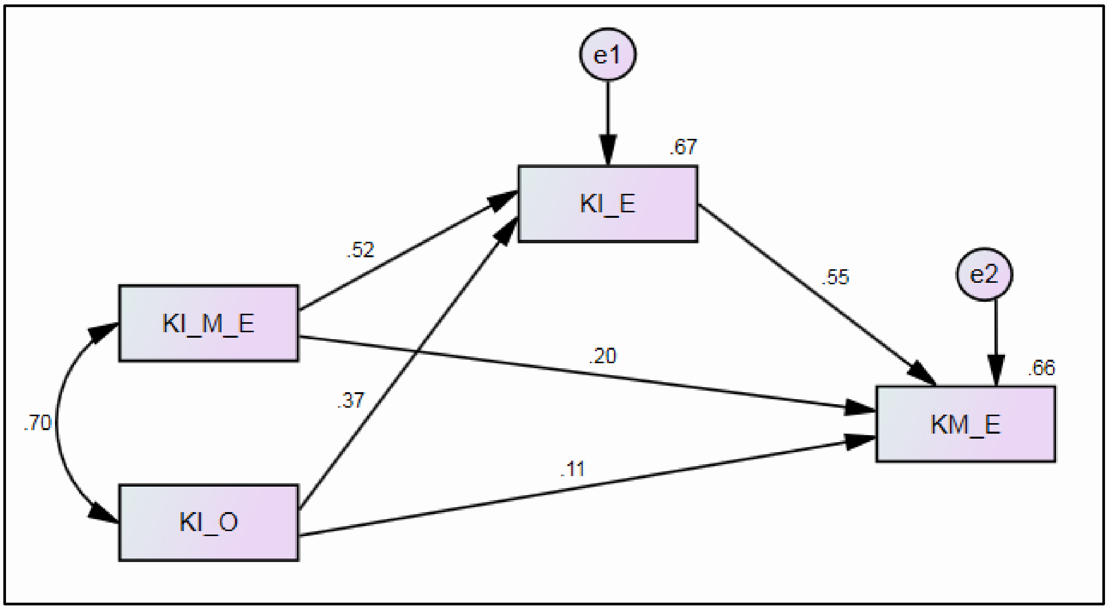



**FIGURE 6-31 MEASUREMENT MODEL.**

The table below shows the regression weights and the significant relationships (noted by the ***). The three significant relationships are:

- KI Methods Effectiveness on KI Effectiveness.
- KI Operationalisation on KI Effectiveness.
- KI Effectiveness on KM Effectiveness.

**TABLE 6-41 REGRESSION WEIGHTS**

| | | | Estimate | S.E. | C.R. | P | Label |
|---|---|---|---|---|---|---|---|
| KI_E | <--- | KI_M_E | .511 | .088 | 5.789 | *** | |
| KI_E | <--- | KI_O | .362 | .088 | 4.120 | *** | |
| KM_E | <--- | KI_E | .551 | .110 | 5.005 | *** | |
| KM_E | <--- | KI_M_E | .202 | .105 | 1.922 | .055 | |
| KM_E | <--- | KI_O | .110 | .097 | 1.137 | .256 | |

These results show that KI Effectiveness accounts for 55 per cent of the variance in KM Effectiveness.

Next, I added the control variables Organisation Size and Organisation Industry to the measurement model. The underlying assumption is that larger organisations have higher number of employees and a greater amount of knowledge. The industry in which an organisation is may also have an influence on KI and KM, and is therefore considered as a control variable. I re-ran the analysis and obtained the results below:

Minimum was achieved

Chi-square = 6.435

Degrees of freedom = 5

Probability level = .266

The figure below shows the final model. The regression weights barely changed.

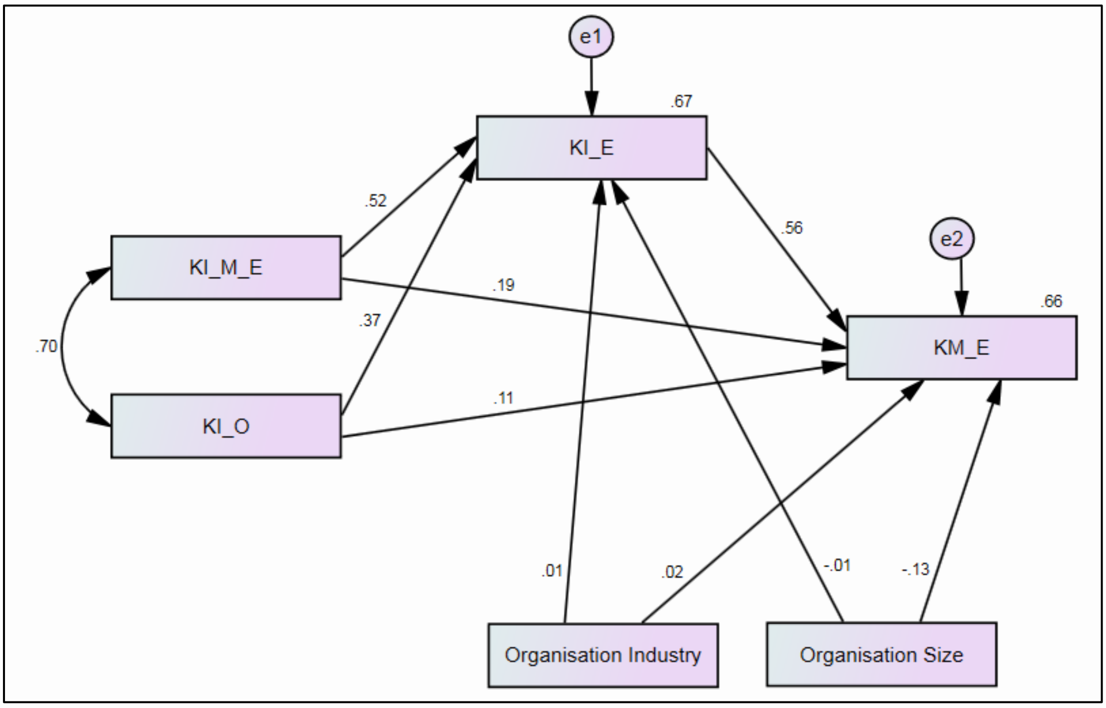



**FIGURE 6-32 MEASUREMENT MODEL WITH CONTROL VARIABLES.**

The table on the next page shows the regression weights and the significant relationships (noted by the ***). The three significant relationships are again:

- KI Methods Effectiveness on KI Effectiveness.
- KI Operationalisation on KI Effectiveness.
- KI Effectiveness on KM Effectiveness.

**TABLE 6-42 REGRESSION WEIGHTS**

| | | | Estimate | S.E. | C.R. | P | Label |
|---|---|---|---|---|---|---|---|
| KI_E | <--- | KI_M_E | .512 | .088 | 5.799 | *** | |
| KI_E | <--- | KI_O | .360 | .088 | 4.092 | *** | |
| KI_E | <--- | OrgIndustry | .002 | .013 | .161 | .872 | |
| KI_E | <--- | OrgSize | .000 | .000 | -.129 | .897 | |
| KM_E | <--- | KI_E | .547 | .108 | 5.087 | *** | |
| KM_E | <--- | KI_M_E | .187 | .102 | 1.820 | .069 | |
| KM_E | <--- | KI_O | .103 | .094 | 1.086 | .277 | |
| KM_E | <--- | OrgIndustry | .004 | .013 | .315 | .753 | |
| KM_E | <--- | OrgSize | .000 | .000 | -1.988 | .047 | |

These results demonstrate that there is truly a significant relationship between KI Effectiveness influences KM Effectiveness despite organisation size and organisation industry. Findings show that the relationship between KI Effectiveness and KM Effectiveness is applicable to organisations of various sizes (where organisations have no less than 10 members) and that there is basically no significant difference in the critical nature of this relationship among organisations of different sizes.

## Additional tests

I also tested the inverse relationship between KM Effectiveness and KI Effectiveness. The results show that KM Effectiveness contributes to 80 per cent of KI Effectiveness. Clearly, there is a strong link between the two.

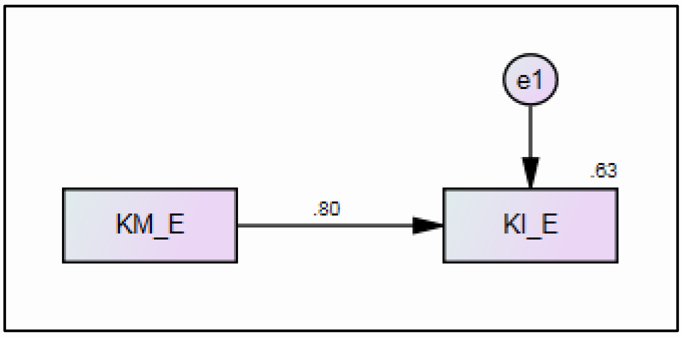



**FIGURE 6-33 KM_E ON KI_E.**

Given that I have more than one variable predicting the independent variable KI Effectiveness, I also had to check for multicollinearity - to check whether KI Methods Effectiveness and KI Operationalisation overlap.

To do so, I used linear regression in SPSS, setting the options as shown below. I used the same composites as I used to test the measurement model.

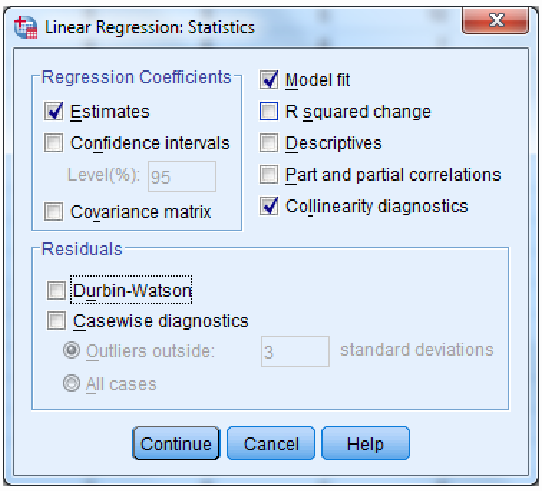



**FIGURE 6-34 LINEAR REGRESSION OPTIONS.**

The tables below show the results obtained.

**TABLE 6-43 MODEL SUMMARY.**

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate | Change Statistics | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | R Square Change | F Change | df1 | df2 | Sig. F Change |
| 1 | .817[a] | .668 | .660 | .57129 | .668 | 81.511 | 2 | 81 | .000 |

a. Predictors: (Constant), KI_O, KI_M_E

**TABLE 6-44 COEFFICIENTS.**

| Model | | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. | Collinearity Statistics | |
|---|---|---|---|---|---|---|---|---|
| | | B | Std. Error | Beta | | | Tolerance | VIF |
| 1 | (Constant) | .537 | .195 | | 2.760 | .007 | | |
| | KI_M_E | .511 | .089 | .516 | 5.719 | .000 | .503 | 1.986 |
| | KI_O | .362 | .089 | .367 | 4.070 | .000 | .503 | 1.986 |

a. Dependent Variable: KI_E

There was no significant change in R square (0.008) and as the table above shows, the tolerance values are greater than 0.1, and the VIF values are less than 10. Therefore, in this case, multicollinearity is not an issue.

The 'Responsible-for KM' questionnaire also had a question on KI methods used. I report on the results obtained next.

### 6.4.8. KI Methods

The chart below shows the responses obtained when respondents were asked which KI methods their organisations use. The percentages are out of 84 respondents.

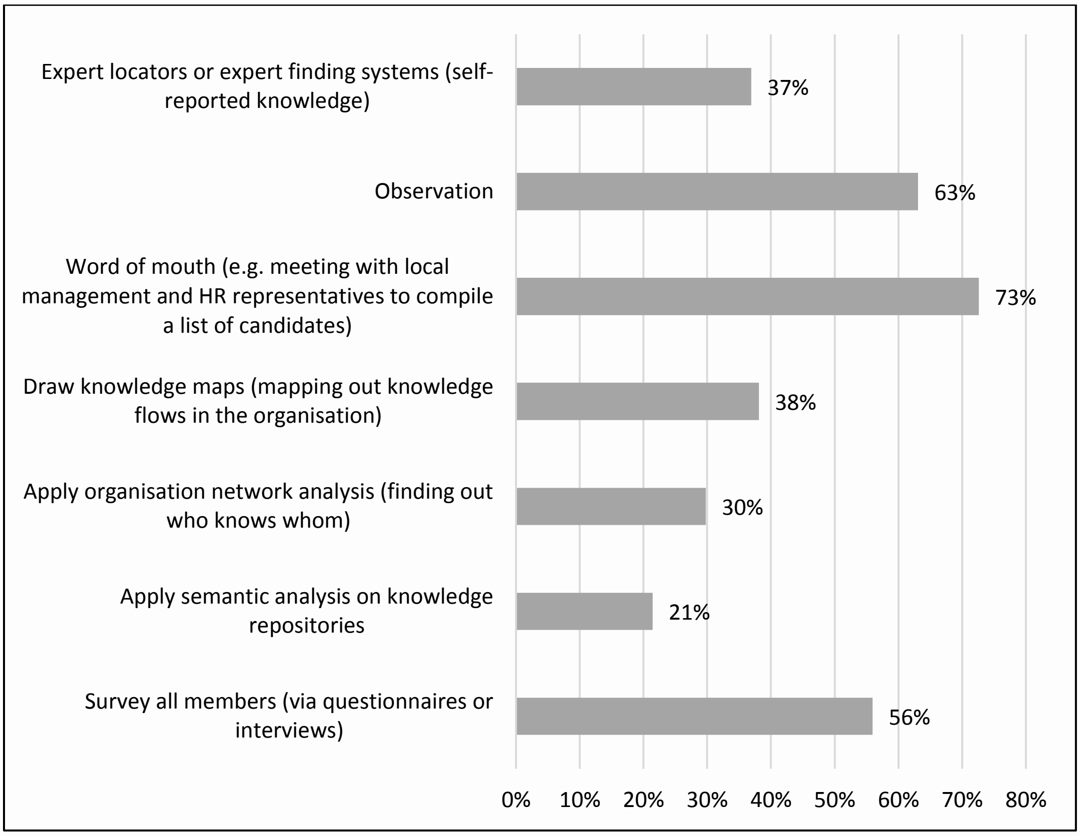



**Figure 6-35 KI Methods used across the globe.**

Again, similar to the KI methods surfaced in phase one, word of mouth, surveying and observation were among the most used methods.

Again, respondents were given the option to add their own in-house KI methods. 12 per cent of the respondents provided insights around how KI is practised in their organisations. The table on the next page lists those methods.

**TABLE 6-45 IN-HOUSE KI METHODS.**

| |
|---|
| Compilation of work instructions made compulsory within departments and saved on the document management system. |
| Work in cross-cutting themes and regularly exchange in discussions around projects. During these discussions the knowledge is identified and shared. |
| Database and sever infrastructure. |
| Some in-house automated facilities. |
| Map knowledge back onto staff's programme responsibilities and experiences. |
| Business process engineering initiatives. |
| Through team leaders who are aware of their teams skills and knowledge. |
| Consultation between knowledge team and end users. |
| Establishment of communities around global priorities. |
| Virtual communities of practice. |
| Process maps and job descriptions with skills matrices. |
| Cognitive mapping. |

In the next section, I report on the responses from the 'Not-Responsible-for-KM' survey.

## 6.5. Results from Not-Responsible-for KM survey

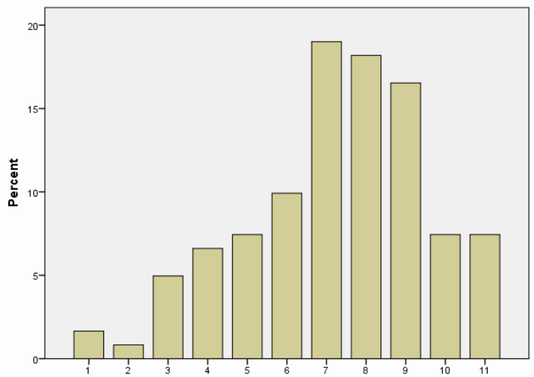
In the following pages, I report on the results obtained from analysing the responses from the 'Not-responsible-for-KM' questionnaire.

As described in chapter three (Research Design and Method), these responses were not meant to be analysed exhaustively as the questionnaire itself was rather short and straight-forward. The responses were analysed using standard statistical analysis methods, including measures of central tendency and association between variables.

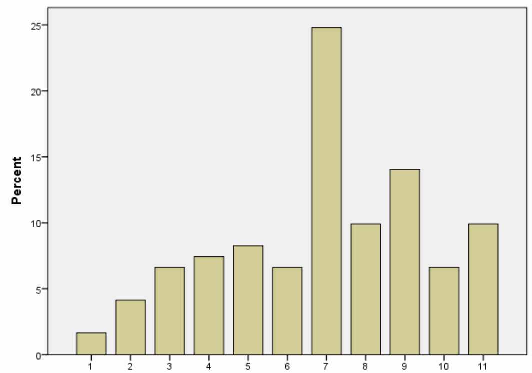
A similar scale used in the 'Responsible-for-KM' applies here: from 'Completely Disagree' represented by '1' on the charts, to 'Completely Agree' represented by '11' on the charts.

## Knowledge Sharing

My organisation promotes a knowledge-sharing culture among its members.

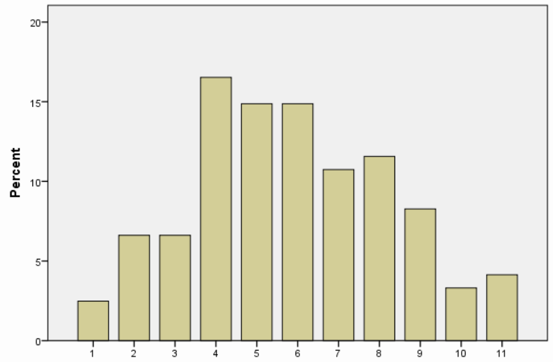
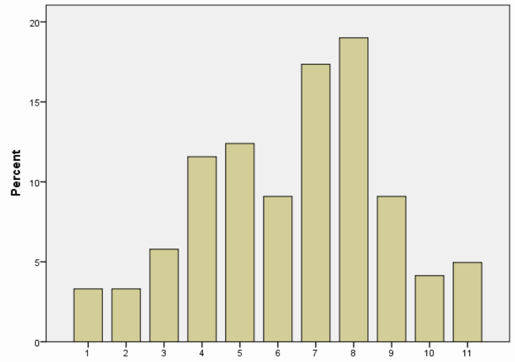
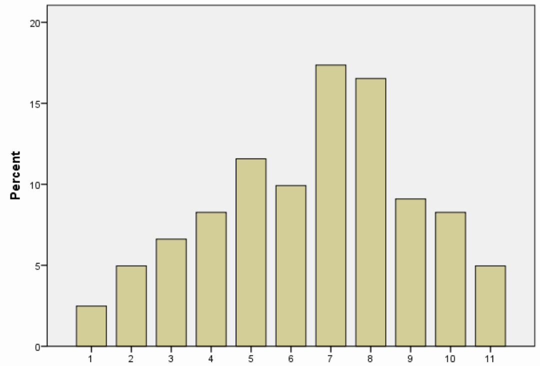



Technology effectively supports me to share my knowledge.



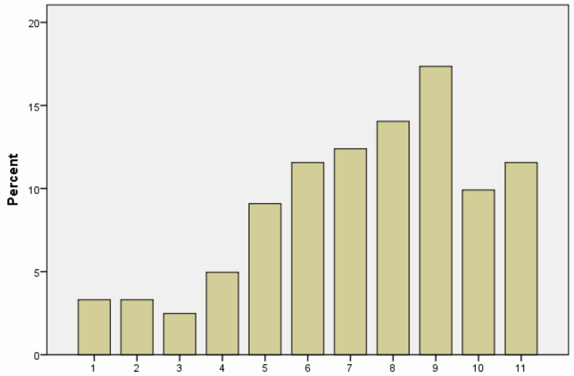
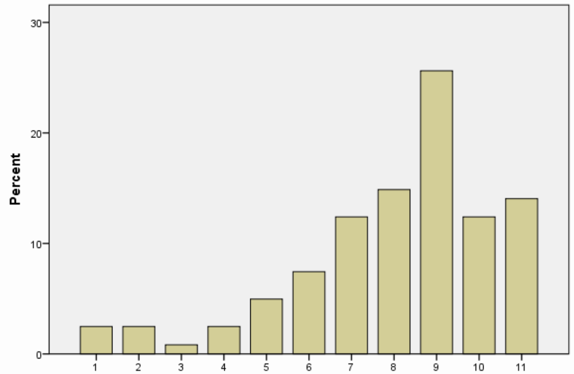
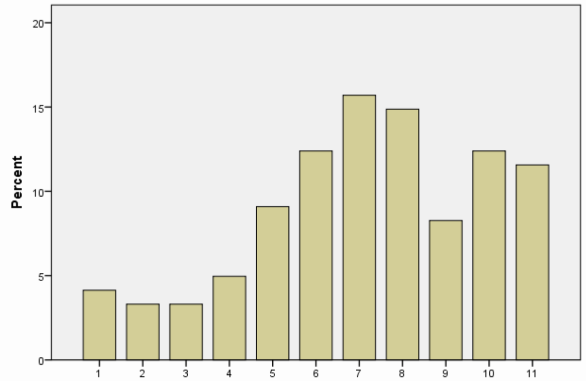

The results above indicates that organisations generally promote a knowledge-sharing culture.

KI Effectiveness

| It is easy for me to determine whether the knowledge I need is available somewhere in my organisation. | It is easy for me to determine who has knowledge I need to do my job. | It is easy for me to determine where to find the knowledge I need to do my job. |
| --- | --- | --- |
|  |  |  |

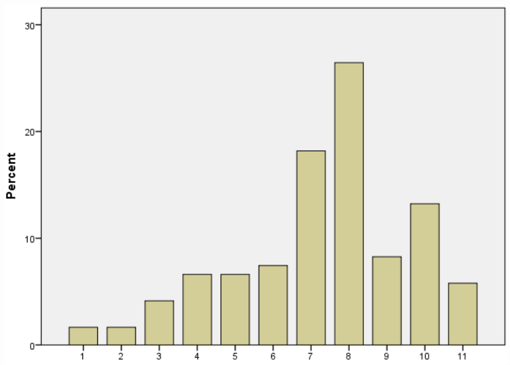
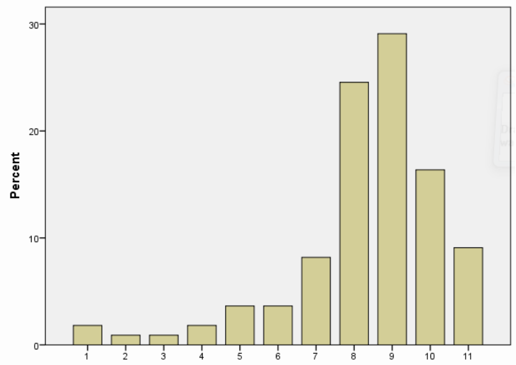
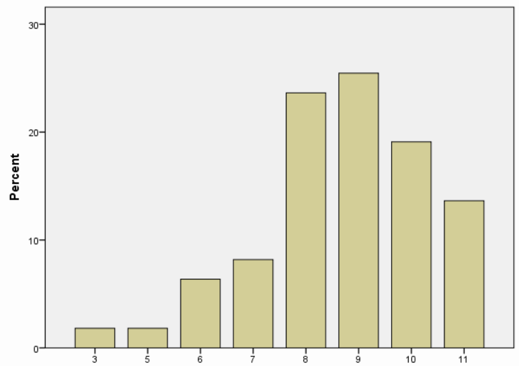
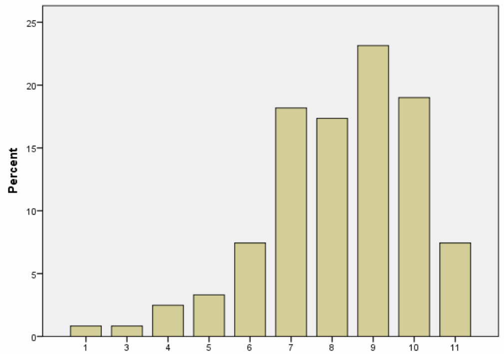
The results here are not really conclusive.  On one hand, some respondents seem to have difficulties establishing what knowledge exists within their organisation.  On the other hand, respondents also indicate that it is relatively easy to determine where to find knowledge they need.

Access to knowledge

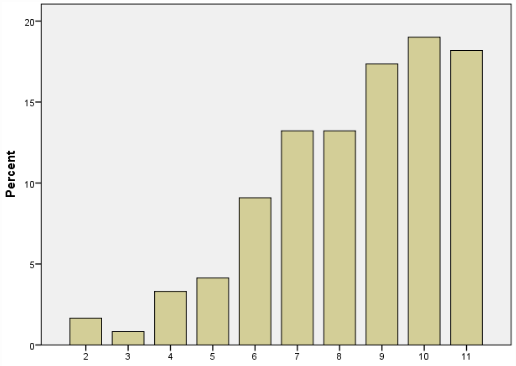
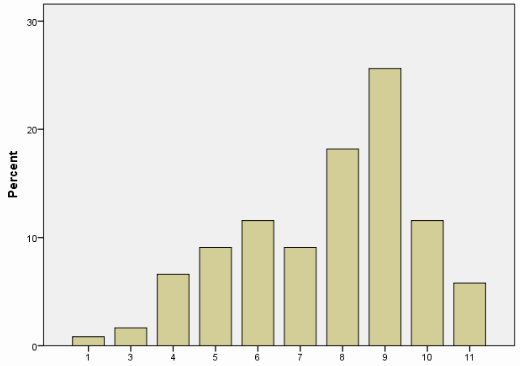
| I don't need permission or it is easy for me to access knowledge that my organisation has. | I don't need permission or it is easy for me to obtain permission to access other members of my organisation. | I don't need permission or it is easy for me to obtain permission to access knowledge stored in knowledge repositories. |
| --- | --- | --- |
|  |  |  |

The results above show that employees generally have access to either other employees in their organisations or knowledge repositories within their organisations.

Knowledge Needs Identification

| | | |
|---|---|---|
| I know all I need to do my job.<br><br> | I have all the skills I need to do my job well.<br><br> | I am highly skilled at doing my job.<br><br> |
| | I know of knowledge that I wish I could get to do my job better.<br><br> | These results suggest that employees generally know what they need to do their job and do it well. |

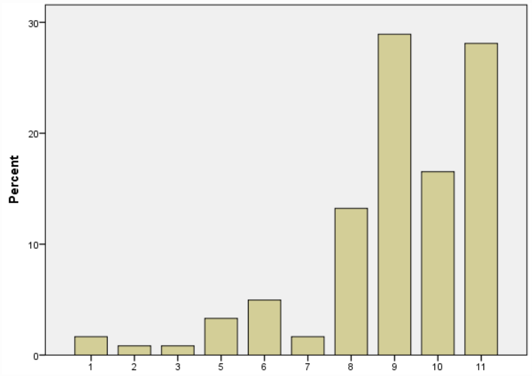
KM Effectiveness

| I can obtain knowledge I need when I need it. | If I do not have knowledge I need, I can obtain it. |
| --- | --- |
|  |  |

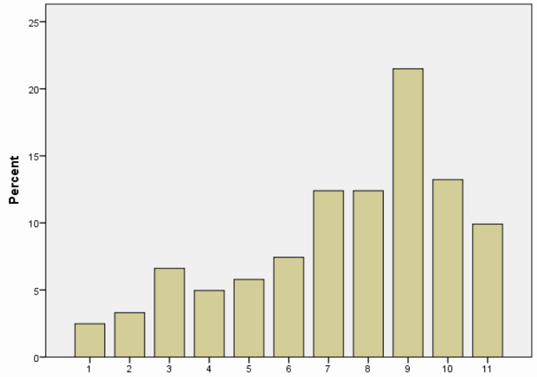
The results above indicate that most organisations are generally effective at practising KM.

## Knowledge Recording

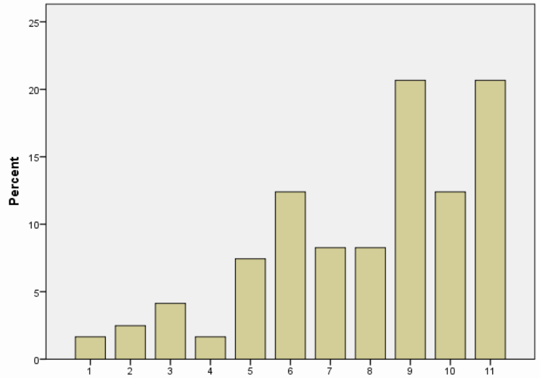
I am willing to record what I know in knowledge repositories.




I know what I am supposed to record in knowledge repositories.




I record what I am supposed to record in knowledge repositories.




The results above indicate that employees are generally willing to share their knowledge and do record what they know, but often times do not know what they are meant to record.

In the next section, I discuss the implications of the findings from phase three before summarising the chapter.

## 6.6. Implications of Findings

The goals in phase three was to test and if necessary, refine the model (the theory) generated in phase two, based on the strength of the relationships among the factors. After a battery of tests and analyses, the model was indeed refined. The initial model and the revised model are shown below.

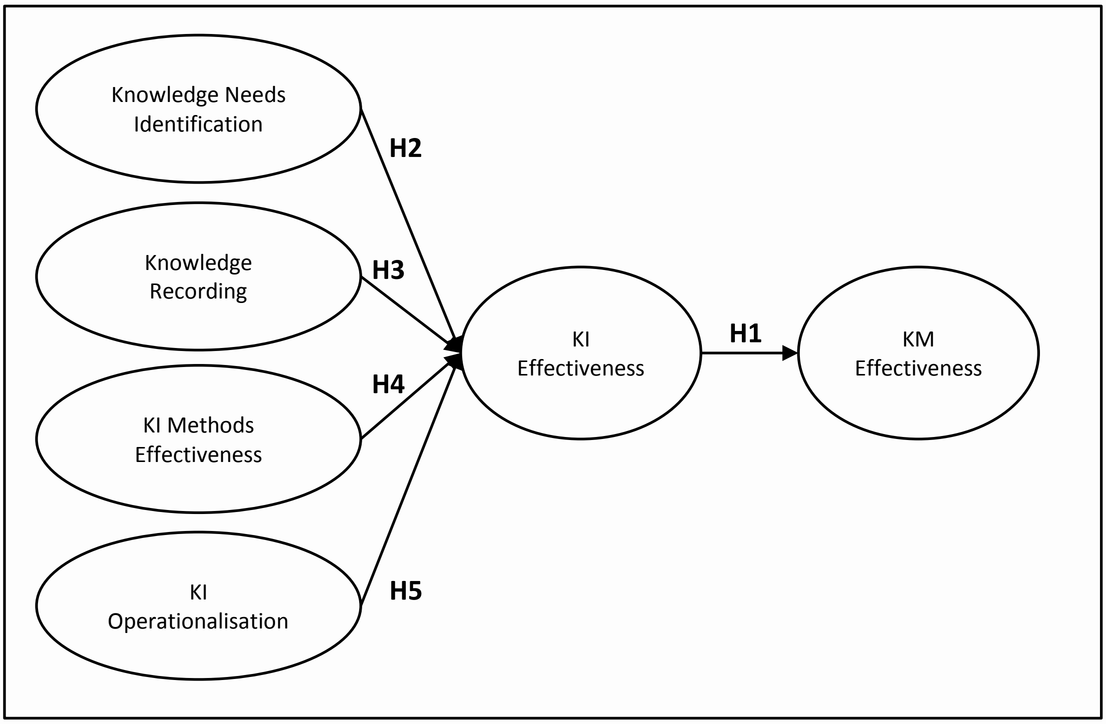



**Figure 6-36 Initial model.**

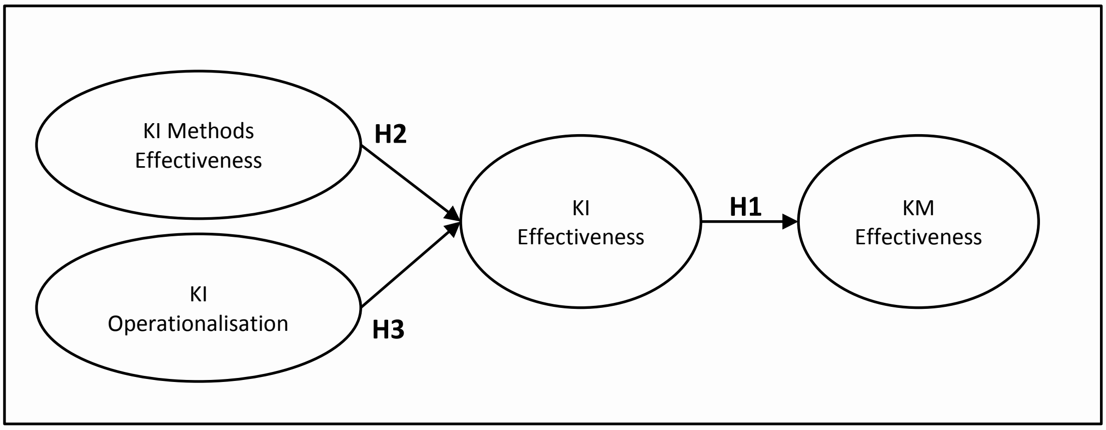



**Figure 6-37 Revised model.**

The revised model was the result of two actions: first, dropping the latent variable Knowledge Recording and second, merging the latent variables Knowledge Needs Identification and KI Effectiveness.

The analyses and tests conducted demonstrate that KI Operationalisation and KI Methods Effectiveness influence KI Effectiveness, and KI Effectiveness influences KM Effectiveness. The figure below depicts the results obtained.

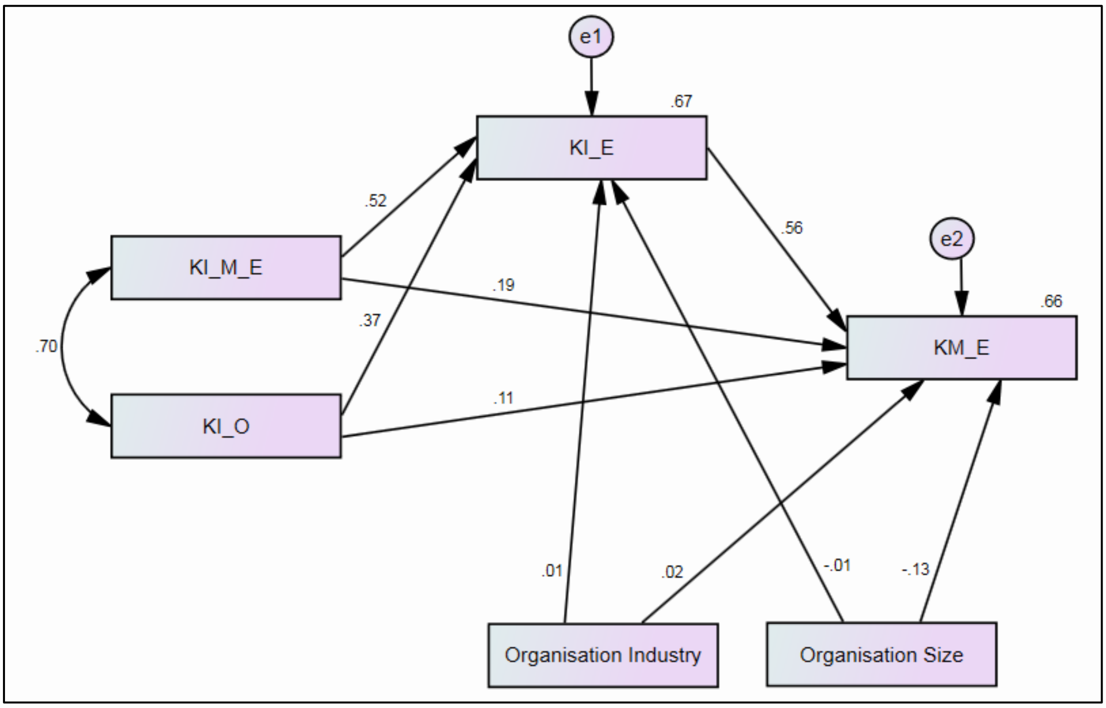



**FIGURE 6-38 MEASUREMENT MODEL WITH CONTROL VARIABLES.**

The proven hypotheses (H1, H2, H3) are detailed below (from left to right and top to bottom):

H2 is positive:

The extent to which the methods, tools, techniques or other means that an organisation uses to practise KI work well (KI Methods Effectiveness), influences the extent to which an organisation is able to identify internal sources of knowledge that are relevant and needed for organisational performance (KI Effectiveness).

KI Methods Effectiveness accounts for 52 per cent of the variance in KI Effectiveness.

H3 is positive:

The extent to which KI is practised proactively, and actively governed (KI Operationalisation), influences the extent to which an organisation is able to identify internal sources of knowledge that are relevant and needed for organisational performance (KI Effectiveness).

KI Operationalisation accounts for 37 per cent of the variance in KI Effectiveness.

H1 is positive:

The extent to which an organisation is able to identify internal sources of knowledge that are relevant and needed for organisational performance (KI Effectiveness), influences the extent to which an organisation is able to identify and leverage its knowledge assets to drive and support organisational performance (KM Effectiveness).

KI Effectiveness accounts for 55 per cent of the variance in KM Effectiveness.

Phase three thus established:

- The relationship between KI and KM is strong.
- Two factors (KI Operationalisation and KI Methods Effectiveness) that have a relatively strong influence on KI effectiveness.

Some limitations of the theory-testing survey in phase three include:

- The sample size was quite small for the 'Responsible-for-KM' questionnaire with a bias towards the 'Professional, Scientific and Technical Services' industry.
- I did not take into account the KM maturity of the responding organisations. This could have been used as a control variable in the model.

- I did not take into account the "mood" of the respondents. This could introduce bias in the survey responses.
- This theory-testing exercise could have been improved if I had used one sample for the Exploratory Factor Analysis (EFA) and another sample for the Confirmatory Factor Analysis (CFA).

Next, I summarise this chapter. I synthesise the findings from this research (chapters four to six) in the next chapter.

## 6.7. Chapter Summary

Phase three reported and discussed the findings from the theory-testing survey. Findings from phase three established the strength of the relationships among factors influencing KI Effectiveness and between effective KI and effective KM.

The next chapter concludes this thesis.

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# Chapter Seven: Conclusion and Future Work

This chapter concludes this thesis. This chapter consists of two parts; in the first part, I discuss how I met the research objectives set, and in the second part, I recommend potential avenues for future work to leverage this research and future research around KI.

## 7.1. Research Objectives Met

A review of relevant literature (section 2.3.2) indicated that there is a lack of literature around KI. With the intent of filling the gaps in the literature and establishing whether or not KI is critical to KM, research objectives were set.

Through a three-phase research project, these research objectives were met. In phase one, I deepened our understanding of KI practices among organisations through a paper-based questionnaire survey.

Results (from chapter four) showed that while the majority of the 121 organisations who responded value KI highly, they do not actively practise KI.

When asked: "How important is it to identify what knowledge exists within your organisation?", 49 per cent chose 'To a great extent', while another 40 per cent chose the second highest point. 64 per cent indicated significant problems with the KI methods currently used.

One of the problems (see table 4-4) alluded to a common challenge in KM: capturing tacit knowledge. That is, it is difficult to identify knowledge that may be needed when that knowledge itself is difficult to articulate and codify – but it is better to try to identify than not to do anything at all.

In phase two, semi-structured interviews surfaced some of the problems related to practising KI and some of the factors that influence KI effectiveness were identified. As a result of extensive analysis of interview data, a model of factors influencing KI effectiveness was developed. This same model was extended to relate KI effectiveness and KM effectiveness.

I tested the model constructed in the third and final phase of this research, via detailed quantitative data analysis – covariance-based Structural Equation Modelling.

Data analysis (from chapter six) showed which factors actually contribute (or not) to KI effectiveness and to what extent KI effectiveness contributes to KM effectiveness. The factors that contribute to KI effectiveness are: KI Methods Effectiveness and KI Operationalisation. The results confirmed the critical nature of the relationship between KI and KM: effective KI contributes to effective KM.

This research thus extended the literature in the following ways:

- By providing new insights in KI practices.

  Findings have surfaced the problems that different KM stakeholders face with respect to KI and KI methods. For example, the survey in phase one shed light upon what capabilities KM stakeholders seek in KI methods. These can be used to develop more effective KI methods.

- By establishing new theory explaining the relationship between effective KI and effective KM.

  Findings demonstrate that KI effectiveness accounts for much of the variance in KM effectiveness. These findings support the argument by many researchers who advocate the case of KI - noting the definition of KI applied in this research.

  These findings also explain why organisations should include KI as part of their overall KM strategy and why organisations should practise KI if they are not doing so already.

- By establishing some of the factors that influence KI effectiveness.

  Findings have also surfaced some of the factors that influence KI effectiveness. These factors can be further explored to identify what exactly in KI that contributes so much to KM effectiveness.

In the next section, I recommend some potential avenues for future work.

## 7.2. Future Work

There is more to be done in the domain of KM and KI. There is still more to understand in the KI domain, more to be unlocked and unpacked. Some of the questions that this research has raised and which warrant further research include:

- This research itself.

  Based simply on the limitations articulated in this research, I recommend replicating this research in a different country other than Australia or within one single, large multi-national enterprise. Then, compare the results with those produced in this research.

- KI strategy.

  More needs to be done also in terms of quantifying the value of KI and how to implement a KI strategy *vis à vis* KM. For example, how does an organisation get KI fundamentals right? What makes up these fundamentals? How does an organisation use this research in the face of its ageing workforce? These are some questions yet to be answered.

- KI and organisational performance.

  While the relationship between effective KI and effective KM was established in this research, we ought to further expand this relationship and stretch it to test the relationship between KI, KM, organisational performance, capabilities and learning.

  I also recommend a case study on how surfacing what knowledge exists within an organisation, particularly in regards to who knows what, impacts the organisation culture. A case study would provide a much richer depiction of KI phenomena.

- KI, KM and other KM processes.

  As mentioned in earlier chapters, while KI may be positioned as one of the first KM processes to execute, it does not necessarily dilute the importance of other KM processes. That is, KI is not an end in itself. Which KM process contributes more to effective KM - KI or say, Knowledge Sharing is yet to be determined.

  Similarly, more research is warranted around the influence KI has on other KM processes and beyond. For example, how much does KI effectiveness contribute to Knowledge Sharing effectiveness? Would Knowledge Sharing be more effective if employees knew what knowledge they are meant to share? In other words, despite being willing to share their knowledge, employees do not share their knowledge because they do not know what to share in the first place.

  More research to investigate the relationships between KI, Organisational Learning and Organisation Memory, and how KI may impact OL and OM is also warranted.

- KI methods.

  A number of KI methods were surfaced in phase one. While knowing what KI methods are available is useful, we also need to establish which KI method or combination of KI methods is more effective in identifying which type or form of knowledge.

Finally, I recommend investigating the following two items that were out of scope in this research: organisational memory, and how organisations go about determining what knowledge they needed for organisational performance.

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# Appendices

**Appendix A: Phase One - Exploratory Survey**

**Appendix B: Phase two - in-Depth Interviews**

**Appendix C: Phase three - Theory-Testing Survey**

**Appendix D: Results from EFA**

**Appendix E: EFA and CFA with Six-Factor Model**

# Appendix A. Phase one: Exploratory Survey

### Letter sent to participants.

<Title><First Name><Last Name>
<Organisation Name>
<Organisation Address>

<Date>

Dear <Title><First Name><Last Name>

An increasing number of organisations are investing in knowledge management systems to better manage their knowledge. Global knowledge management market revenues are projected to exceed US$157 billion by 2012.

I am a researcher at Curtin University, and I invite you to participate in a survey into knowledge management practices in Australian organisations. Enclosed is a short questionnaire, an information sheet and a reply-paid envelope.

According to Lew Platt, the former CEO of Hewlett Packard, "*if HP knew what HP knows, we would be three times as profitable.*" Does your organisation know what it knows? How do you know who knows what, within your organisation? How does your organisation compare to other Australian organisations in its knowledge management practices? This study will help Australian organisations benchmark themselves in relation to questions such as these.

In return for the completion of this short questionnaire, a copy of the findings will be sent to you. Your participation is voluntary and the questionnaire should take no more than 15 minutes to complete. Your response will be greatly appreciated.

Yours sincerely,

<Signature of researcher>

William Newk-Fon Hey Tow
School of Information Systems
Curtin University

## Information sheet

*Project Title*

Toward More Effective Knowledge Management: An Investigation of Problems in Knowledge Identification

*Purpose of Study*

You are invited to participate in a study which aims to investigate knowledge management practices in Australian organisations. This short questionnaire explores the methods used in your organisation to identify what knowledge employees possess, and what problems you face with respect to those methods.

Your participation is voluntary and the questionnaire should take no more than 15 minutes to complete. In return for the completion of the questionnaire, a copy of the survey findings will be sent to you.

*Confidentiality*

Your response will be de-identified and nothing identifying you or your organisation will be published. If you have any questions about the questionnaire you can contact me at W.Newk-FonHeyTow@postgrad.curtin.edu.au.

This research is supervised by Associate Professor John Venable and Dr. Peter Dell. They can be contacted at John.Venable@cbs.curtin.edu.au and Peter.Dell@cbs.curtin.edu.au.

This study has been approved by the Curtin University Human Research Ethics Committee (Approval Number IS_10_17). Verification of approval can be obtained either by writing to the Curtin University Human Research Ethics Committee, c/- Office of Research and Development, Curtin University, GPO Box U1987, Perth, 6845, by telephoning 9266 2784 or by email to hrec@curtin.edu.au.

# Knowledge Management Practices Questionnaire

This questionnaire explores the methods used in your organisation to identify who knows what - in other words, identifying knowledge that exists within your organisation, and what problems you face with respect to those methods.

| 1. To which industry does your organisation belong? (Please select the best match.) | |
|---|---|
| ◯ Accommodation and Food Services | ◯ Information Media and Telecommunications |
| ◯ Administrative and Support Services | ◯ Manufacturing |
| ◯ Agriculture, Forestry and Fishing | ◯ Mining |
| ◯ Arts and Recreation Services | ◯ Professional, Scientific and Technical Services |
| ◯ Construction | ◯ Public Administration and Safety |
| ◯ Education and Training | ◯ Rental, Hiring and Real Estate Services |
| ◯ Electricity, Gas, Water and Waste Services | ◯ Retail Trade |
| ◯ Financial and Insurance Services | ◯ Transport, Postal and Warehousing |
| ◯ Health Care and Social Assistance | ◯ Wholesale Trade |
| ◯ If other, please specify: | |

| 2. What is your job title? |
|---|
| |

| 3. Approximately how many full-time employees are there in your organisation? |
|---|
| |

| 4. Who is responsible for the overall Knowledge Management practices in your organisation? (Please tick as many boxes as applicable.) | |
|---|---|
| ☐ Chief Knowledge Officer | ☐ Chief Information Officer |
| ☐ IT Manager | ☐ Project Manager |
| ☐ Director of Human Resources | ☐ I don't know |
| ☐ If other, please specify: | |

| 5. Please indicate the extent of each of the following at your organisation. | | | | | | |
|---|---|---|---|---|---|---|
| | Not at all | | | | To a great extent | Don't know |
| **How experienced is your organisation with Knowledge Management?** | ◯ | ◯ | ◯ | ◯ | ◯ | ◯ |
| **How important is it to identify what knowledge exists within your organisation?** | ◯ | ◯ | ◯ | ◯ | ◯ | ◯ |
| **To what extent does your organisation identify existing knowledge?** | ◯ | ◯ | ◯ | ◯ | ◯ | ◯ |
| **To what extent has knowledge that exists within your organisation been identified?** | ◯ | ◯ | ◯ | ◯ | ◯ | ◯ |
| **Are the current methods of identifying who knows what within your organisation problematic?** | ◯ | ◯ | ◯ | ◯ | ◯ | ◯ |

| 6. Why does your organisation identify / not identify existing knowledge? |
|---|
| |

| 7. If you need to find someone within your organisation with specific knowledge, how would you go about finding that person? (Please list as many methods as possible.) |
|---|
| |

| 8. Among the methods above, which do you consider the most effective? |
|---|
| |

| 9. Below is a list of methods available to identify what knowledge exists within organisations. Which of the following does your organisation use? Please select as many as applicable. | | | | |
|---|---|---|---|---|
| | Not used | Currently in use | Previously used | Don't know |
| **Staff self-identify their areas of expertise in Knowledge Sharing Systems such as wikis or knowledge databases.** | ○ | ○ | ○ | ○ |
| **Applying different content analysis techniques on existing documents in your organisation.** | ○ | ○ | ○ | ○ |
| **Interviewing staff to determine what knowledge they possess.** | ○ | ○ | ○ | ○ |
| **Analysing the relationships among employees to determine who knows whom.** | ○ | ○ | ○ | ○ |
| **Having meetings among management representatives, HR representatives and employees of the KM department to compile a list of potential employees.** | ○ | ○ | ○ | ○ |
| **Expert Finding Systems** | ○ | ○ | ○ | ○ |
| **Knowledge Loss Risk Assessment** | ○ | ○ | ○ | ○ |
| **Organisational Network Analysis** | ○ | ○ | ○ | ○ |
| **ExTra (Expertise Transfer)** | ○ | ○ | ○ | ○ |
| **If in-house or other methods, please describe:** | | | | |

| 10. What do you perceive as problematic or dislike about the methods you use? |
|---|
| |

| 11. If you could have whatever you wanted, what factors should be taken into account when designing methods of identifying who knows what within your organisation? |
|---|
| |

## Contact details

If you would like to further share your thoughts about knowledge management, please complete the following.

Name: ______________________________________________________________

Email: ______________________________________________________________

## End of Questionnaire

Thank you for taking part in this survey.

Please return this questionnaire in the reply paid envelope provided.

# Appendix B. Phase two: in-Depth Interviews

**E-mail sent to participants.**

Subject:

Knowledge Management Practices in Australia

Body

Dear <Title><First Name><Last Name>,

Thank you for participating in the "Knowledge Management Practices" survey from Curtin University in April.

As promised, I would like to send you a copy of the survey results. However, before sending the document I would like to confirm that I have the most appropriate email address for this purpose.

I would also like to invite you to participate in a telephone interview. You indicated that you were interested in further sharing your thoughts on Knowledge Management, and I would appreciate hearing your perspectives on the matter.

Could you please give me your telephone number so I can contact you to arrange a suitable time for the interview?

Kind regards,

William Newk-Fon Hey Tow

## Information Sheet

### Interview Information Sheet and Consent Form

This interview is being undertaken as part of a research project titled *Toward More Effective Knowledge Management: An Investigation of Problems in Knowledge Identification*.

The intent of this interview is to gain deeper understanding of what employees with different roles in organisations like, dislike, or perceive is problematic in Knowledge Identification methods i.e., methods of identifying who within organisations knows what.

Your participation is voluntary. If you agree to participate, you will be asked questions revolving around your perceptions of the effectiveness, benefits, problems, and difficulties in using Knowledge Identification methods.

The interviewer will take notes during the discussion. If you give permission, the interview will be recorded. Any information provided will be kept in a safe and secure place at Curtin University, accessible only to the interviewer and his two supervisors, for a period of five years – at the conclusion of which it will be destroyed.

No information that could lead to the identification of any individual will be disclosed in any publication. You may refuse to answer any question, withdraw from the interview at any time, or request that information provided not be used.

If you have questions or concerns about this research, you can contact me at W.Newk-FonHeyTow@postgrad.curtin.edu.au.

This research is supervised by Associate Professor John Venable and Dr. Peter Dell. They can be contacted at John.Venable@cbs.curtin.edu.au and Peter.Dell@cbs.curtin.edu.au.

This study has been approved by the Curtin University Human Research Ethics Committee (Approval Number IS_11_04). Verification of approval can be obtained either by writing to the Curtin University Human Research Ethics Committee, c/- Office of Research and Development, Curtin University, GPO Box U1987, Perth, 6845, by telephoning 08 9266 2784 or by email to hrec@curtin.edu.au.

I hereby agree to be interviewed under the conditions set out above.

Name: ___________________________________________ Date: ____/____/______

Signature: ___________________________

I hereby agree that in order to back up written notes an audio recording of this interview may be taken: Yes No

(Please circle)

## Interview schedule

*Beginning of the interview*

*Mind the different time zone.*

<Greetings>

Ok. Let me begin by asking you some questions about your organisation - <organisation name>

*Establish rapport. Determine how much organisational knowledge the informant has potentially accumulated.*

1. How long have you been working at <organisation name>?
2. And you are the <position title>, is that right?
3. How many full time employees are there at <organisation name>?

*Introduce the topic of Knowledge Management and Knowledge Identification*

<organisation name> is certainly a relatively large organisation. Let's move on to the topic of knowledge management. There are a lot of definitions of KM out there but in your opinion, what is knowledge management?

*Wait for answer.*

So, Knowledge Management consists of several steps or processes.

4. Is there a specific kind of knowledge <organisation name> manage or wish to manage?

I am focusing on one of processes of KM that is knowledge identification or KI.

And KI is about identifying what knowledge exists within the organisation.

5. Could you tell me how do employees at <organisation name> usually go about finding who within the organisation knows what? For example, if an employee were to look for someone who knows X, how would he or she go about finding that person?

6. Why did your organisation choose to implement <method A>? Is <method A> the most effective?
7. Is it mandatory to use <method A> or voluntary?
8. Do you actually look for the employees who you would want to write down what they know?
9. Is it time consuming? How long does it take?

*Explore the problems with the Knowledge Identification methods used in the organisation.*

10. Would you say that <method A> works all the time?
11. Could you please describe a scenario when <method A> did not work? In what kind of situation does it not work?

*Determine the effectiveness of the Knowledge Identification method.*

12. What would you say are the strengths and weaknesses of <method A>?
13. Would you have done it differently?
14. How would you improve <method A>?

15. What do you personally do?

*State a technique from survey or pick one mentioned during the interview to discuss further.*

16. Are there any other methods that employees at <organisation name> use?

*Allows for comparison between the methods identified in the survey (together with the ones declared as "most effective") to the methods "usually" used, given here.*

*Discuss Knowledge Identification methods in general and investigate factors influencing the effectiveness of Knowledge Identification methods.*

*Determine what factors prevent these methods from working effectively?*

*Determine what interviewee thinks is problematic.*

Looking at these methods of finding who knows what in general,

17. What do you dislike or feel is missing in these methods? Could you give me an example?
18. Is there anything that you particularly perceive is problematic in these methods? Could you give me an example?
19. If you were to have a better method, what would it be?
20. If you could change anything in your organisation (not just the method), what would you change to improve the effectiveness of methods of finding who knows what?

*Close (maintaining rapport).*

*Summarise.*

This has been valuable, <salutation>.  I should have all the information I need, but would it be alright to contact you if I have any more questions?

Do you know anyone who you think would be interested in this area of research?

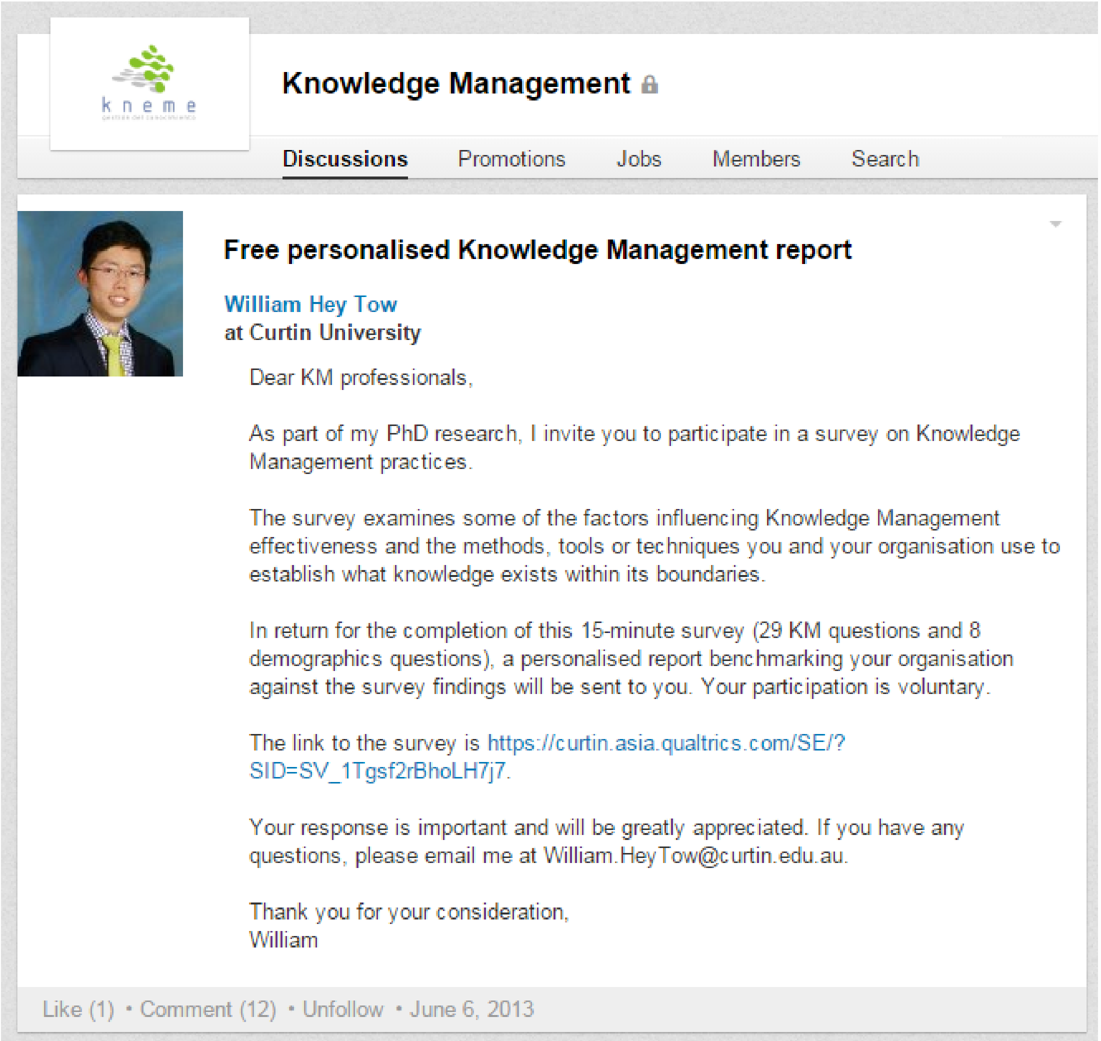
Also, would it be all right by you to approach some of the employees at Toowoomba <organisation name> to discuss the methods finding who knows what? I would like to obtain the views of employees in different roles in the organisation.

Thanks again.

I appreciate the time you took for this interview.

# Appendix C. Phase three: Theory-Testing Survey

Examples of invitations and reminders posted on LinkedIn are shown below.



kneme

**Knowledge Management**

Discussions | Promotions | Jobs | Members | Search

**Free personalised Knowledge Management report**

**William Hey Tow**
**at Curtin University**

Dear KM professionals,

As part of my PhD research, I invite you to participate in a survey on Knowledge Management practices.

The survey examines some of the factors influencing Knowledge Management effectiveness and the methods, tools or techniques you and your organisation use to establish what knowledge exists within its boundaries.

In return for the completion of this 15-minute survey (29 KM questions and 8 demographics questions), a personalised report benchmarking your organisation against the survey findings will be sent to you. Your participation is voluntary.

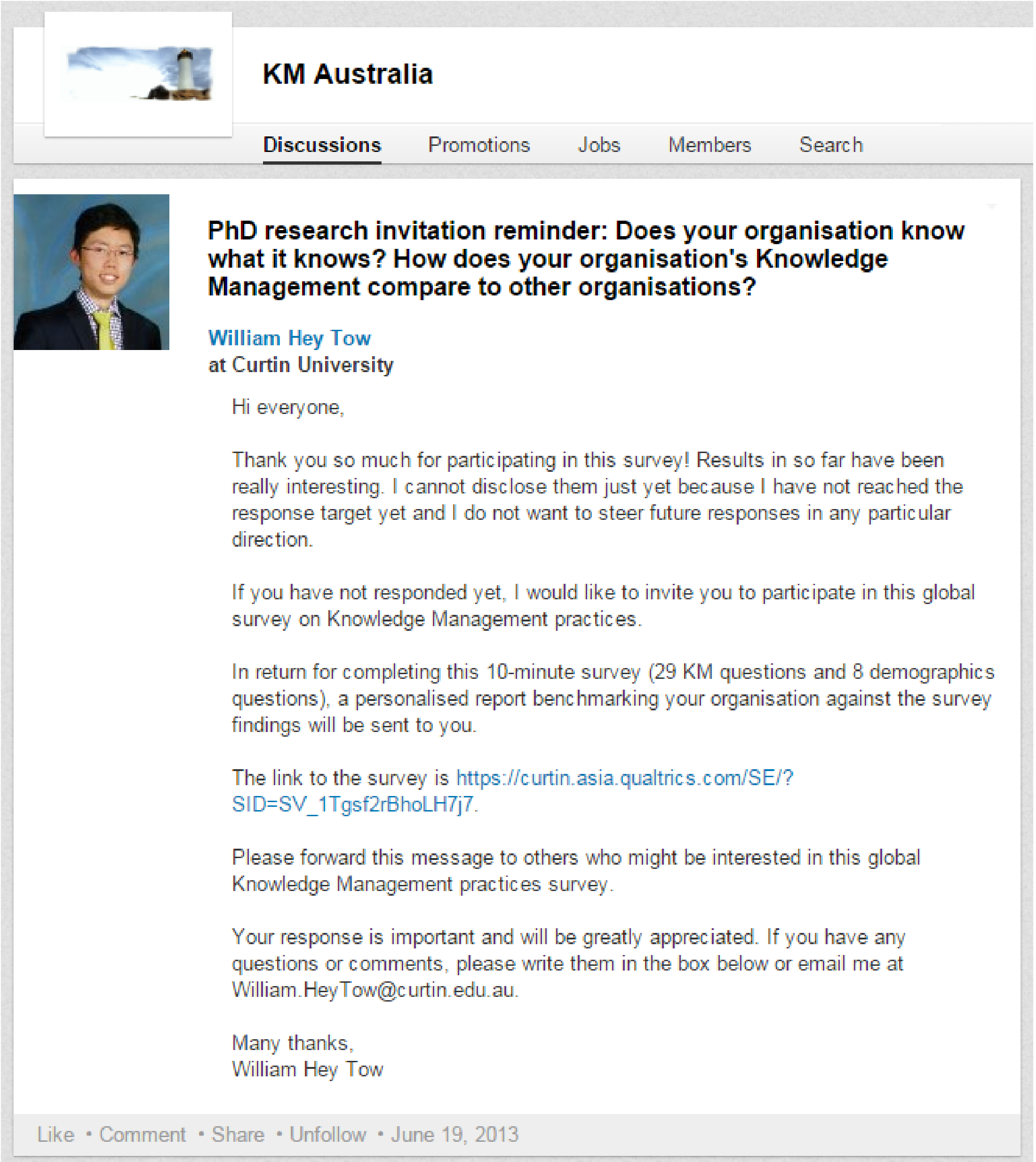
The link to the survey is https://curtin.asia.qualtrics.com/SE/?SID=SV_1Tgsf2rBhoLH7j7.

Your response is important and will be greatly appreciated. If you have any questions, please email me at William.HeyTow@curtin.edu.au.

Thank you for your consideration,
William

Like (1) • Comment (12) • Unfollow • June 6, 2013

**FIGURE APPENDIX C 1 EXAMPLE OF SURVEY INVITATION POSTED ON LINKEDIN.**



KM Australia

Discussions Promotions Jobs Members Search

**PhD research invitation reminder: Does your organisation know what it knows? How does your organisation's Knowledge Management compare to other organisations?**

William Hey Tow
at Curtin University

Hi everyone,

Thank you so much for participating in this survey! Results in so far have been really interesting. I cannot disclose them just yet because I have not reached the response target yet and I do not want to steer future responses in any particular direction.

If you have not responded yet, I would like to invite you to participate in this global survey on Knowledge Management practices.

In return for completing this 10-minute survey (29 KM questions and 8 demographics questions), a personalised report benchmarking your organisation against the survey findings will be sent to you.

The link to the survey is https://curtin.asia.qualtrics.com/SE/?SID=SV_1Tgsf2rBhoLH7j7.

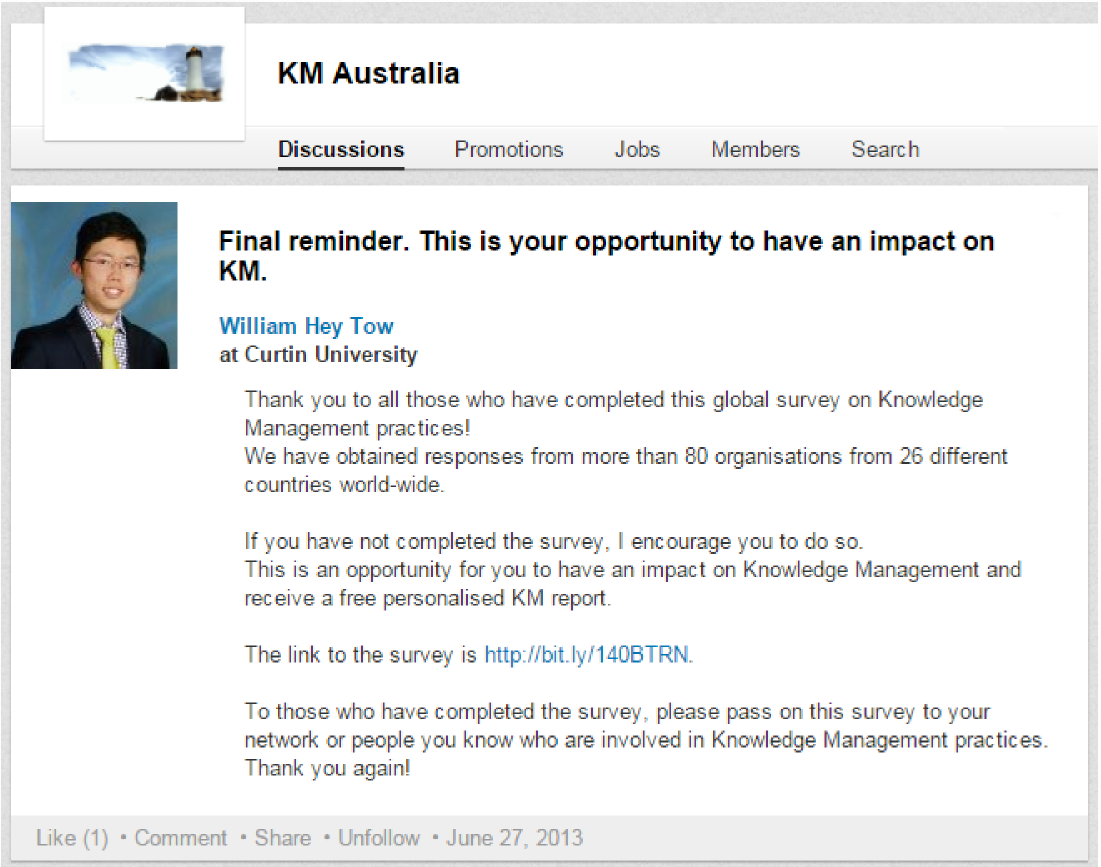
Please forward this message to others who might be interested in this global Knowledge Management practices survey.

Your response is important and will be greatly appreciated. If you have any questions or comments, please write them in the box below or email me at William.HeyTow@curtin.edu.au.

Many thanks,
William Hey Tow

Like • Comment • Share • Unfollow • June 19, 2013

Figure Appendix C 2 Example of survey reminder posted on LinkedIn.


KM Australia

Discussions Promotions Jobs Members Search

**Final reminder. This is your opportunity to have an impact on KM.**

William Hey Tow
at Curtin University

Thank you to all those who have completed this global survey on Knowledge Management practices!
We have obtained responses from more than 80 organisations from 26 different countries world-wide.

If you have not completed the survey, I encourage you to do so.
This is an opportunity for you to have an impact on Knowledge Management and receive a free personalised KM report.

The link to the survey is http://bit.ly/140BTRN.

To those who have completed the survey, please pass on this survey to your network or people you know who are involved in Knowledge Management practices.
Thank you again!

Like (1) • Comment • Share • Unfollow • June 27, 2013

**FIGURE APPENDIX C 3 EXAMPLE OF FINAL SURVEY REMINDER POSTED ON LINKEDIN.**

**Landing page of the primary survey**

(URL #1)

Thank you for your interest in this study.

**Purpose of Study**

You are invited to participate in a worldwide survey on Knowledge Management practices. The survey examines some of the factors influencing Knowledge Management effectiveness and the methods, tools or techniques you and your organisation use to establish what knowledge exists within its boundaries. The survey should take less than 10 minutes to complete.

In return for completing the survey, a personalised report benchmarking your organisation against the survey findings will be sent to you. Your participation is completely voluntary and you may withdraw your participation at any time.

**Further Information**

Your responses will be de-identified. Nothing identifying you or your organisation will be published. If you have any concerns about the survey, please contact me at William.HeyTow@curtin.edu.au.

This study is supervised by Associate Professors John Venable and Peter Dell. They can be contacted at J.Venable@curtin.edu.au and P.T.Dell@curtin.edu.au. This study has been approved by the Curtin University Human Research Ethics Committee (Approval Number IS_13_09). Verification of approval can be obtained either by writing to the Curtin University Human Research Ethics Committee, c/- Office of Research and Development, Curtin University, GPO Box U1987, Perth, 6845, by telephoning 9266 2784 or by email to hrec@curtin.edu.au.

Please click 'Next' to start the survey.

**Example of an email drafted for respondents of the survey to invite other participants with overall KM responsibility.**

Subject: Knowledge Management

Body: Greetings,

I am passing this on to you because I think you have overall Knowledge Management responsibility for our organisation. I would like to encourage you to complete the survey described below because I think it would be valuable to our organisation.

William Hey Tow, a researcher at Curtin University is inviting us to participate in a worldwide survey on Knowledge Management practices. In return for the completion of the 15-minute survey, a personalised report benchmarking our organisation against the survey findings will be provided. To complete the survey, please go to https://curtin.asia.qualtrics.com/SE/?SID=SV_1Tgsf2rBhoLH7j7.

If you have any questions about the survey, please email William (copied on this email).

Regards

**Example of an email drafted for respondents of the survey to invite other participants without overall KM responsibility.**

Subject: Knowledge Management

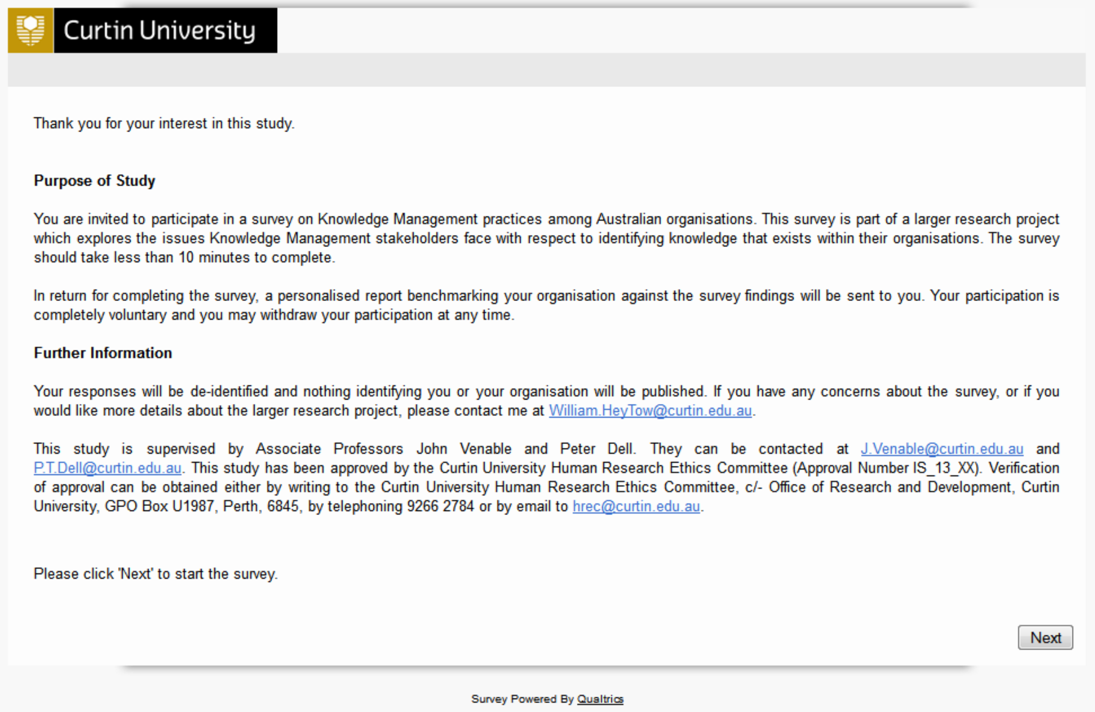
Body: Greetings,

I am passing this on to you because I think you have had relevant experience of Knowledge Management practices at our organisation.

William Hey Tow, a researcher at Curtin University is inviting us to participate in a worldwide survey on Knowledge Management practices. The survey should take less than 10 minutes to complete. Please complete the survey at https://curtin.asia.qualtrics.com/SE/?SID=SV_723S469fw9Icf8F.

If you have any questions about the survey, please email William (copied on this email).

Regards



Curtin University

Thank you for your interest in this study.

**Purpose of Study**

You are invited to participate in a survey on Knowledge Management practices among Australian organisations. This survey is part of a larger research project which explores the issues Knowledge Management stakeholders face with respect to identifying knowledge that exists within their organisations. The survey should take less than 10 minutes to complete.

In return for completing the survey, a personalised report benchmarking your organisation against the survey findings will be sent to you. Your participation is completely voluntary and you may withdraw your participation at any time.

**Further Information**

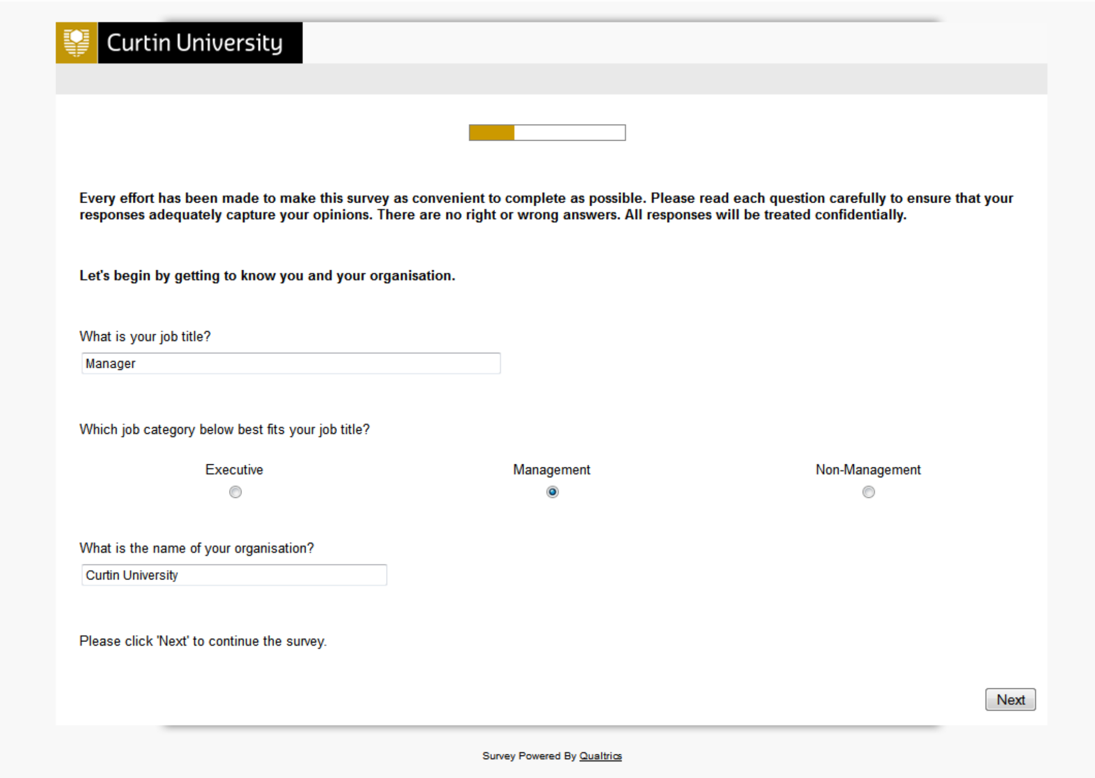
Your responses will be de-identified and nothing identifying you or your organisation will be published. If you have any concerns about the survey, or if you would like more details about the larger research project, please contact me at William.HeyTow@curtin.edu.au.

This study is supervised by Associate Professors John Venable and Peter Dell. They can be contacted at J.Venable@curtin.edu.au and P.T.Dell@curtin.edu.au. This study has been approved by the Curtin University Human Research Ethics Committee (Approval Number IS_13_XX). Verification of approval can be obtained either by writing to the Curtin University Human Research Ethics Committee, c/- Office of Research and Development, Curtin University, GPO Box U1987, Perth, 6845, by telephoning 9266 2784 or by email to hrec@curtin.edu.au.

Please click 'Next' to start the survey.

Next

Survey Powered By Qualtrics



Curtin University

**Every effort has been made to make this survey as convenient to complete as possible. Please read each question carefully to ensure that your responses adequately capture your opinions. There are no right or wrong answers. All responses will be treated confidentially.**

**Let's begin by getting to know you and your organisation.**

What is your job title?

Manager

Which job category below best fits your job title?

Executive　Management　Non-Management

What is the name of your organisation?

Curtin University

Please click 'Next' to continue the survey.

Next

Survey Powered By Qualtrics

**Branches out to Management or Non-Management set of questions.**

**Management set of questions**

Curtin University

How long have you been employed at Curtin University?

4 years

Approximately how many people (including volunteers) are employed at Curtin University?

5000

**In this survey, knowledge refers to facts, information and skills that are relevant to organisation performance.**

Are you responsible for the overall Knowledge Management practices at Curtin University?

◉ Yes

○ No

**On a 0 to 10 scale from 'Completely disagree' to 'Completely agree', please indicate the extent to which you agree or disagree with the following statements:**

**It is easy for members of Curtin University to obtain permission to access:**

| | Completely disagree 0 | 1 | 2 | 3 | 4 | Neutral 5 | 6 | 7 | 8 | 9 | Completely agree 10 | Unable to judge |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| knowledge that Curtin University has. | ○ | ○ | ○ | ○ | ○ | ◉ | ○ | ○ | ○ | ○ | ○ | ○ |
| other members of Curtin University. | ○ | ○ | ○ | ○ | ○ | ◉ | ○ | ○ | ○ | ○ | ○ | ○ |
| knowledge stored in Curtin University's knowledge repositories. | ○ | ○ | ○ | ○ | ○ | ◉ | ○ | ○ | ○ | ○ | ○ | ○ |
| corporate financial information. | | | | | | | | | ○ | ○ | ○ | ○ |

Knowledge repositories refer to places where recorded knowledge is stored (e.g. documents, databases, document management systems, or social networking systems).

**Members of Curtin University:**

| | Completely disagree 0 | 1 | 2 | 3 | 4 | Neutral 5 | 6 | 7 | 8 | 9 | Completely agree 10 | Unable to judge |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| record what they know in knowledge repositories. | ○ | ○ | ○ | ○ | ○ | ◉ | ○ | ○ | ○ | ○ | ○ | ○ |
| are willing to record what they know in knowledge repositories. | ○ | ○ | ○ | ○ | ○ | ◉ | ○ | ○ | ○ | ○ | ○ | ○ |
| know what to record in knowledge repositories. | ○ | ○ | ○ | ○ | ○ | ◉ | ○ | ○ | ○ | ○ | ○ | ○ |

**Curtin University has explicitly established:**

| | Completely disagree 0 | 1 | 2 | 3 | 4 | Neutral 5 | 6 | 7 | 8 | 9 | Completely agree 10 | Unable to judge |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| what relevant knowledge it has within its boundaries. | ○ | ○ | ○ | ○ | ○ | ◉ | ○ | ○ | ○ | ○ | ○ | ○ |
| what relevant knowledge its members have. | ○ | ○ | ○ | ○ | ○ | ◉ | ○ | ○ | ○ | ○ | ○ | ○ |
| which knowledge has high priority or low priority for its organisation performance. | ○ | ○ | ○ | ○ | ○ | ◉ | ○ | ○ | ○ | ○ | ○ | ○ |
| its knowledge gaps (knowledge that Curtin University or its members need but do not have). | ○ | ○ | ○ | ○ | ○ | ◉ | ○ | ○ | ○ | ○ | ○ | ○ |

**With respect to Curtin University:**

| | Completely disagree 0 | 1 | 2 | 3 | 4 | Neutral 5 | 6 | 7 | 8 | 9 | Completely agree 10 | Unable to judge |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Curtin University promotes a knowledge-sharing culture among its members. | ○ | ○ | ○ | ○ | ○ | ◉ | ○ | ○ | ○ | ○ | ○ | ○ |
| Technology effectively supports members of Curtin University to share their knowledge. | ○ | ○ | ○ | ○ | ○ | ◉ | ○ | ○ | ○ | ○ | ○ | ○ |

**You have completed half of the survey questions.** Please click 'Next' to continue the survey.

Next

Survey Powered By Qualtrics

Curtin University

Your responses are important. Please take a moment to read each question carefully.

Thinking of knowledge that members of Curtin University use to do their job, please indicate the extent to which you agree or disagree with the following statements:

| | Completely disagree 0 | 1 | 2 | 3 | 4 | Neutral 5 | 6 | 7 | 8 | 9 | Completely agree 10 | Unable to judge |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Members of Curtin University have the knowledge they need to do their job. | ○ | ○ | ○ | ○ | ○ | ◉ | ○ | ○ | ○ | ○ | ○ | ○ |
| Members of Curtin University would still have the knowledge they need to do their job, even if some members retired or left. | ○ | ○ | ○ | ○ | ○ | ◉ | ○ | ○ | ○ | ○ | ○ | ○ |

If members do NOT have knowledge they need to do their job,

| | Completely disagree 0 | 1 | 2 | 3 | 4 | Neutral 5 | 6 | 7 | 8 | 9 | Completely agree 10 | Unable to judge |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| they can obtain it. | ○ | ○ | ○ | ○ | ○ | ◉ | ○ | ○ | ○ | ○ | ○ | ○ |
| they can obtain it when they need it. | ○ | ○ | ○ | ○ | ○ | ◉ | ○ | ○ | ○ | ○ | ○ | ○ |
| they can obtain it in the form they need it (e.g., in the form of a document containing the needed knowledge or a colleague who has the needed knowledge). | ○ | ○ | ○ | ○ | ○ | ◉ | ○ | ○ | ○ | ○ | ○ | ○ |

Curtin University has determined:

| | Completely disagree 0 | 1 | 2 | 3 | 4 | Neutral 5 | 6 | 7 | 8 | 9 | Completely agree 10 | Unable to judge |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| the knowledge that it needs for organisation performance. | ○ | ○ | ○ | ○ | ○ | ◉ | ○ | ○ | ○ | ○ | ○ | ○ |
| the knowledge that its members need to do their job. | ○ | ○ | ○ | ○ | ○ | ◉ | ○ | ○ | ○ | ○ | ○ | ○ |
| the relative importance of the different knowledge it needs for organisation performance. | ○ | ○ | ○ | ○ | ○ | ◉ | ○ | ○ | ○ | ○ | ○ | ○ |
| the legal regulations it needs to comply with. | ○ | ○ | ○ | ○ | ○ | ◉ | ○ | ○ | ○ | ○ | ○ | ○ |

With respect to identifying knowledge that exists within Curtin University:

| | Completely disagree 0 | 1 | 2 | 3 | 4 | Neutral 5 | 6 | 7 | 8 | 9 | Completely agree 10 | Unable to judge |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Curtin University does NOT take formal steps to identify knowledge that exists within its boundaries. | ○ | ○ | ○ | ○ | ○ | ◉ | ○ | ○ | ○ | ○ | ○ | ○ |
| Curtin University does NOT allocate sufficient resources to identify knowledge that exists within its boundaries. | ○ | ○ | ○ | ○ | ○ | ◉ | ○ | ○ | ○ | ○ | ○ | ○ |
| The practice of identifying what knowledge exists within the organisation boundaries is NOT important at Curtin University. | ○ | ○ | ○ | ○ | ○ | ◉ | ○ | ○ | ○ | ○ | ○ | ○ |

Please click 'Next' to answer the final survey questions.

Back Next

Survey Powered By Qualtrics

Curtin University

Being aware of what knowledge the organisation has is one of the first things an organisation achieves in practising effective knowledge management. For example, prior to establishing communities of practice, organisations first identify who within the organisation has relevant and needed knowledge, and who needs that knowledge.

**Organisations may use various methods, tools or techniques to do so. Please select which of the methods below Curtin University uses to identify the knowledge it has.**

- [ ] Survey all members (via questionnaires or interviews)
- [x] Apply semantic analysis on knowledge repositories
- [x] Apply organisation network analysis (finding out who knows whom)
- [ ] Draw knowledge maps (mapping out knowledge flows in the organisation)
- [ ] Word of mouth (e.g. meeting with local management and HR representatives to compile a list of candidates)
- [ ] Observation
- [ ] Expert locators or expert finding systems (self-reported knowledge)
- [ ] Other

**Referring to the methods, tools or techniques that you selected above, please indicate the extent to which you agree or disagree with the following statements:**

**The methods, tools or techniques that Curtin University uses to establish:**

| | Completely disagree 0 | 1 | 2 | 3 | 4 | Neutral 5 | 6 | 7 | 8 | 9 | Completely agree 10 | Unable to judge |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| whether needed knowledge exists within the organisation work well. | ○ | ○ | ○ | ○ | ○ | ● | ○ | ○ | ○ | ○ | ○ | ○ |
| who knows what within the organisation work well. | ○ | ○ | ○ | ○ | ○ | ● | ○ | ○ | ○ | ○ | ○ | ○ |
| where to find needed knowledge work well. | ○ | ○ | ○ | ○ | ○ | ● | ○ | ○ | ○ | ○ | ○ | ○ |

**Please use the box below to share any thoughts or comments you may have on Knowledge Management practices or on the survey questions.**

**If you would like to be contacted to discuss the survey or your comments above, please also enter your name and e-mail address below and I will be in touch shortly.**

| | |
|---|---|
| Name | William |
| E-mail | william@curtin.edu.au |

**Please click 'Next' for information on the findings report.**

Back Next

Survey Powered By Qualtrics

Curtin University

Thank you for your responses. You are entitled to receive a personalised report benchmarking Curtin University against the survey findings.

**In order to provide you with a fully informative and representative report, we also need to survey a few non-management members of Curtin University.** I suggest the participation of 5 or more non-management members.

Please click here to invite members.

Will you invite other members of Curtin University to participate in the survey?

- (●) Yes
- ( ) No

**William, thank you for your responses.** Your report will be sent via the e-mail address you provided.

Back Submit responses

Survey Powered By Qualtrics

## Non-Management set of questions

Curtin University

Every effort has been made to make this survey as convenient to complete as possible. Please read each question carefully to ensure that your responses adequately capture your opinions. There are no right or wrong answers. All responses will be treated confidentially.

**Let's begin by getting to know you and your organisation.**

What is your job title?

Non-manager

Which job category below best fits your job title?

Executive | Management | Non-Management

What is the name of your organisation?

Curtin University

Please click 'Next' to continue the survey.

Next

Survey Powered By Qualtrics

Curtin University

How long have you been employed at Curtin University?

5 years

**In this survey, knowledge refers to facts, information and skills that are relevant to organisation performance.**

Are you responsible for the overall Knowledge Management practices at Curtin University?

- Yes
- No

**On a 0 to 10 scale from 'Completely disagree' to 'Completely agree', please indicate the extent to which you agree or disagree with the following statements:**

| | Completely disagree 0 | 1 | 2 | 3 | 4 | Neutral 5 | 6 | 7 | 8 | 9 | Completely agree 10 | Unable to judge |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| My organisation promotes a knowledge-sharing culture among its members. | | | | | | | | | | | | |
| Technology effectively supports me to share my knowledge. | | | | | | | | | | | | |

**It is easy for me to determine:**

| | Completely disagree 0 | 1 | 2 | 3 | 4 | Neutral 5 | 6 | 7 | 8 | 9 | Completely agree 10 | Unable to judge |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| whether the knowledge I need is available somewhere in my organisation. | | | | | | | | | | | | |
| who has knowledge I need to do my job. | | | | | | | | | | | | |
| where to find the knowledge I need to do my job. | | | | | | | | | | | | |

**I don't need permission or it is easy for me to obtain permission to access:**

| | Completely disagree 0 | 1 | 2 | 3 | 4 | Neutral 5 | 6 | 7 | 8 | 9 | Completely agree 10 | Unable to judge |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| knowledge that my organisation has. | | | | | | | | | | | | |
| other members of my organisation. | | | | | | | | | | | | |
| knowledge stored in knowledge repositories. | | | | | | | | | | | | |

Knowledge repositories refer to places where recorded knowledge is stored (e.g. documents, databases, document management systems, or social networking systems).

**You have completed half of the survey questions. Please click 'Next' to continue the survey.**

Next

Survey Powered By Qualtrics

Curtin University

**Thinking of knowledge you use to do your job, please indicate the extent to which you agree or disagree with the following statements:**

| | Completely disagree 0 | 1 | 2 | 3 | 4 | Neutral 5 | 6 | 7 | 8 | 9 | Completely agree 10 | Unable to judge |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| I know all I need to do my job. | | | | | | | | | | | | |
| I have all the skills I need to do my job well. | | | | | | | | | | | | |
| I am highly skilled at doing my job. | | | | | | | | | | | | |

| | Completely disagree 0 | 1 | 2 | 3 | 4 | Neutral 5 | 6 | 7 | 8 | 9 | Completely agree 10 | Unable to judge |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| If I do not have knowledge I need, I can obtain it. | | | | | | | | | | | | |
| I can obtain knowledge I need when I need it. | | | | | | | | | | | | |
| I know of knowledge that I wish I could get to do my job better. | | | | | | | | | | | | |

**Regarding Curtin University's knowledge repositories:**

Knowledge repositories refer to places where recorded knowledge is stored (e.g. documents, databases, document management systems, or social networking systems).

| | Completely ... | | | | | | | | 8 | 9 | Completely agree 10 | Unable to judge |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| I know what I am supposed to record in knowledge repositories. | | | | | | | | | | | | |
| I am willing to record what I know in knowledge repositories. | | | | | | | | | | | | |
| I record what I am supposed to record in knowledge repositories. | | | | | | | | | | | | |

**Please use the box below to share any thoughts or comments you may have on Knowledge Management practices or on the survey questions.**

**If you would like me to follow-up with you on the above, please also enter your name and e-mail address details below.**

| | |
|---|---|
| Name | William |
| E-mail | william@curtin.edu.au |

**Please click 'Next' for information on the findings report.**

Back Next

Survey Powered By Qualtrics

Curtin University

Thank you for your responses. You are entitled to receive a personalised report benchmarking Curtin University against the survey findings.

**In order to provide you with a fully informative and representative report, we also need to survey more members of Curtin University.** I suggest the participation of 5 or more non-management members.

Please click here to invite members.

Will you invite other members of Curtin University to participate in the survey?

- Yes
- No

Thank you for your responses. Your report will be sent to the e-mail address you provided.

Back Submit responses

Survey Powered By Qualtrics

# Appendix D. Results from EFA

#### Appendix D - 1 Skewness and Kurtosis check for the 'Responsible-for-KM' questionnaire.

**Descriptives**

| | | | Statistic | Std. Error |
|---|---|---|---|---|
| Employees can access knowledge that the organisation has. | Mean | | 8.00 | .307 |
| | 95% Confidence Interval for Mean | Lower Bound | 7.39 | |
| | | Upper Bound | 8.61 | |
| | 5% Trimmed Mean | | 8.18 | |
| | Median | | 9.00 | |
| | Variance | | 7.650 | |
| | Std. Deviation | | 2.766 | |
| | Minimum | | 1 | |
| | Maximum | | 11 | |
| | Range | | 10 | |
| | Interquartile Range | | 4 | |
| | Skewness | | -.661 | .267 |
| | Kurtosis | | -.632 | .529 |
| Employees can access other employees in the organisation. | Mean | | 8.20 | .295 |
| | 95% Confidence Interval for Mean | Lower Bound | 7.61 | |
| | | Upper Bound | 8.78 | |
| | 5% Trimmed Mean | | 8.39 | |
| | Median | | 9.00 | |
| | Variance | | 7.035 | |
| | Std. Deviation | | 2.652 | |
| | Minimum | | 2 | |
| | Maximum | | 11 | |
| | Range | | 9 | |
| | Interquartile Range | | 3 | |
| | Skewness | | -.948 | .267 |
| | Kurtosis | | -.084 | .529 |
| Employees can access the knowledge repositories of the organisation. | Mean | | 8.65 | .257 |
| | 95% Confidence Interval for Mean | Lower Bound | 8.14 | |
| | | Upper Bound | 9.17 | |
| | 5% Trimmed Mean | | 8.89 | |
| | Median | | 9.00 | |
| | Variance | | 5.354 | |
| | Std. Deviation | | 2.314 | |

| | | | | |
|---|---|---|---|---|
| | Minimum | | 1 | |
| | Maximum | | 11 | |
| | Range | | 10 | |
| | Interquartile Range | | 4 | |
| | Skewness | | -1.292 | .267 |
| | Kurtosis | | 1.785 | .529 |
| Employees can access corporate financial information. | Mean | | 6.43 | .332 |
| | 95% Confidence Interval for Mean | Lower Bound | 5.77 | |
| | | Upper Bound | 7.09 | |
| | 5% Trimmed Mean | | 6.48 | |
| | Median | | 7.00 | |
| | Variance | | 8.948 | |
| | Std. Deviation | | 2.991 | |
| | Minimum | | 1 | |
| | Maximum | | 11 | |
| | Range | | 10 | |
| | Interquartile Range | | 5 | |
| | Skewness | | -.146 | .267 |
| | Kurtosis | | -1.014 | .529 |
| Employees record what they know. | Mean | | 6.07 | .292 |
| | 95% Confidence Interval for Mean | Lower Bound | 5.49 | |
| | | Upper Bound | 6.66 | |
| | 5% Trimmed Mean | | 6.08 | |
| | Median | | 7.00 | |
| | Variance | | 6.919 | |
| | Std. Deviation | | 2.630 | |
| | Minimum | | 1 | |
| | Maximum | | 11 | |
| | Range | | 10 | |
| | Interquartile Range | | 4 | |
| | Skewness | | -.112 | .267 |
| | Kurtosis | | -.807 | .529 |
| Employees are willing to record what they know. | Mean | | 6.53 | .292 |
| | 95% Confidence Interval for Mean | Lower Bound | 5.95 | |
| | | Upper Bound | 7.11 | |
| | 5% Trimmed Mean | | 6.58 | |
| | Median | | 7.00 | |
| | Variance | | 6.927 | |
| | Std. Deviation | | 2.632 | |
| | Minimum | | 1 | |
| | Maximum | | 11 | |

| | | | | |
|---|---|---|---|---|
| | Range | | 10 | |
| | Interquartile Range | | 4 | |
| | Skewness | | -.177 | .267 |
| | Kurtosis | | -.730 | .529 |
| Employees know what to record in knowledge repositories. | Mean | | 6.25 | .309 |
| | 95% Confidence Interval for Mean | Lower Bound | 5.63 | |
| | | Upper Bound | 6.86 | |
| | 5% Trimmed Mean | | 6.27 | |
| | Median | | 6.00 | |
| | Variance | | 7.738 | |
| | Std. Deviation | | 2.782 | |
| | Minimum | | 1 | |
| | Maximum | | 11 | |
| | Range | | 10 | |
| | Interquartile Range | | 5 | |
| | Skewness | | -.105 | .267 |
| | Kurtosis | | -.892 | .529 |
| Organisation has established what relevant knowledge it has. | Mean | | 6.41 | .336 |
| | 95% Confidence Interval for Mean | Lower Bound | 5.74 | |
| | | Upper Bound | 7.08 | |
| | 5% Trimmed Mean | | 6.45 | |
| | Median | | 7.00 | |
| | Variance | | 9.169 | |
| | Std. Deviation | | 3.028 | |
| | Minimum | | 1 | |
| | Maximum | | 11 | |
| | Range | | 10 | |
| | Interquartile Range | | 5 | |
| | Skewness | | -.260 | .267 |
| | Kurtosis | | -.961 | .529 |
| Organisation has established what relevant knowledge its members have. | Mean | | 6.30 | .335 |
| | 95% Confidence Interval for Mean | Lower Bound | 5.63 | |
| | | Upper Bound | 6.96 | |
| | 5% Trimmed Mean | | 6.33 | |
| | Median | | 7.00 | |
| | Variance | | 9.111 | |
| | Std. Deviation | | 3.018 | |
| | Minimum | | 1 | |
| | Maximum | | 11 | |
| | Range | | 10 | |
| | Interquartile Range | | 5 | |

| | | | | |
|---|---|---|---|---|
| | Skewness | | -.247 | .267 |
| | Kurtosis | | -1.033 | .529 |
| Organisation has established which knowledge has high priority or low priority. | Mean | | 6.53 | .334 |
| | 95% Confidence Interval for Mean | Lower Bound | 5.87 | |
| | | Upper Bound | 7.20 | |
| | 5% Trimmed Mean | | 6.59 | |
| | Median | | 7.00 | |
| | Variance | | 9.027 | |
| | Std. Deviation | | 3.005 | |
| | Minimum | | 1 | |
| | Maximum | | 11 | |
| | Range | | 10 | |
| | Interquartile Range | | 5 | |
| | Skewness | | -.226 | .267 |
| | Kurtosis | | -1.038 | .529 |
| Organisation has established its knowledge gaps. | Mean | | 6.00 | .320 |
| | 95% Confidence Interval for Mean | Lower Bound | 5.36 | |
| | | Upper Bound | 6.64 | |
| | 5% Trimmed Mean | | 6.00 | |
| | Median | | 6.00 | |
| | Variance | | 8.300 | |
| | Std. Deviation | | 2.881 | |
| | Minimum | | 1 | |
| | Maximum | | 11 | |
| | Range | | 10 | |
| | Interquartile Range | | 4 | |
| | Skewness | | .032 | .267 |
| | Kurtosis | | -.888 | .529 |
| Organisation promotes a knowledge-sharing culture. | Mean | | 7.75 | .311 |
| | 95% Confidence Interval for Mean | Lower Bound | 7.13 | |
| | | Upper Bound | 8.37 | |
| | 5% Trimmed Mean | | 7.95 | |
| | Median | | 8.00 | |
| | Variance | | 7.838 | |
| | Std. Deviation | | 2.800 | |
| | Minimum | | 1 | |
| | Maximum | | 11 | |
| | Range | | 10 | |
| | Interquartile Range | | 4 | |
| | Skewness | | -.815 | .267 |
| | Kurtosis | | .136 | .529 |

| | | | | |
|---|---|---|---|---|
| Technology effectively supports employees to share their knowledge. | Mean | | 7.79 | .294 |
| | 95% Confidence Interval for Mean | Lower Bound | 7.21 | |
| | | Upper Bound | 8.37 | |
| | 5% Trimmed Mean | | 7.99 | |
| | Median | | 8.00 | |
| | Variance | | 6.993 | |
| | Std. Deviation | | 2.644 | |
| | Minimum | | 1 | |
| | Maximum | | 11 | |
| | Range | | 10 | |
| | Interquartile Range | | 4 | |
| | Skewness | | -.823 | .267 |
| | Kurtosis | | .202 | .529 |
| Employees have the knowledge they need to do their job. | Mean | | 7.98 | .217 |
| | 95% Confidence Interval for Mean | Lower Bound | 7.54 | |
| | | Upper Bound | 8.41 | |
| | 5% Trimmed Mean | | 8.06 | |
| | Median | | 8.00 | |
| | Variance | | 3.824 | |
| | Std. Deviation | | 1.956 | |
| | Minimum | | 3 | |
| | Maximum | | 11 | |
| | Range | | 8 | |
| | Interquartile Range | | 2 | |
| | Skewness | | -.489 | .267 |
| | Kurtosis | | .069 | .529 |
| Employees would still have the knowledge they need to do their job, even if some members retired or left. | Mean | | 6.67 | .266 |
| | 95% Confidence Interval for Mean | Lower Bound | 6.14 | |
| | | Upper Bound | 7.20 | |
| | 5% Trimmed Mean | | 6.69 | |
| | Median | | 7.00 | |
| | Variance | | 5.725 | |
| | Std. Deviation | | 2.393 | |
| | Minimum | | 2 | |
| | Maximum | | 11 | |
| | Range | | 9 | |
| | Interquartile Range | | 3 | |
| | Skewness | | -.183 | .267 |
| | Kurtosis | | -.755 | .529 |
| If employees do not have knowledge they need, they | Mean | | 7.64 | .240 |
| | 95% Confidence Interval for | Lower Bound | 7.16 | |

| | | | | |
|---|---|---|---|---|
| can obtain it. | Mean | Upper Bound | 8.12 | |
| | 5% Trimmed Mean | | 7.74 | |
| | Median | | 8.00 | |
| | Variance | | 4.683 | |
| | Std. Deviation | | 2.164 | |
| | Minimum | | 2 | |
| | Maximum | | 11 | |
| | Range | | 9 | |
| | Interquartile Range | | 2 | |
| | Skewness | | -.608 | .267 |
| | Kurtosis | | .214 | .529 |
| If employees do not have knowledge they need, they can obtain it when they need it. | Mean | | 7.32 | .236 |
| | 95% Confidence Interval for Mean | Lower Bound | 6.85 | |
| | | Upper Bound | 7.79 | |
| | 5% Trimmed Mean | | 7.40 | |
| | Median | | 7.00 | |
| | Variance | | 4.496 | |
| | Std. Deviation | | 2.120 | |
| | Minimum | | 1 | |
| | Maximum | | 11 | |
| | Range | | 10 | |
| | Interquartile Range | | 3 | |
| | Skewness | | -.580 | .267 |
| | Kurtosis | | .198 | .529 |
| If employees do not have knowledge they need, they can obtain it in the form they need it. | Mean | | 7.12 | .255 |
| | 95% Confidence Interval for Mean | Lower Bound | 6.62 | |
| | | Upper Bound | 7.63 | |
| | 5% Trimmed Mean | | 7.17 | |
| | Median | | 7.00 | |
| | Variance | | 5.260 | |
| | Std. Deviation | | 2.293 | |
| | Minimum | | 2 | |
| | Maximum | | 11 | |
| | Range | | 9 | |
| | Interquartile Range | | 3 | |
| | Skewness | | -.359 | .267 |
| | Kurtosis | | -.557 | .529 |
| Organisation has determined the knowledge it needs. | Mean | | 7.11 | .302 |
| | 95% Confidence Interval for Mean | Lower Bound | 6.51 | |
| | | Upper Bound | 7.71 | |
| | 5% Trimmed Mean | | 7.23 | |

| | | | | |
|---|---|---|---|---|
| | Median | | 7.00 | |
| | Variance | | 7.375 | |
| | Std. Deviation | | 2.716 | |
| | Minimum | | 1 | |
| | Maximum | | 11 | |
| | Range | | 10 | |
| | Interquartile Range | | 4 | |
| | Skewness | | -.362 | .267 |
| | Kurtosis | | -.412 | .529 |
| Organisation has determined the knowledge its members need. | Mean | | 7.42 | .288 |
| | 95% Confidence Interval for Mean | Lower Bound | 6.85 | |
| | | Upper Bound | 7.99 | |
| | 5% Trimmed Mean | | 7.56 | |
| | Median | | 8.00 | |
| | Variance | | 6.722 | |
| | Std. Deviation | | 2.593 | |
| | Minimum | | 1 | |
| | Maximum | | 11 | |
| | Range | | 10 | |
| | Interquartile Range | | 4 | |
| | Skewness | | -.552 | .267 |
| | Kurtosis | | -.151 | .529 |
| Organisation has determined the relative importance of the different knowledge it needs. | Mean | | 7.07 | .321 |
| | 95% Confidence Interval for Mean | Lower Bound | 6.44 | |
| | | Upper Bound | 7.71 | |
| | 5% Trimmed Mean | | 7.19 | |
| | Median | | 8.00 | |
| | Variance | | 8.344 | |
| | Std. Deviation | | 2.889 | |
| | Minimum | | 1 | |
| | Maximum | | 11 | |
| | Range | | 10 | |
| | Interquartile Range | | 5 | |
| | Skewness | | -.452 | .267 |
| | Kurtosis | | -.764 | .529 |
| Organisation has determined the legal regulations it needs to comply with. | Mean | | 8.38 | .267 |
| | 95% Confidence Interval for Mean | Lower Bound | 7.85 | |
| | | Upper Bound | 8.91 | |
| | 5% Trimmed Mean | | 8.55 | |
| | Median | | 9.00 | |
| | Variance | | 5.789 | |

| | | | | |
|---|---|---|---|---|
| | Std. Deviation | | 2.406 | |
| | Minimum | | 1 | |
| | Maximum | | 11 | |
| | Range | | 10 | |
| | Interquartile Range | | 3 | |
| | Skewness | | -.923 | .267 |
| | Kurtosis | | .302 | .529 |
| Organisation takes formal steps to practise KI. | Mean | | 6.95 | .354 |
| | 95% Confidence Interval for Mean | Lower Bound | 6.25 | |
| | | Upper Bound | 7.65 | |
| | 5% Trimmed Mean | | 7.06 | |
| | Median | | 7.00 | |
| | Variance | | 10.123 | |
| | Std. Deviation | | 3.182 | |
| | Minimum | | 1 | |
| | Maximum | | 11 | |
| | Range | | 10 | |
| | Interquartile Range | | 6 | |
| | Skewness | | -.341 | .267 |
| | Kurtosis | | -1.127 | .529 |
| Organisation allocates sufficient resources to practise KI. | Mean | | 6.14 | .354 |
| | 95% Confidence Interval for Mean | Lower Bound | 5.43 | |
| | | Upper Bound | 6.84 | |
| | 5% Trimmed Mean | | 6.15 | |
| | Median | | 6.00 | |
| | Variance | | 10.144 | |
| | Std. Deviation | | 3.185 | |
| | Minimum | | 1 | |
| | Maximum | | 11 | |
| | Range | | 10 | |
| | Interquartile Range | | 6 | |
| | Skewness | | -.098 | .267 |
| | Kurtosis | | -1.329 | .529 |
| Organisation values the practice of KI. | Mean | | 7.91 | .324 |
| | 95% Confidence Interval for Mean | Lower Bound | 7.27 | |
| | | Upper Bound | 8.56 | |
| | 5% Trimmed Mean | | 8.13 | |
| | Median | | 9.00 | |
| | Variance | | 8.505 | |
| | Std. Deviation | | 2.916 | |
| | Minimum | | 1 | |

| | | | | |
|---|---|---|---|---|
| | Maximum | | 11 | |
| | Range | | 10 | |
| | Interquartile Range | | 4 | |
| | Skewness | | -.911 | .267 |
| | Kurtosis | | -.050 | .529 |
| Methods used to find needed knowledge work well. | Mean | | 6.74 | .276 |
| | 95% Confidence Interval for Mean | Lower Bound | 6.19 | |
| | | Upper Bound | 7.29 | |
| | 5% Trimmed Mean | | 6.79 | |
| | Median | | 7.00 | |
| | Variance | | 6.169 | |
| | Std. Deviation | | 2.484 | |
| | Minimum | | 1 | |
| | Maximum | | 11 | |
| | Range | | 10 | |
| | Interquartile Range | | 3 | |
| | Skewness | | -.167 | .267 |
| | Kurtosis | | -.373 | .529 |
| Methods used to find who knows what work well. | Mean | | 6.47 | .274 |
| | 95% Confidence Interval for Mean | Lower Bound | 5.92 | |
| | | Upper Bound | 7.01 | |
| | 5% Trimmed Mean | | 6.49 | |
| | Median | | 6.00 | |
| | Variance | | 6.077 | |
| | Std. Deviation | | 2.465 | |
| | Minimum | | 1 | |
| | Maximum | | 11 | |
| | Range | | 10 | |
| | Interquartile Range | | 3 | |
| | Skewness | | -.139 | .267 |
| | Kurtosis | | -.482 | .529 |
| Methods used to establish whether knowledge needed exists within the organisation work well. | Mean | | 6.62 | .257 |
| | 95% Confidence Interval for Mean | Lower Bound | 6.11 | |
| | | Upper Bound | 7.13 | |
| | 5% Trimmed Mean | | 6.66 | |
| | Median | | 7.00 | |
| | Variance | | 5.339 | |
| | Std. Deviation | | 2.311 | |
| | Minimum | | 1 | |
| | Maximum | | 11 | |

| | | | |
|---|---|---|---|
| | Range | 10 | |
| | Interquartile Range | 3 | |
| | Skewness | -.197 | .267 |
| | Kurtosis | -.088 | .529 |

# Appendix E. EFA and CFA With Six-Factor Model

Appendix E contains the detailed results from the EFA and CFA for a six-factor model. As the results shows, the six-factor model is statistically sound, however, it does not makes theoretical sense.

## Exploratory Factor Analysis

The following indicators were dropped for the six-factor model to work:

KR1 Employees record what they know.

KR2 Employees are willing to record what they know.

KR3 Employees know what to record in knowledge repositories.

KIE1 Organisation has established what relevant knowledge it has.

KIE2 Organisation has established what relevant knowledge its members have.

~~KIE3 Organisation has established which knowledge has high priority or low priority.~~

~~KIE4 Organisation has established its knowledge gaps.~~

~~KME1 Employees have the knowledge they need to do their job.~~

~~KME2 Employees would still have the knowledge they need to do their job, even if some members retired or left.~~

KME3 If employees do not have knowledge they need, they can obtain it.

KME4 If employees do not have knowledge they need, they can obtain it when they need it.

~~KME5 If employees do not have knowledge they need, they can obtain it in the form they need it.~~

KNI1 Organisation has determined the knowledge it needs.

KNI2 Organisation has determined the knowledge its members need.

KNI3 Organisation has determined the relative importance of the different knowledge it needs.

KIO1 Organisation takes formal steps to practise KI.

KIO2 Organisation allocates sufficient resources to practise KI.

~~KIO3 Organisation values the practice of KI.~~

~~KIME1 Methods used to find needed knowledge work well.~~

KIME2 Methods used to find who knows what work well.

KIME3 Methods used to establish whether knowledge needed exists within the organisation work well.

In the KMO and Bartlett's test, a sample adequacy of above 0.60 with a significant p-value was obtained as shown in the table below.

**TABLE APPENDIX E- 1 KMO AND BARTLETT'S TEST.**

| | | |
|---|---|---|
| Kaiser-Meyer-Olkin Measure of Sampling Adequacy. | | .874 |
| Bartlett's Test of Sphericity | Approx. Chi-Square | 1264.910 |
| | df | 91 |
| | Sig. | .000 |

In terms of communalities all items had extraction values greater than 0.3. However, note that the message indicating: "One or more communality estimates greater than 1 were encountered during iterations. The resulting solution should be interpreted with caution." was displayed.

**TABLE APPENDIX E- 2 COMMUNALITIES.**

| | Initial | Extraction |
|---|---|---|
| Employees know what to record in knowledge repositories. | .654 | .653 |
| Organisation has established what relevant knowledge it has. | .906 | .885 |
| Organisation has established what relevant knowledge its members have. | .926 | .999 |
| If employees do not have knowledge they need, they can obtain it. | .778 | .999 |
| If employees do not have knowledge they need, they can obtain it when they need it. | .809 | .775 |
| Organisation has determined the knowledge it needs. | .911 | .933 |
| Organisation has determined the knowledge its members need. | .866 | .906 |
| Organisation has determined the relative importance of the different knowledge it needs. | .831 | .837 |
| Organisation allocates sufficient resources to practise KI. | .799 | .999 |
| Methods used to find who knows what work well. | .838 | .925 |
| Methods used to establish whether knowledge needed exists within the organisation work well. | .863 | .901 |
| Employees record what they know. | .785 | .842 |
| Employees are willing to record what they know. | .705 | .805 |
| Organisation takes formal steps to practise KI. | .669 | .641 |

Extraction Method: Maximum Likelihood.

a. One or more communalitiy estimates greater than 1 were encountered during iterations. The resulting solution should be interpreted with caution.

In terms of total variance explained, again the factors explained more than 80% of the variance as the table below shows. The corresponding scree plot obtained is shown on the next page.

**TABLE APPENDIX E- 3 TOTAL VARIANCE EXPLAINED.**

| Factor | Initial Eigenvalues | | | Extraction Sums of Squared Loadings | | | Rotation Sums of Squared Loadings[a] |
|---|---|---|---|---|---|---|---|
| | Total | % of Variance | Cumulative % | Total | % of Variance | Cumulative % | Total |
| 1 | 8.774 | 62.670 | 62.670 | 7.836 | 55.973 | 55.973 | 6.156 |
| 2 | 1.224 | 8.743 | 71.413 | .884 | 6.312 | 62.285 | 7.233 |
| 3 | 1.015 | 7.247 | 78.660 | .840 | 6.002 | 68.287 | 5.231 |
| 4 | .841 | 6.010 | 84.670 | 1.284 | 9.171 | 77.458 | 5.651 |
| 5 | .628 | 4.485 | 89.155 | .788 | 5.626 | 83.084 | 6.058 |
| 6 | .379 | 2.705 | 91.860 | .469 | 3.348 | 86.432 | 6.294 |
| 7 | .306 | 2.185 | 94.045 | | | | |
| 8 | .222 | 1.586 | 95.631 | | | | |
| 9 | .176 | 1.257 | 96.888 | | | | |
| 10 | .138 | .983 | 97.871 | | | | |
| 11 | .111 | .789 | 98.660 | | | | |
| 12 | .090 | .644 | 99.304 | | | | |
| 13 | .058 | .416 | 99.720 | | | | |
| 14 | .039 | .280 | 100.000 | | | | |

Extraction Method: Maximum Likelihood.

a. When factors are correlated, sums of squared loadings cannot be added to obtain a total variance.

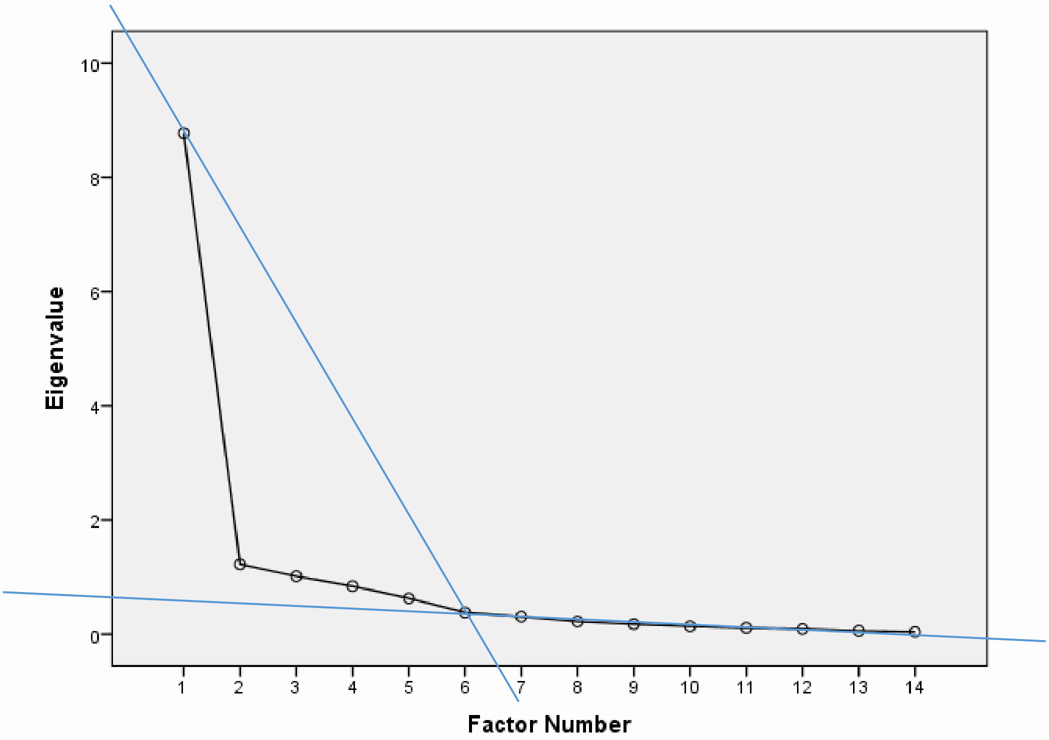



**Figure Appendix E- 1 Scree plot.**

The factor matrix obtained is shown on the next page. The six factors extracted required 9 iterations.

**TABLE APPENDIX E- 4 FACTOR MATRIX.**

| | Factor | | | | | |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 |
| Organisation has established what relevant knowledge its members have. | .855 | .245 | .457 | | | |
| If employees do not have knowledge they need, they can obtain it. | .849 | .291 | -.440 | | | |
| Organisation allocates sufficient resources to practise KI. | .834 | -.550 | | | | |
| Organisation has determined the knowledge it needs. | .828 | | | .291 | -.384 | |
| Organisation has established what relevant knowledge it has. | .826 | | .423 | | | |
| If employees do not have knowledge they need, they can obtain it when they need it. | .824 | | -.235 | | | |
| Organisation has determined the knowledge its members need. | .784 | | | .258 | -.392 | .201 |
| Organisation has determined the relative importance of the different knowledge it needs. | .777 | | .206 | .308 | -.272 | |
| Methods used to establish whether knowledge needed exists within the organisation work well. | .699 | | | .594 | | |
| Methods used to find who knows what work well. | .678 | | | .637 | | -.218 |
| Employees record what they know. | .656 | | | .342 | .414 | .270 |
| Employees know what to record in knowledge repositories. | .644 | | .260 | .208 | | .300 |
| Organisation takes formal steps to practise KI. | .563 | -.549 | | | | |
| Employees are willing to record what they know. | .562 | | | .324 | .418 | .418 |

Extraction Method: Maximum Likelihood.

a. 6 factors extracted. 9 iterations required.

The goodness-of-fit test obtained is shown in the table below. Chi-Square divided by the degree of freedom (df) should be between one and three optimally. I obtained 1.63. We also want the significance value to be greater than 0.05 (rejecting the null hypothesis). I obtained 0.031.

**TABLE APPENDIX E- 5 GOODNESS-OF-FIT TEST.**

| Chi-Square | df | Sig. |
|---|---|---|
| 35.957 | 22 | .031 |

Under the reproduced correlation table, SPSS indicated that residuals are computed between observed and reproduced correlations. There were 0 (0.0%) non-redundant residuals with absolute values greater than 0.05. The percentage of non-redundant residuals above 0.05 should be under 50%.

The pattern matrix as shown on the table on the next page indicates that I obtained discriminant validity. There are no cross-loadings.

The results also indicate convergent validity given that each factor is represented by loadings all above 0.5 and the average loading for each factor is greater than 0.7.

**TABLE APPENDIX E- 6 PATTERN MATRIX.**

| | Factor | | | | | |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 |
| Employees are willing to record what they know. | .996 | | | | | |
| Employees record what they know. | .800 | | | | | |
| Employees know what to record in knowledge repositories. | .647 | | | | | |
| Organisation has determined the knowledge its members need. | | 1.007 | | | | |
| Organisation has determined the knowledge it needs. | | .862 | | | | |
| Organisation has determined the relative importance of the different knowledge it needs. | | .777 | | | | |
| Organisation allocates sufficient resources to practise KI. | | | .966 | | | |
| Organisation takes formal steps to practise KI. | | | .830 | | | |
| If employees do not have knowledge they need, they can obtain it. | | | | 1.047 | | |
| If employees do not have knowledge they need, they can obtain it when they need it. | | | | .673 | | |
| Methods used to find who knows what work well. | | | | | .951 | |
| Methods used to establish whether knowledge needed exists within the organisation work well. | | | | | .786 | |
| Organisation has established what relevant knowledge its members have. | | | | | | .919 |
| Organisation has established what relevant knowledge it has. | | | | | | .807 |

Extraction Method: Maximum Likelihood.

Rotation Method: Promax with Kaiser Normalization.

a. Rotation converged in 9 iterations.

Based on the results above, the resulting six factors are:

- Factor 1: Knowledge Recording,
- Factor 2: Knowledge Needs Identification,
- Factor 3: KI Operationalisation,
- Factor 4: KM Effectiveness, and
- Factor 5: KI Effectiveness.

Finally, the factor correlation matrix obtained is shown below. The correlations (the amount of variance explained in one factor by another factor) obtained are all above 0.3 and below 0.7.

**TABLE APPENDIX E- 7 FACTOR CORRELATION MATRIX.**

| Factor | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| 1 | 1.000 | .611 | .490 | .578 | .662 | .688 |
| 2 | .611 | 1.000 | .627 | .685 | .684 | .759 |
| 3 | .490 | .627 | 1.000 | .524 | .626 | .547 |
| 4 | .578 | .685 | .524 | 1.000 | .589 | .566 |
| 5 | .662 | .684 | .626 | .589 | 1.000 | .527 |
| 6 | .688 | .759 | .547 | .566 | .527 | 1.000 |

Extraction Method: Maximum Likelihood.

Rotation Method: Promax with Kaiser Normalization.

The figure on the next page illustrates the indicators grouping in a 3D graph. We can see KI Effectiveness, KI Methods Effectiveness and KM Effectiveness are closely related - so closely related, that we can actually see four factors rather than six.

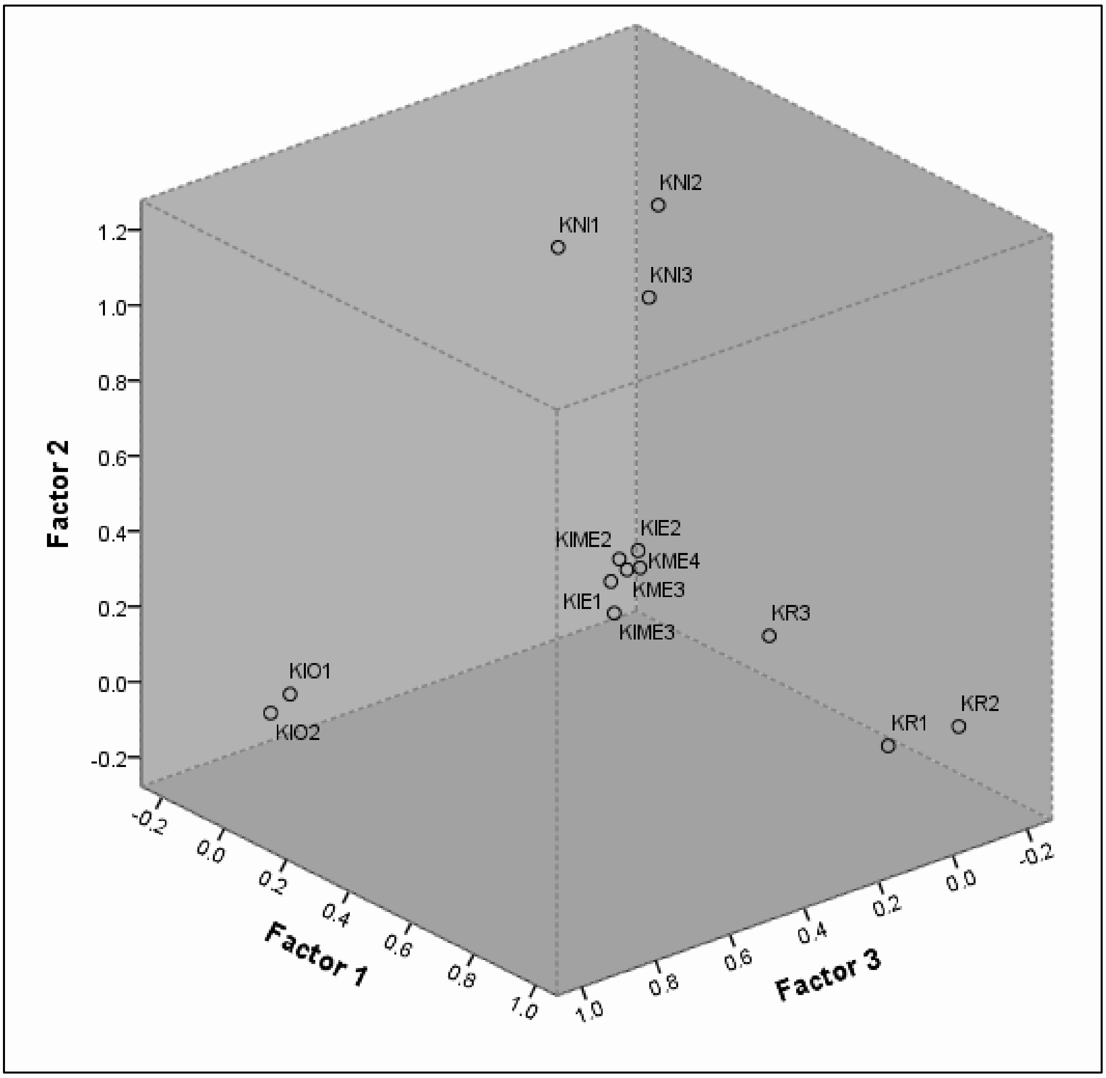



FIGURE APPENDIX E- 2 FINAL EFA FACTOR PLOT.

The next step was to check for reliability (i.e. Do the indicators move together consistently within each factor?). This is done by checking the values for the Cronbach's alphas. I report on the reliability check next.

In SPSS: Analyse -> Scale -> Reliability Analysis.

I ticked the check box "Scale if item deleted" to see what the Cronbach's alpha value would be if an item were deleted.

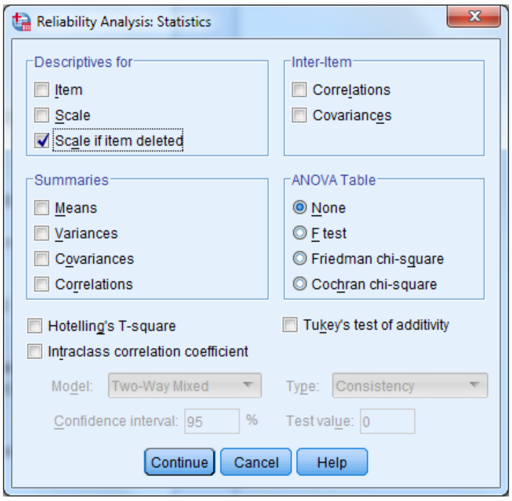



**FIGURE APPENDIX E- 3 RELIABILITY ANALYSIS.**

I selected the indicators for one latent variable, ran the analysis and repeated for each latent variable. All Cronbach's alpha values were above 0.7. The results obtained are shown on the following pages.

The tables below show the results for: KI Effectiveness.

**Table Appendix E- 8 KI Effectiveness reliability statistics.**

| Cronbach's Alpha | N of Items |
|---|---|
| .967 | 2 |

**Table Appendix E- 9 KI Effectiveness Item-Total Statistics.**

| | Scale Mean if Item Deleted | Scale Variance if Item Deleted | Corrected Item-Total Correlation | Cronbach's Alpha if Item Deleted |
|---|---|---|---|---|
| Organisation has established what relevant knowledge it has. | 6.32 | 8.871 | .936 | . |
| Organisation has established what relevant knowledge its members have. | 6.44 | 8.972 | .936 | . |

The tables below show the results for: KM Effectiveness.

**Table Appendix E- 10 KM Effectiveness reliability statistics.**

| Cronbach's Alpha | N of Items |
|---|---|
| .918 | 2 |

**Table Appendix E- 11 KM Effectiveness Item-Total Statistics.**

| | Scale Mean if Item Deleted | Scale Variance if Item Deleted | Corrected Item-Total Correlation | Cronbach's Alpha if Item Deleted |
|---|---|---|---|---|
| If employees do not have knowledge they need, they can obtain it. | 7.42 | 4.607 | .849 | . |
| If employees do not have knowledge they need, they can obtain it when they need it. | 7.69 | 4.674 | .849 | . |

The tables below show the results for: KI Operationalisation.

**TABLE APPENDIX E- 12 KI OPERATIONALISATION RELIABILITY STATISTICS.**

| Cronbach's Alpha | N of Items |
|---|---|
| .868 | 2 |

**TABLE APPENDIX E- 13 KI OPERATIONALISATION ITEM-TOTAL STATISTICS.**

| | Scale Mean if Item Deleted | Scale Variance if Item Deleted | Corrected Item-Total Correlation | Cronbach's Alpha if Item Deleted |
|---|---|---|---|---|
| Organisation allocates sufficient resources to practise KI. | 7.10 | 10.328 | .767 | . |
| Organisation takes formal steps to practise KI. | 6.31 | 10.602 | .767 | . |

The tables below show the results for: Knowledge Recording.

**TABLE APPENDIX E- 14 KNOWLEDGE RECORDING RELIABILITY STATISTICS.**

| Cronbach's Alpha | N of Items |
|---|---|
| .886 | 3 |

**TABLE APPENDIX E- 15 KNOWLEDGE RECORDING ITEM-TOTAL STATISTICS.**

| | Scale Mean if Item Deleted | Scale Variance if Item Deleted | Corrected Item-Total Correlation | Cronbach's Alpha if Item Deleted |
|---|---|---|---|---|
| Employees record what they know. | 12.93 | 24.453 | .834 | .788 |
| Employees are willing to record what they know. | 12.46 | 25.167 | .789 | .828 |
| Employees know what to record in knowledge repositories. | 12.85 | 25.650 | .714 | .895 |

The tables below show the results for: Knowledge Needs Identification.

**TABLE APPENDIX E- 16 KNOWLEDGE NEEDS IDENTIFICATION RELIABILITY STATISTICS.**

| Cronbach's Alpha | N of Items |
|---|---|
| .953 | 3 |

**TABLE APPENDIX E- 17 KNOWLEDGE NEEDS IDENTIFICATION ITEM-TOTAL STATISTICS.**

| | Scale Mean if Item Deleted | Scale Variance if Item Deleted | Corrected Item-Total Correlation | Cronbach's Alpha if Item Deleted |
|---|---|---|---|---|
| Organisation has determined the knowledge it needs. | 14.67 | 27.695 | .921 | .915 |
| Organisation has determined the knowledge its members need. | 14.35 | 29.217 | .905 | .929 |
| Organisation has determined the relative importance of the different knowledge it needs. | 14.68 | 26.703 | .881 | .948 |

The tables below show the results for: KI Methods Effectiveness.

**TABLE APPENDIX E- 18 KI METHODS EFFECTIVENESS RELIABILITY STATISTICS.**

| Cronbach's Alpha | N of Items |
|---|---|
| .944 | 2 |

**TABLE APPENDIX E- 19 KI METHODS EFFECTIVENESS ITEM-TOTAL STATISTICS.**

| | Scale Mean if Item Deleted | Scale Variance if Item Deleted | Corrected Item-Total Correlation | Cronbach's Alpha if Item Deleted |
|---|---|---|---|---|
| Methods used to find who knows what work well. | 6.70 | 5.513 | .895 | . |
| Methods used to establish whether knowledge needed exists within the organisation work well. | 6.55 | 6.178 | .895 | . |

The table on the next page shows the pattern matrix together with the Cronbach's alpha for each factor.

**TABLE APPENDIX E- 20 PATTERN MATRIX WITH CRONBACH'S ALPHA.**

| | Factor | | | | | |
|---|---|---|---|---|---|---|
| | Knowledge Recording | Knowledge Needs Identification | KI Operation-alisation | KM Effectiveness | KI Methods Effectiveness | KI Effectiveness |
| Cronbach's Alpha | 0.886 | 0.953 | 0.868 | 0.918 | 0.944 | 0.967 |
| Employees are willing to record what they know. | .996 | | | | | |
| Employees record what they know. | .800 | | | | | |
| Employees know what to record in knowledge repositories. | .647 | | | | | |
| Organisation has determined the knowledge its members need. | | 1.007 | | | | |
| Organisation has determined the knowledge it needs. | | .862 | | | | |
| Organisation has determined the relative importance of the different knowledge it needs. | | .777 | | | | |
| Organisation allocates sufficient resources to practise KI. | | | .966 | | | |
| Organisation takes formal steps to practise KI. | | | .830 | | | |
| If employees do not have knowledge they need, they can obtain it. | | | | 1.047 | | |
| If employees do not have knowledge they need, they can obtain it when they need it. | | | | .673 | | |
| Methods used to find who knows what work well. | | | | | .951 | |
| Methods used to establish whether knowledge needed exists within the organisation work well. | | | | | .786 | |
| Organisation has established what relevant knowledge its members have. | | | | | | .919 |
| Organisation has established what relevant knowledge it has. | | | | | | .807 |

Extraction Method: Maximum Likelihood.

Rotation Method: Promax with Kaiser Normalization.

a. Rotation converged in 9 iterations.

Next, I report on the results from the Confirmatory Factor Analysis.

## Confirmatory Factor Analysis - Structural Model

In this sub-section, I report on the results from the Confirmatory Factor Analysis (CFA). The figure below shows the resulting model.

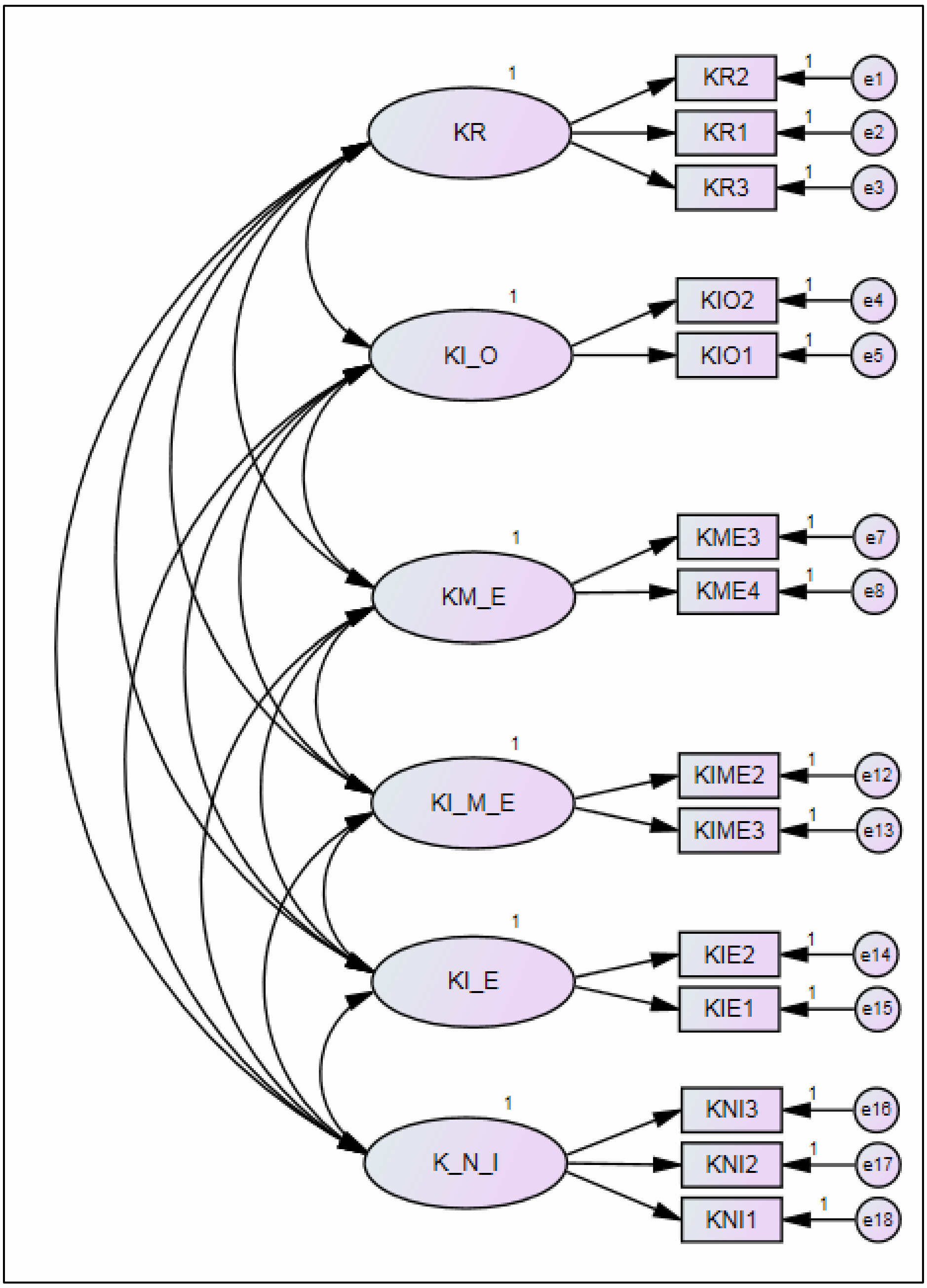



**FIGURE APPENDIX E- 4 CFA MODEL.**

I ran the analysis. The figure below shows the results obtained. These are the standardised estimates.

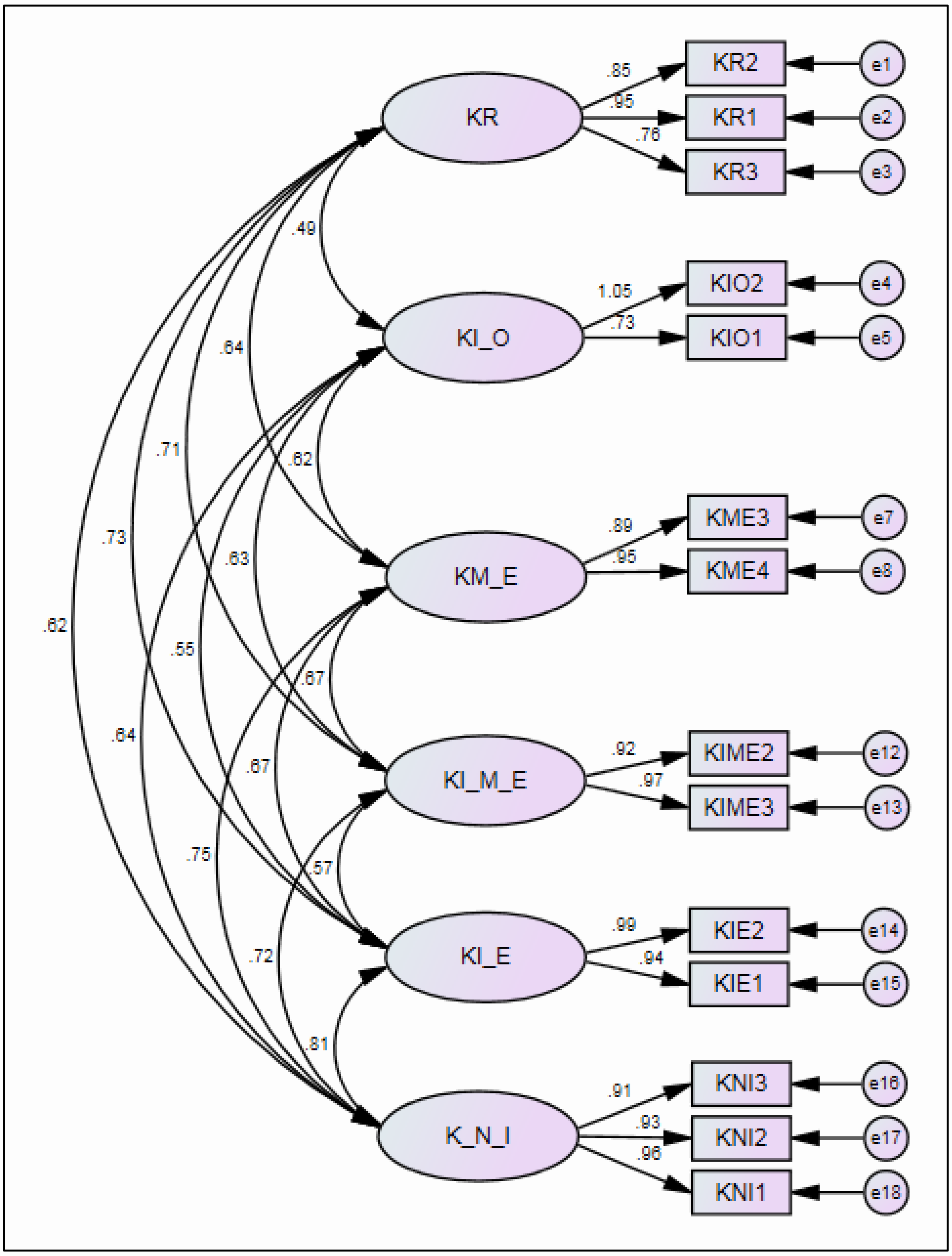



**FIGURE APPENDIX E- 5 INITIAL CFA MODEL WITH LOADINGS.**

As the figure above shows, other than the correlation between the latent variables Knowledge Needs Identification and KI Effectiveness, there are no other exceptionally high (> 0.82) correlations between latent variables.

The indicator loadings (between latent variables and indicators) are greater than 0.7 on average. Note the exceptionally high loading (1.05) on KIO2.

As a result, the following message was output from AMOS:

The following variances are negative. (Group number 1 - Default model)

| | e4 |
|---|---|
| | -1.080 |

To address this, I was informed by Gaskin (2015). I constrained the regression weights of both indicators as shown on the figure on the next page. Note, constraining just one indicator did not solve the issue.

I then re-ran the analysis. I report on the results obtained on the following page.

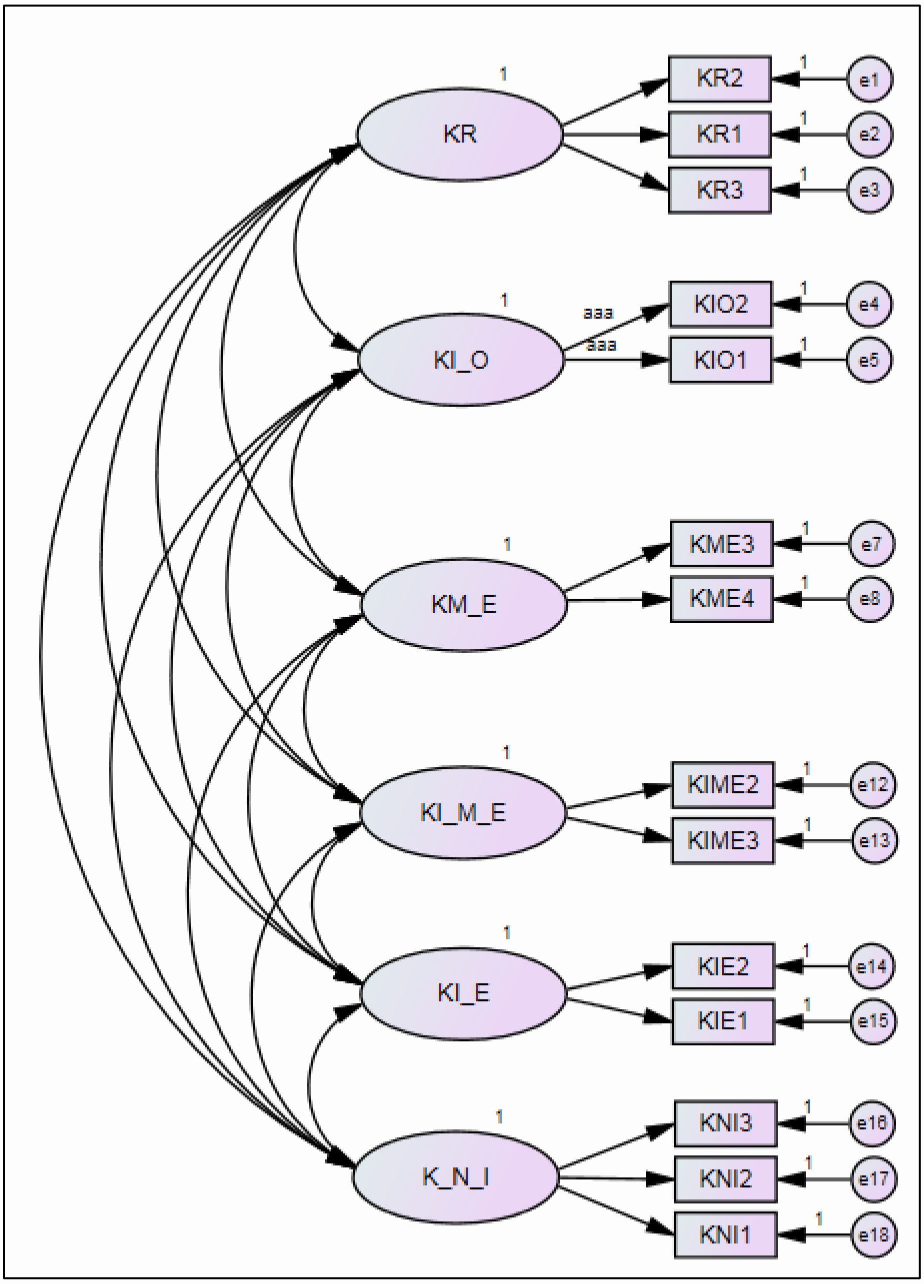



**FIGURE APPENDIX E- 6 CFA MODEL WITH CONSTRAINTS.**

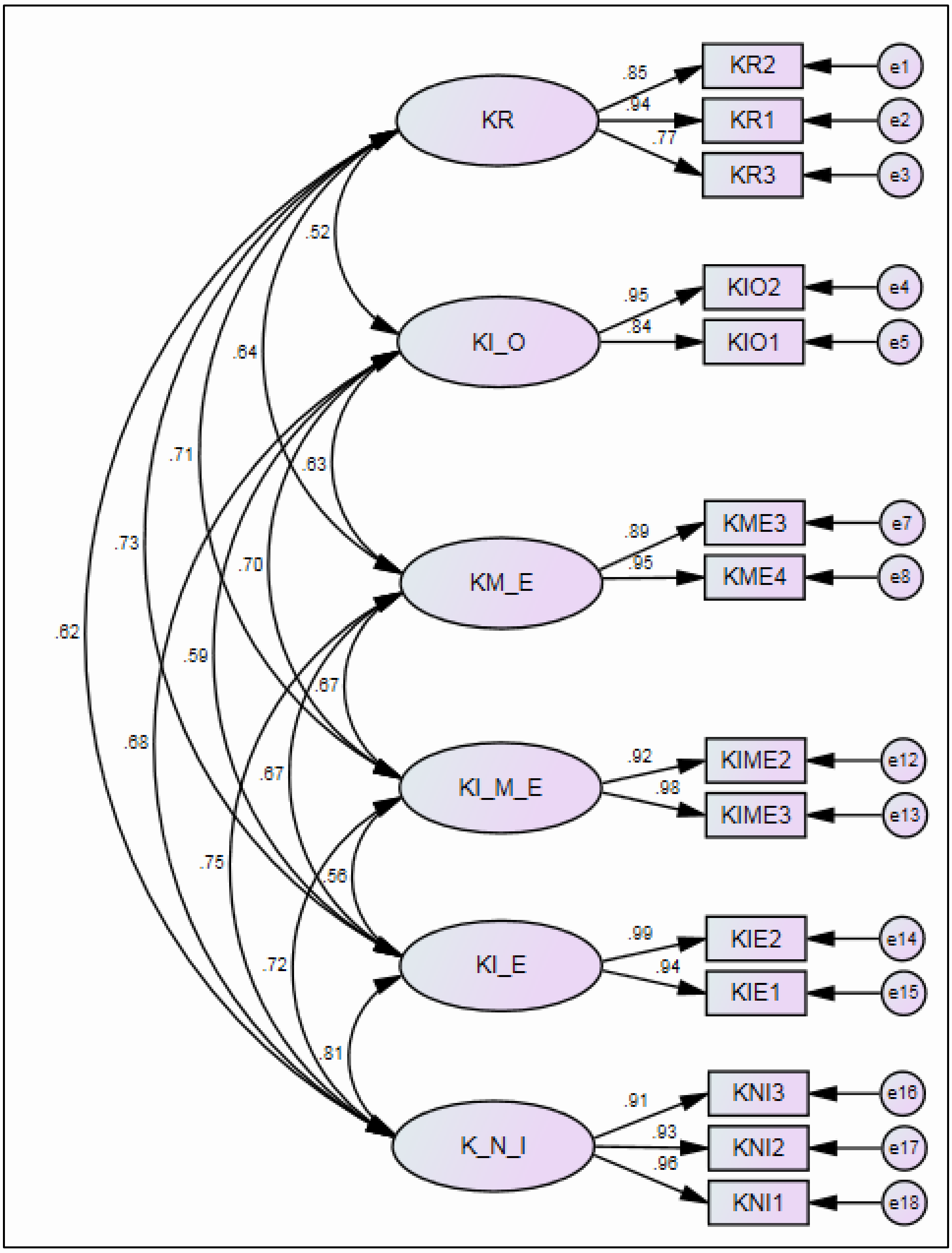



**FIGURE APPENDIX E- 7 REVISED CFA MODEL WITH LOADINGS.**

As the figure above shows, adding the constraints on the KIO indicators lowered the loadings and as a result:

Result (Default model)

Minimum was achieved

Chi-square = 112.560

Degrees of freedom = 63

Probability level = .000

The two tables below show the correlations values and the standardised regression weights obtained - both for the default model.

**TABLE APPENDIX E- 21 CORRELATIONS.**

| | | | Estimate |
|---|---|---|---|
| KR | <--> | KI_O | .518 |
| KR | <--> | KM_E | .637 |
| KR | <--> | KI_M_E | .714 |
| KR | <--> | KI_E | .727 |
| KR | <--> | K_N_I | .619 |
| KI_O | <--> | KM_E | .625 |
| KI_O | <--> | KI_M_E | .696 |
| KI_O | <--> | KI_E | .586 |
| KI_O | <--> | K_N_I | .682 |
| KM_E | <--> | KI_M_E | .668 |
| KM_E | <--> | KI_E | .668 |
| KM_E | <--> | K_N_I | .749 |
| KI_M_E | <--> | KI_E | .564 |
| KI_M_E | <--> | K_N_I | .724 |
| KI_E | <--> | K_N_I | .808 |

**TABLE APPENDIX E- 22 STANDARDISED REGRESSION WEIGHTS.**

| | | | Estimate |
|---|---|---|---|
| KR2 | <--- | KR | .849 |
| KR1 | <--- | KR | .944 |
| KR3 | <--- | KR | .766 |
| KIO2 | <--- | KI_O | .948 |
| KIO1 | <--- | KI_O | .836 |
| KME3 | <--- | KM_E | .889 |
| KME4 | <--- | KM_E | .954 |
| KIME2 | <--- | KI_M_E | .918 |
| KIME3 | <--- | KI_M_E | .975 |
| KIE2 | <--- | KI_E | .993 |
| KIE1 | <--- | KI_E | .942 |
| KNI3 | <--- | K_N_I | .910 |
| KNI2 | <--- | K_N_I | .931 |
| KNI1 | <--- | K_N_I | .964 |

Next, I used the Excel StatTools provided by Gaskin (2015) to check for discriminant validity.

According to many scholars, comparing MSV (Maximum Shared Squared Variance) with AVE (Average Variance Extract) is the only true way to establish discriminant validity (Gaskin 2015). MSV should be less than AVE - which is what the results obtained on the table below show.

**Table Appendix E- 23 Comparing MSV with AVE.**

| | CR | AVE | MSV | Check | ASV | KI_E | KR | KI_O | KM_E | KI_M_E | K_N_I |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **KI_E** | 0.967 | 0.937 | 0.653 | ✔ | 0.458 | 0.968 | | | | | |
| **KR** | 0.891 | 0.733 | 0.529 | ✔ | 0.419 | 0.727 | 0.856 | | | | |
| **KI_O** | 0.888 | 0.799 | 0.484 | ✔ | 0.390 | 0.586 | 0.518 | 0.894 | | | |
| **KM_E** | 0.919 | 0.850 | 0.561 | ✔ | 0.450 | 0.668 | 0.637 | 0.625 | 0.922 | | |
| **KI_M_E** | 0.945 | 0.897 | 0.524 | ✔ | 0.457 | 0.564 | 0.714 | 0.696 | 0.668 | 0.947 | |
| **K_N_I** | 0.954 | 0.875 | 0.653 | ✔ | 0.517 | 0.808 | 0.619 | 0.682 | 0.749 | 0.724 | 0.935 |

The tables below list the results obtained for model fit.

CMIN/DF should be between 1 and 3. I obtained 1.787.

**Table Appendix E- 24 Initial CMIN/DF.**

| Model | NPAR | CMIN | DF | P | CMIN/DF |
|---|---|---|---|---|---|
| Default model | 42 | 112.560 | 63 | .000 | 1.787 |
| Saturated model | 105 | .000 | 0 | | |
| Independence model | 14 | 1354.678 | 91 | .000 | 14.887 |

CFI should be above 0.95. I obtained 0.961.

**Table Appendix E- 25 Initial Baseline Comparisons.**

| Model | NFI Delta1 | RFI rho1 | IFI Delta2 | TLI rho2 | CFI |
|---|---|---|---|---|---|
| Default model | .917 | .880 | .962 | .943 | .961 |
| Saturated model | 1.000 | | 1.000 | | 1.000 |
| Independence model | .000 | .000 | .000 | .000 | .000 |

RMSEA should be less than 0.1, I obtained 0.097.

**Table Appendix E- 26 RMSEA.**

| Model | RMSEA | LO 90 | HI 90 | PCLOSE |
|---|---|---|---|---|
| Default model | .097 | .067 | .126 | .007 |
| Independence model | .409 | .390 | .428 | .000 |

SRMR should be less than 0.10. Using the AMOS Standardised RMR plugin, I obtained a value of Standardised RMR of 0. 0553.

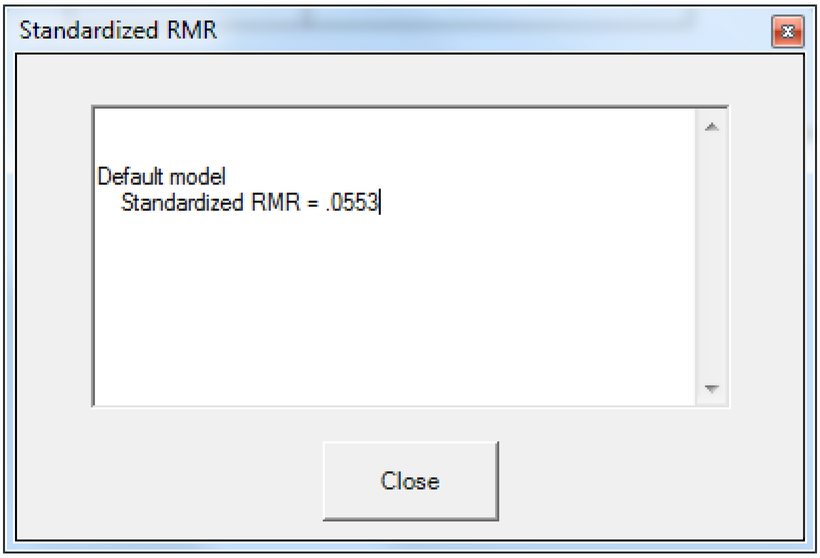



**Figure Appendix E- 8 Standardised RMR.**

## Confirmatory Factor Analysis - Measurement Model

I created the measurement (or path) model as shown below.

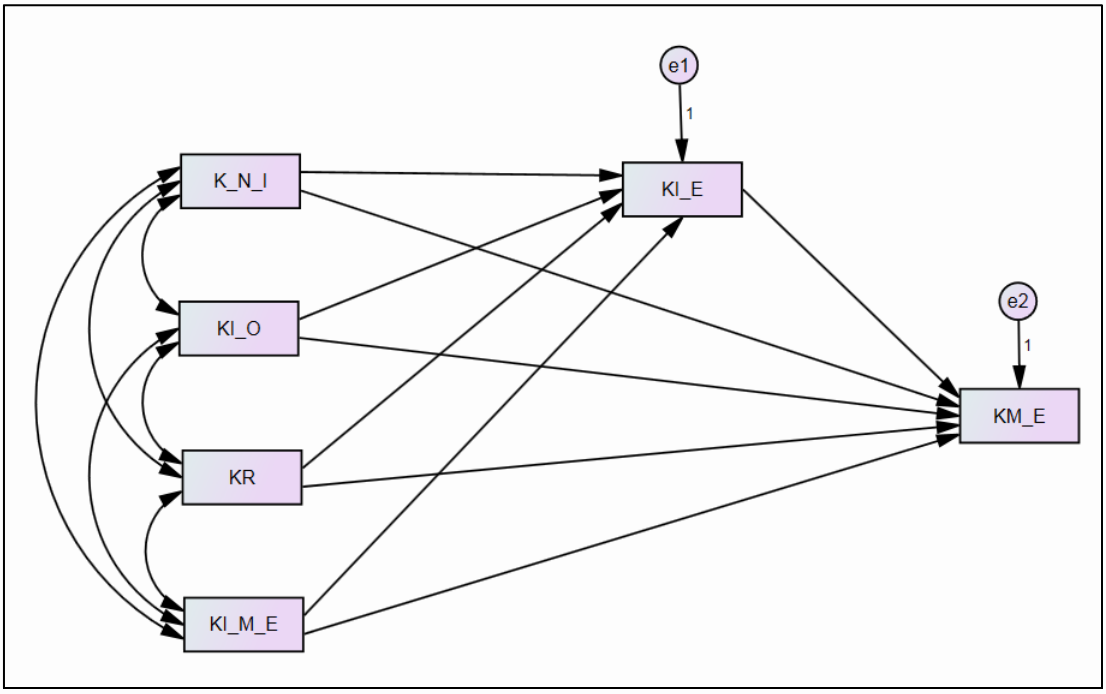



**FIGURE APPENDIX E- 9 MEASUREMENT MODEL.**

Next, I ran the analysis. AMOS out the notes below for the model.

Minimum was achieved
Chi-square = .000
Degrees of freedom = 0
Probability level cannot be computed

The regression weights are shown in the model below.

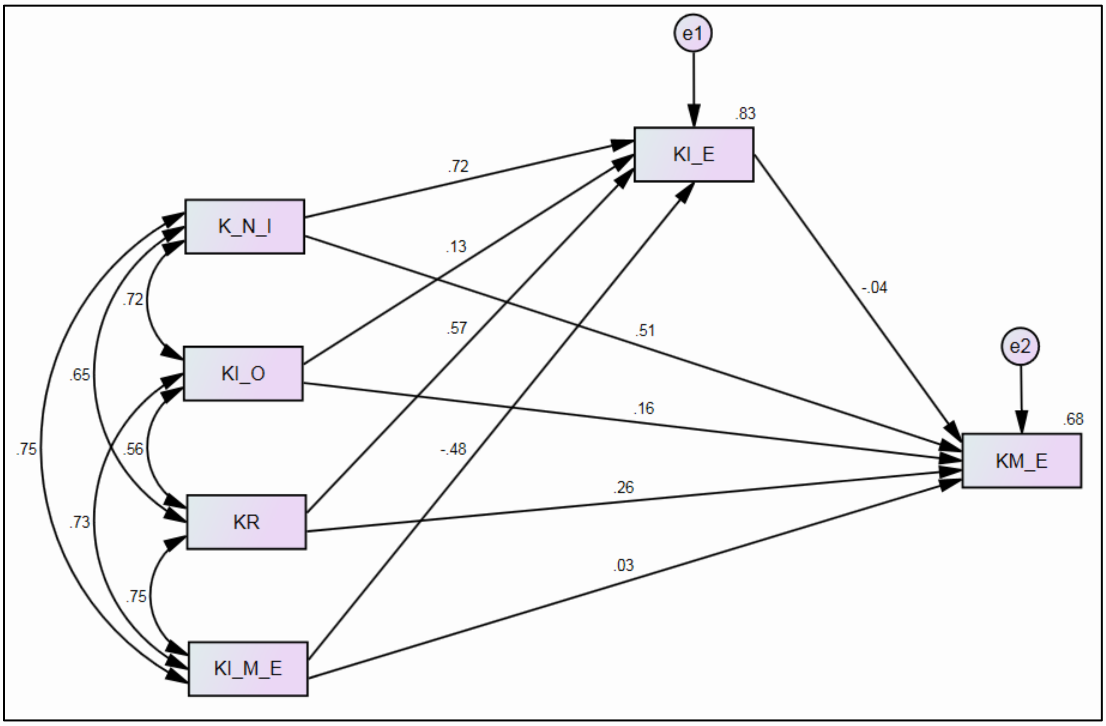



**Figure Appendix E- 10 Path model with weights.**

The regression weights obtained are listed below.

TABLE APPENDIX E- 27 REGRESSION WEIGHTS.

| | | | Estimate | S.E. | C.R. | P | Label |
|---|---|---|---|---|---|---|---|
| KI_E | <--- | K_N_I | .727 | .077 | 9.397 | *** | |
| KI_E | <--- | KI_O | .130 | .075 | 1.725 | .085 | |
| KI_E | <--- | KR | .588 | .073 | 8.088 | *** | |
| KI_E | <--- | KI_M_E | -.485 | .089 | -5.462 | *** | |
| KM_E | <--- | K_N_I | .498 | .148 | 3.370 | *** | |
| KM_E | <--- | KI_O | .158 | .102 | 1.547 | .122 | |
| KM_E | <--- | KR | .265 | .129 | 2.052 | .040 | |
| KM_E | <--- | KI_M_E | .032 | .138 | .232 | .816 | |
| KM_E | <--- | KI_E | -.038 | .146 | -.258 | .796 | |

The results above show that Knowledge Needs Identification has a significant effect on KI Effectiveness. However, KI Methods Effectiveness has a negative effect on KI effectiveness - which is difficult to explain, and KI Effectiveness does not have a significant relationship with KM Effectiveness.

It is difficult to qualify these relationships. That is why I have not pursued this model, but adopted the four-factor model.

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