Operations-Based Knowledge Management (OBKM) in Aircraft Engineering

By

Rafed Zawawi

A thesis submitted in fulfilment of the requirements for the degree of Doctor of Philosophy

Faculty of Engineering & IT

University of Technology, Sydney

Australia

2014

Certificate of Authorship/Originality

I certify that the work in this thesis has not previously been submitted for a degree, nor has it been submitted as part of requirements for a degree except as fully acknowledged within the text.

I also certify that the thesis has been written by me. Any help that I have received in my research work and the preparation of the thesis itself has been acknowledged. In addition, I certify that all information sources and literature used are indicated in the thesis.

Signature of Student

Dedication

This dissertation is dedicated for my father, Abdulwahab, and my mother, Noor, who taught me that working hard will get you your dreams. Thank you for believing in me. Your love and prayers is what brought me where I am today. Also, I dedicated this dissertation to my wife, Heba. I would not be able to accomplish this research without her ultimate support, deep understanding and profound encouragement. She was always there cheering me up and stood by me through the good times and bad. Nevertheless, I would like to thank my father and mother in-low Abdulla and Khadija for their prayers, love and support during this journey. Finally, I want to dedicate it to my beloved daughter, Maya, and son, Mohammad, whose unconditional love and sweet spirits lifted and sustained me during the darkest hours.

Acknowledgements

All praise and thanks are due to Allah, the one with whose blessings and grace all good deeds can be accomplished. The long journey to finishing this dissertation would not be possible without great support and inspiration from many people along the way.

First, I would like to express my deepest gratitude to my principal supervisor Dr. Hasan Akpolat who was my mentor, inspirer and friend. Your patience, guidance, charisma and effort were essential to the birth of this thesis and my formation as a researcher. Also, I am especially indebted to my co-supervisor, Mr. Ravindra Bagia, who believed in me. Thank you for giving me the opportunity and support to become a PhD candidate. When I am in doubt and frustration, your words give me comfort and confidence there is light at the end of the tunnel.

I want to thank my engineering mentor, Eng. Elsayed Emara, who planted and championed the research idea. You supported my study and backed me up when all doors was closed. Nevertheless, I like to thank the Saudi Arabian aviation industry for being helpful and participating in my research.

Moreover, I would like to thank the Saudi Arabian government especially the cultural mission of the royal embassy of Saudi Arabia in Canberra, Australia for sponsoring my research and helping me overcame the logistic obstacles. Also, I like to thank all my friends and colleges at the Faculty of Engineering and IT of the University of Technology, Sydney, Australia. My special thanks to Phyllis Agius from the Faculty of Engineering and IT for the administrative support. Finally, I want to thank all my family and friends for their understanding and kindness during this long journey.

Rafed Zawawi,

October, 2014

Abstract

Raising oil prices, intense rivalry completion, safety concerns and downward pressure on prices are some of the serious challenges facing the civil aviation industry. However, in the past decade the civil aviation industry experienced a new kind of challenge; the escalading shortage of sophisticated technical capabilities especially in the aircraft engineering fields. This was fuelled by the high job rotation, job reduction and the raising rate of retirement of the aging engineering workforce. This exposed the raising knowledge gap between the aircraft engineering experts and new hires. The need for an effective knowledge management (KM) system was evident.

Hence, the main objective of this study is to develop and validate a framework for better management of knowledge in the aircraft engineering field. The Saudi Arabian aviation industry was the domain for this research. A review of KM literature was conducted. Many of the KM initiatives seems to relate to focusing on the information technology (IT) based solutions rather than dealing with the organizations' operational issues that have diverse effect on KM implementation. Thus, Operations-Based Knowledge Management (OBKM) framework guidelines were proposed.

Also, an empirical investigation of the KM practices in the Saudi Arabian aviation industry was performed. Convergent interviews were carried out. It was discovered that level KM awareness among aircraft engineers is low. Moreover,

current KM practices are modest and, where they exist, are merely incidental to everyday operations, and not due to any deliberate focus on KM.

Further development for the OBKM framework guidelines was needed. KM critical success factors (CSF) literature coding and analysis were performed to identify the theoretical OBKM framework.

To incorporate the industry experts' feedback into the framework a KM workshop was performed in the Saudi Arabian aviation industry. It was attended by 63 aircraft engineering experts. It consisted of KM seminar followed by KM focus groups. The workshop helped raising the KM awareness and, at the same time, gathering the CSF for an effective KM system from their point of view. Developing the practice-based OBKM framework was done by integrating the focus groups findings with the proposed theoretical OBKM framework. In the last stage of this study, an industry wide survey was carried out to validate the practice-based framework.

The main outcome of this study was an OBKM framework with a proposed model and implementation guidelines for the Saudi Arabian aviation industry. It will assist the aviation organization to effectively manage aircraft engineering knowledge.

Contents

Chapter 3 Research Methodologies and Plan 38

List of Tables

List of Figures

List of Publications

Conference Proceedings:

- ZAWAWI, R., AKPOLAT, H. & BAGIA, R. Managing Knowledge in Aircraft Engineering. Proceedings of the 2nd International Conference on Logistics and Transport (ICLT 2010), 2010 Queenstown, New Zealand

- ZAWAWI, R., AKPOLAT, H. & BAGIA, R. Operations-Based Knowledge Management. Proceedings of the 2nd International Conference on Industrial Engineering and Operations Management (IEOM 2011), 2011 Kuala Lumpur, Malaysia. IEOM Research Solutions Pty Ltd.

- ZAWAWI, R., AKPOLAT, H. & BAGIA, R. Managing Knowledge in Aircraft Engineering.Proceedings of The 3rd International Conference on Logistics & Transport and The 4th International Conference on Operations and Supply Chain Management on 15-17 December 2011, Kurumba Maldives Resort, Malé, Maldives

- ZAWAWI, R., AKPOLAT, H. & BAGIA, R. Managing Knowledge in Aircraft Engineering – An Operations-Based Approach. Proceedings of the 2012 International Conference on Industrial Engineering and Operations Management (IEOM 2012), 2012 Istanbul, Turkey. IEOM Research Solutions Pty Ltd.

Journals:

- ZAWAWI, R., AKPOLAT, H. & BAGIA, R. 2010. Managing Knowledge in Aircraft Engineering. *International Journal of Business and Economics,* Vol. 2**,** Pages. 161-174.

Chapter 1 Introduction

This chapter provides an introduction to this research. Section 1.1 describes the problem that triggers the need for this research. Also, this section rationalises the significance of the research and research contribution. The list of objectives of the study is driven from the main objective and illustrated in Section 1.2. Similarly, the research questions are driven from the research objectives and listed in Section 1.3. Section 1.4 is a preliminary description of the research steps while Section 1.5 provides a more general overview of the structure of the thesis.

1. 1. Background of the Research

This section is aimed to provide a rationale for the need of the research. It is consisted of three parts: problem background, research significance and original contribution of this study.

1.1.1 Problem Background

Knowledge Management (KM) emerged as a scientific discipline in the early 1990s (Wiig, 1997). However, it has been said that KM is thousands of years old dating back to when the first humans drew pictures on a cave wall. Knowledge has been and still is vital for the survival of humankind. It was critical for our ancestors to "know how" to light a fire, catch pray and build a shelter. Without learning from their mistakes, improving their techniques and sharing their knowledge from father to son and generation to generation, mankind would not have lasted this long. Although today most organizations use some sort of KM methods, knowledge sharing is still a matter of organizational survival. KM is the process of retaining employees' knowledge and experience within the organization's boundaries.

Organizational knowledge (or in other words the "know-how") is viewed by many as the most meaningful resource and the crucial survival factor for organizations (Akhavan et al., 2006, Alazmi and Zairi, 2003, Allen, 2010, Al-Mabrouk, 2006, Barsky and Marchant, 2000, Bassi, 1999, BenMoussa, 2009, Burger, 2004, Carter, 2004, Collison and Parcell, 2001, Davenport and Prusak, 1998, Freke, 2006, Goh, 2002, Gupta and McDaniel, 2002, Harvey and Holdsworth, 2005, Manasco, 1999, Mathi, 2004, Nonaka and Takeuchi, 1995, Powell and Swart, 2005, Prusak, 2001). Although, there is a common recognition of the significance of organizational knowledge for the survival of an organization in the current global marketplace, organizations are still struggling in fully understanding and implementing KM (Mathi, 2004). Many of those KM implementation attempts have failed and many mistakes were made.

One could argue that KM in the aviation industry is even more critical than other industries. Strong downward pressure on prices in the past decades has become a well-known characteristic of the aviation industry. Additionally, rising oil prices, intense competition and safety concerns have placed the aviation industry in one of the toughest fights for survival (Harvey and Holdsworth, 2005, Shaw and Smith, 2003). In an industry where maintenance operations cost contributes to a major portion of the expenses, sustainable success in these operations is highly dependent on sound KM practices based on knowledge and technology sharing (Harvey and Holdsworth, 2005).

Despite this fact, it appears that due to heavy workloads and a strong emphasis on the reduction of operational costs, KM has not been given a high priority (Harvey and Holdsworth, 2005). However, organizations are increasingly realising the importance of aircraft engineering knowledge as an asset, and this has initiated the need for retaining critical knowledge within the organization (Allen, 2010, McNichols, 2008, Tat and Stewart, 2007).

Most organizations in the civil aviation industry including aircraft manufacturers, airlines and maintenance providers suffer from the loss of engineering knowledge. This is due to the loss of the specialised engineering manpower caused by job rotation, job reduction and turnover (Shaw and Smith, 2003, Arkell, 2007). More importantly, the retirement of the "baby-boomer" engineers in recent years contributes greatly in the loss of engineering knowledge (McNichols, 2008).

Freshly graduated or recruited engineers require a lot of experience before they can fully function as "aircraft engineers". They may take up to five or more years of mentoring and training (on the job training) to be fully functional, making it very costly to train new aircraft engineers (Peyman et al., 2006, Shaw and Smith, 2003). Also, incorrectly performed aircraft engineering activities lead to a high level of risk and are therefore closely monitored by intensive safety regulations

(Harvey and Holdsworth, 2005). As a result, aircraft engineering knowledge and experience is costly and crucial for the aviation industry. Thus, there is a need for effective KM in the aircraft engineering field.

This research focuses on the KM practices in the context of aircraft engineering in the Saudi Arabian aviation industry. This industry is mainly dominated by one organization. More than half of the Saudi Arabian aircraft engineers are employed within this organization and therefore this organization was used as a case study for this research. Preliminary research data was obtained through discussions and interviews with senior aircraft engineers, and personal observations of the researcher during his six years of work experience as an aircraft engineer with one of the companies in the Saudi Arabian aviation industry.

In the Saudi Arabian aviation industry, it has been identified that KM practices appeared to be relatively under-developed (Zawawi et al., 2010). Furthermore, aircraft engineering knowledge seemed to be informally managed, in a more or less ad hoc manner. It was concluded that the level of KM awareness amongst aircraft engineers was low. Moreover, the current modest KM practices, where they existed, were merely incidental to everyday operations, and not due to any deliberate focus on KM (Zawawi et al., 2010). Through a comparison with KM theories, a gap in the Saudi Arabian aviation industry has been identified.

1.1.2 Research Significance

Workforce aging is a global phenomenon. Nevertheless, the demand for an aerospace engineering workforce is increasing worldwide. For example, the US National-Science-Board (2010) reported that around 30% of the aerospace engineering workforce were over 50 years old and retired by 2010. However, little has been done to capture the critical knowledge from this retiring workforce (Carter, 2004). Moreover, the booming aviation industry in the Middle East has caused a shortage of professional aircraft engineers (Morrison, 2008). Nevertheless, Boeing projected the need for around 53 thousand extra aviation technicians to service the growing aviation industry in the Middle East with an average of 2,600 new technicians every year (Nunnally et al., 1967).

This has created an emerging need for effective KM in the aviation industry. KM has been considered problematic and ineffective in this industry (Harvey and Holdsworth, 2005, La Bella et al., 2004, Tat and Stewart, 2007, McNichols, 2008). Many researchers have studied the KM issues and applications however the effective implementation of KM in the engineering fields is less apparent (McNichols, 2008).

The current KM literature[1] did not provide evidence of the integration of KM processes in the context of aircraft engineering and especially in the Saudi Arabian Aviation Industry. Therefore, the need for a holistic framework for effective KM in the aviation industry is clearly apparent.

[1] Refer to Chapter 2

This research is unique as it is focused on KM practices from the perspective of aircraft engineering so as to provide a competitive advantage in the aviation industry. Therefore, a framework aimed at retaining aircraft engineering knowledge within the organization was developed. This framework is based on the gap between the current practices in the industry and KM theories.

1.1.3 Original Contribution

This research makes an original contribution to knowledge by developing an operational based approach to retaining individual aircraft engineering knowledge into organizational knowledge in the context of the civil aviation industry. This includes generating a framework to better manage aircraft engineering knowledge. Also, this study tests the existence of the theoretical critical susses factors of implementing KM systems in the Saudi Arabian aviation industry using industry experts focus groups. Also, this study empirically validates the framework using an industry wide survey. A further contribution of this research is in that it provides an investigation and insight into the current KM practices in the Saudi Arabian aviation industry especially in the aircraft engineering field.

1. 2. Research Objectives

The rationales developed from the problem background and research significance leads to the need for research which aims to diminish the gap between the KM theories and the KM current practices in the Saudi Arabian aviation industry from the perspective of aircraft engineering. Therefore, the main objective of this research was to develop and validate a framework for better management of knowledge in the aircraft engineering field. The validation process will also provide tests for hypotheses. In order to achieve the main objective, the following five specific objectives have to be addressed: (Illustrated in Figure 1-1)

I. Identify the critical elements of an effective KM system and guidelines for a theoretical OBKM framework based on the literature review – this will provide the theoretical base for the OBKM framework.

II. Identify current KM practices in the Saudi Arabian aviation industry, especially in the aircraft engineering field – to examine the gap (if any) between the current practices and theory.

III. Validate the theoretical OBKM guidelines through expanded analysis of literature and use this to develop the theoretical OBKM framework – to validate the level of importance of the framework elements based on KM theorists.

IV. Validate the theoretical framework using feedback obtained from experts in the Saudi Arabian industry and to develop a practice-based framework – to be used as a pilot framework.

V. Validate the practice-based framework through an extensive survey of the Saudi Arabian aviation industry – to statistically validate the practice-based framework.

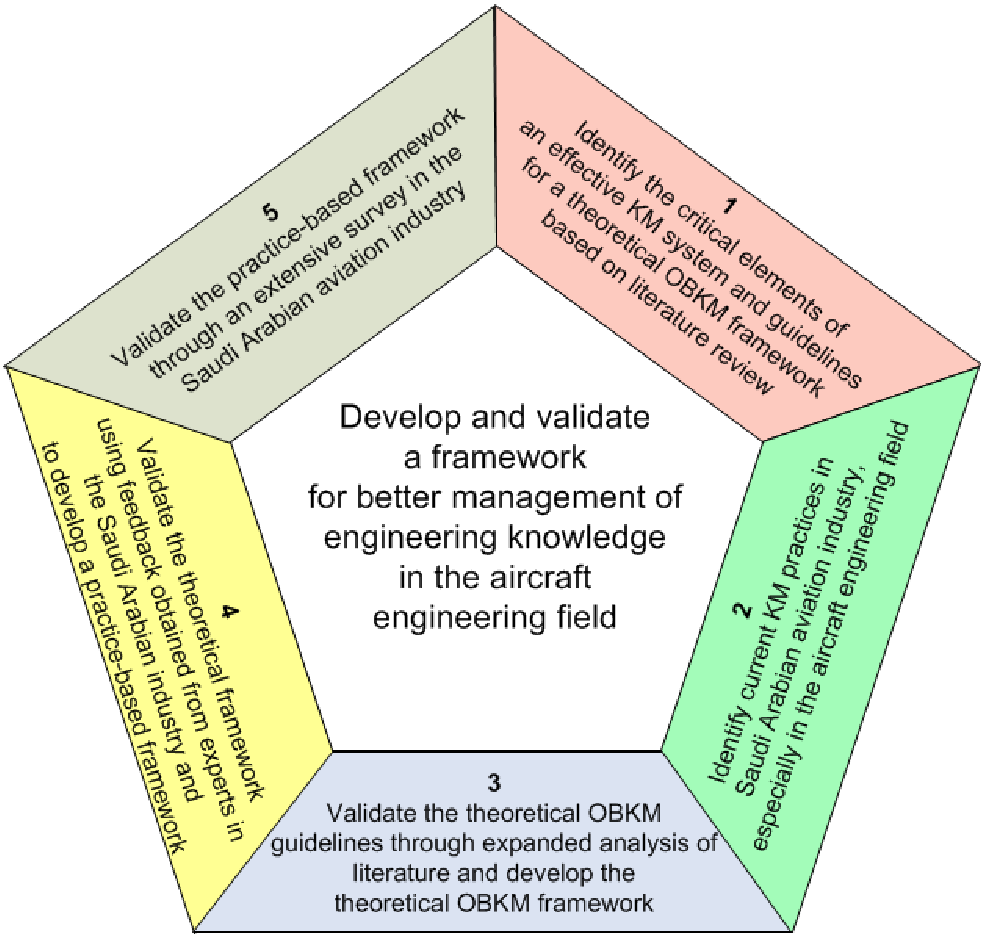


Figure 1-1 Research Objectives

1. 3. Research Questions

Based on the research objectives, the extensive literature review, brainstorming sessions with the research supervisors, and industry experts' feedback, the research questions are as follows:

Question 1: What is Operations Based Knowledge Management (OBKM)?

Question 2: What are the current knowledge management practices in the Saudi Arabian aviation industry in the aircraft engineering field?

Question 3: What are the critical success factors required for an effective OBKM system implementation?

1. 4. Research Steps

This research was carried out in several steps. The literature review in this research was carried out in two parts. The first part is the preliminary literature review that helped identifying the gap in the KM literature and developing the guidelines for the framework. The second part is the literature analysis of the theoretical critical success factors for an effective KM system. The result of this analysis was used to develop the theoretical framework.

Interviews with the industry experts, supervisors' input and researcher's experience in the industry facilitated the identification of the research need. This was used to determine the main objective of this research. This objective was further developed into several sub objectives and research questions.

In other research steps, suitable research methodologies were developed to accommodate the research needs and achieve the research objectives. These methodologies consisted of convergent interviewing, focus groups and survey. During the deployment process of the methodologies, experts from the case study were interviewed and other experts from the industry formed the focus groups. An online questionnaire was sent to all aircraft engineers in the Saudi Arabian aviation industry. Follow-ups and reminders helped in increasing the questionnaire response rate.

The qualitative and quantitative data collected from the focus groups and survey were analysed to test the research concept and provide the recommendations. Accordingly, the proposed framework was modified. Finally, research dissertation and final presentation formed the final research step of this study. Figure 1-2 illustrates the tools and methods used at each research step. These steps are further described in Chapter 3.

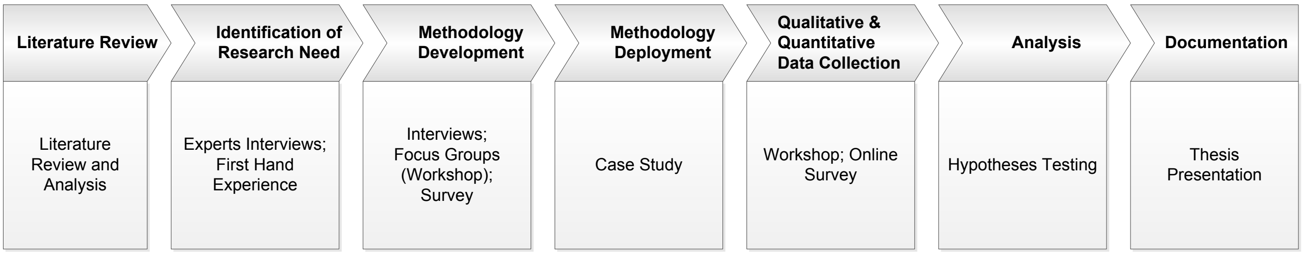


Figure 1-2 List of Tools & Methods Used at Each Research Step

1. 5. Structure of Thesis

A comprehensive study based on theoretical verification and empirical testing was required to achieve the research objectives and answer the research questions. Detailed descriptions of the research approach used were discussed in the subsequent chapters of this dissertation. Thesis outline and structure were followed along the lines of Pitinanondha (2008) thesis. The summary of each chapter is as follows:

Chapter 2 presents the literature review of knowledge management from the operations management perspective. This answers the research question 'What is OBKM?' This chapter gives a brief background about KM. This includes the discussion about the relationship between data, information and knowledge. Also, the two types of knowledge (Explicit and Tacit) are explained. Moreover, it illustrates the focus on IT-based solutions in the KM literature and the move to comprehensive KM systems. Moreover, this chapter lists guidelines for an OBKM framework based on the operations management research. Finally, research hypotheses are introduced.

It is important to note that the literature review in this thesis is not completely contained in chapter 2. The literature review is an ongoing activity through the entire dissertation.

Chapter 3 describes the research plan and methodology employed in this study. Also, the research design and the development of the research instruments are explained. Methods used for the framework development and testing are described in detail, including details of the testing methods of the reliability and validity of the research survey instrument.

Chapter 4 introduces the theoretical OBKM framework based on the literature review and analysis. The validation process of this framework using the integration of industry experts' interviews and expanded literature review is then explained.

Chapter 5 introduces a practice-based OBKM framework based on the validation possess of the theoretical framework using focus groups feedback. Also, research propositions and hypotheses are revised and reintroduced.

Chapter 6 introduces the final OBKM framework as a result of the testing processes of the practice-based OBKM framework. Accordingly, it discusses the results of the survey and the evaluation of the measurement instrument. Research hypotheses are tested using statistical data analysis of the survey results. Finally, a guideline for OBKM system implementation is provided.

Chapter 7 provides a brief summary and main conclusion of this study. Additionally, limitations and suggestions for further study are addressed.

Chapter 2 Literature Review

2. 1. Introduction

Through a literature review, this chapter aims to give a generic background about Knowledge Management (KM), discussing the focus on the Information Technology (IT) solution in the KM literature and introducing a KM model based on the operations management system approach. Thus, section 2.2 presents the general background of KM while section 2.3 discusses the literature focus on the IT-based KM solution and the move toward holistic KM systems. Section 2.4 introduces critical success factors for a new holistic KM approach based on the operations management systems. Research Hypotheses are introduced in section 2.5. The last section of this chapter, section 2.6, summarizes this chapter.

Due to the nature of this research, the review of the literature is a not limited by this chapter. It is a persistent process though out every chapter in this dissertation.

2. 2. What is Knowledge Management (KM)?

This section is aimed at describing the concept of KM. It critically reviews the different perspectives of knowledge and knowledge management in the literature and at the same time, it describes the view point adopted by this research. Distinctive views of data, information and knowledge and the relationship among them are described here. Moreover, types of knowledge and several KM definitions and, different activities are discussed in this section.

2.2.1 Data, Information and Knowledge

Several philosophers, such as Plato, Descartes and Kent, have made attempts to define and grasp the nature of knowledge to understand forces affecting different life phenomena. These attempts draw the fundamental guidelines for understanding knowledge (Maqsood, 2006).

Several different explanations of the concept of knowledge are discussed in the literature. Generally, most of the attempts to describe knowledge seem to be revolving around the idea that knowledge is "understanding". However, some researchers refer to knowledge as "know-how", experience, skills…etc. (Desouza and Awazu, 2006). Other researchers refer to it as the ability to make information usable to take effective actions (Liebowitz and Megbolugbe, 2003) while other researchers suggests that it is impossible to separate knowledge from context (Davenport and Prusak, 1998, Sveiby, 2001). Thus, for the purpose of this research, an understanding of the concept of knowledge will be logically discussed here.

Conventionally, Knowledge is often defined in terms of data and information (Alavi and Leidner, 2001, Davenport and Prusak, 1998, Drucker, 1991). Nevertheless, knowledge is easily confused with data and, at the same time, Information Technology (IT) with information (Drucker, 1991). Therefore, a clear understanding of data and information is necessary to an understanding of their relationship to knowledge.

Data is often defined as raw, isolated and discrete objective facts resulting from event observation or measured phenomena (Liebowitz and Megbolugbe, 2003, Davenport and Prusak, 1998, Alavi and Leidner, 2001, Tuomi, 1999). Usually, data is not meaningful on its own. So, when data is placed in context (Powell and Swart, 2005, Tuomi, 1999, Standards-Australia, 2005), organized and/or given meaning (Davenport and Prusak, 1998) it becomes information where it can be used for decision making (Standards-Australia, 2005). From this, information can be seen as processed or meaningful data (Davenport and Prusak, 1998).

In the literature, there are several different perspectives on the relationship between knowledge and information (Tuomi, 1999, Alavi and Leidner, 2001). Knowledge is seen as more than information. Knowledge is seen as "personalized information"(Alavi and Leidner, 2001), proposed information (Davenport and Prusak, 1998) and/or a conclusion drawn from information (Stewart, 1997). According to Ilkka Tuomi (1999), the above discussion represents the conventional view of the data-information-knowledge relationship which assumes that first we need data to have information and then information is used to generate knowledge. This knowledge could be achieved through learning.

On the other hand, Ilkka Tuomi (1999) proposed an opposite view of the data-information-knowledge relationship. His argument is that it is useful to look at the relationship the other way around. Knowledge is the starting point for information to exist and data comes from information. Moreover, data (or raw data) does not exist and it does not have any meaning unless it has been interpreted and represented in standardized form. So, Tuomi (1999) urges that knowledge exists in the mind of its owner and when it is articulated and structured it becomes information. Then when this information is standardized, it becomes data.

Alavi and Leidner (2001) highlight some important implications of Tuomi's view:

- To have common understanding of data and information between individuals, they must "share a certain knowledge base".
- The significant difference between information systems and knowledge support systems is the user's ability to assign meanings to the stored information and data. This is achieved by capturing some of their knowledge in the system.

2.2.2 Knowledge Types

Scholars have classified knowledge in a variety of ways in order to better comprehend the concept of knowledge. Knowledge is hard to define or categorise (Maqsood, 2006, McNichols, 2008). Nonaka and Peltokorpi (2006) describe knowledge from the perspective of subjective or objective. The subjective knowledge is learned though social interactions. It is constructed socially and held collectively. On the other hand, the objective view of knowledge is a priori perspective knowledge that is independent of any external contribution.

Another classification of knowledge is suggested by Zander and Kogut (1995). They categorise knowledge as declarative knowledge and procedural knowledge. Declarative knowledge is easy to transfer without losing the meaning of it (or in other words information). On the other hand, procedural knowledge refers to the "know-how" knowledge. Also, they classified knowledge into organizational knowledge and individual knowledge. Alavi and Leidner (2001) implies that different perspectives of knowledge help in discovering potential needs for different strategies to manage knowledge.

Categorizing knowledge into Tacit and Explicit is widely accepted within knowledge management literature (Alavi and Leidner, 2001, Nonaka, 1994, Diakoulakis et al., 2004, Freke, 2006, Powell and Swart, 2005). Explicit knowledge is usually represented in the form of reports, patents, databases, manuals and/or documents. This type of knowledge can be captured, codified, articulated and/or documented (Nonaka, 1994, Goh, 2002). However, as Tuomi (1999) said "explicit knowledge is only the tip of the iceberg". Most of the knowledge is tacit knowledge which is the knowledge we don't know that we know (Stewart, 1997) or as Polanyi (1966) described in his work "we know more than we can tell". Figure 2-1 illustrate the iceberg of knowledge.

Tacit knowledge is, commonly, identified as the subconscious knowledge which includes experience, beliefs, values and perspectives. It exists in the minds of the individuals or groups (Freke, 2006). Moreover, tacit knowledge is more challenging to identify, articulate, capture and/or transfer (Goh, 2002, Diakoulakis et al., 2004, Polanyi, 1966). On the other hand, Nonaka (1994) separates tacit knowledge into two elements namely cognitive elements and technical elements. Cognitive elements refer to an individual's mental maps beliefs and viewpoints where the technical elements consist of know-how crafts and skills that apply to specific context.

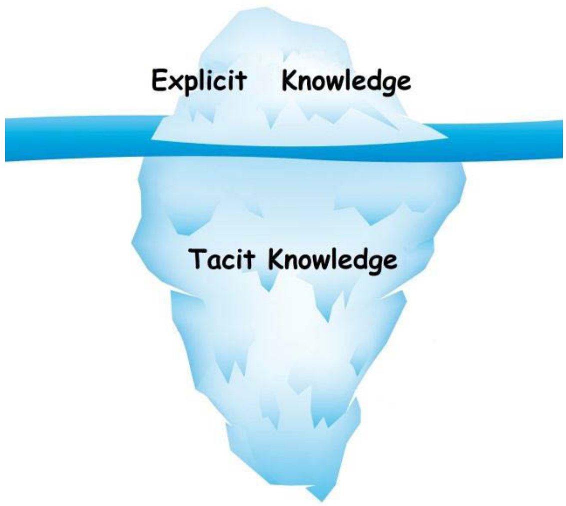


Figure 2-1 Explicit and Tacit Knowledge Iceberg

While explicit knowledge is context-independent, tacit knowledge will lose its meaning if it is abstracted from its context (Stewart, 1997, Swan and Newell, 2000). Nevertheless, tacit and explicit knowledge co-exist (Freke, 2006, Alavi and Leidner, 2001, Hislop, 2002). Tacit knowledge is the background needed to understand and make use of the explicit knowledge. Absence of the common knowledge base among individuals will limit and diminish the use of explicit knowledge (Alavi and Leidner, 2001).

2.2.3 Knowledge Management Definitions

From the early days of mankind, people managed knowledge perhaps unconsciously, in order to survive. The first hunters were almost certainly concerned about the hunting experiences and skills of their fellow hunters. New lessons and experiences were gained and communicated to each other every time they successfully hunted for prey. However, the emergence of Knowledge Management as a discipline came during the early 1980s (Wiig, 1997, Freke, 2006). Knowledge Management has never been an easy subject to describe (Collison and Parcell, 2001) nor been a commonly shared concept (Wiig, 1997). This section will highlight some of the mainstream of KM definitions in the literature. Some of the group of definitions describe Knowledge Management in terms of the expected benefits. For example;

- Knowledge management definition as per KM Standards (Standards-Australia, 2005) "*…a trans-disciplinary approach to improving organizational outcomes and learning, through maximising the use of knowledge….*"

- Debra Arkell (2007) from the Boeing company defines Knowledge Management as "*a disciplined, holistic approach to using expertise effectively for competitive advantage*"

- In the same path, (Freke, 2006) defines Knowledge Management as "*…a systematic effort to share and use organizational knowledge within the organizational context so as to increase organizational performance*"

Others define KM in terms of its activities;

- " *…a systematic process for creating, acquiring, disseminating, leveraging and using knowledge to retain competitive advantage..*" (Nicolas, 2004)
- "*…Knowledge management addresses the generation, representation, storage, transfer, transformation, application, embedding, and protecting of organizational knowledge..*" (Schultze, 1999)
- "*… 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)

Nevertheless, all of these definitions revolve around the idea of Knowledge as an asset that will be used to improve the organizational performance. Another interesting definition comes from Arian World, of Work Frontiers International, (Collison and Parcell, 2001):

> "*it is not about creating an encyclopaedia that captures everything that anybody knows. Rather, it's about keeping track of those who know the recipe, and nurturing the culture and the technology that will get them talking.*"

For the purpose of this research, **Knowledge Management** is defined as the process of retaining employee's knowledge and experience within the boundary of the organization. .

2.2.4 Knowledge Management Theory

By examining the work of Collison and Parcell (2001) and their approach to knowledge management, four main elements for successful Knowledge Management initiatives could be highlighted:

1. Connecting to the *People*, who know-how (or experts), using communities of practice or face to face meetings which facilitates better knowledge sharing prospects.

2. Simple *Processes* that enable knowledge management activities and introduce learning before, during and after the projects or tasks.

3. Enabling *Technology* that facilitates knowledge management activities by providing common infrastructure for knowledge sharing.

4. Knowledge management supporting *Culture*, which can be referring to organizational culture, to promote knowledge management initiatives and induce knowledge sharing traits within the organization.

Figure 2-2 illustrates these elements.

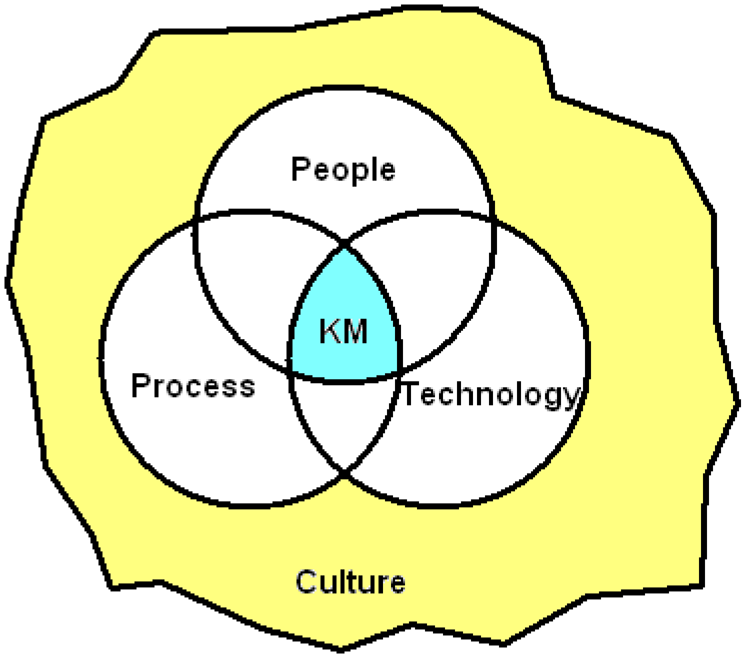


Figure 2-2 People, Process & Technology Model - adapted from (Collison & Parcell 2001)

Proper management of these elements will facilitate the proper execution of Knowledge Management activates within the organization. Collison and Parcell (2001) proposed a knowledge framework. This framework is concerned with the knowledge learning and evolution cycle. Although this framework is a useful model to describe the knowledge development processes throughout a task (or a project), it deals with knowledge as a whole entity. It does not explain the utilization and creating of the two different types of knowledge. A further development of this model, proposed by this study, could be used to explain the process of utilizing and creating the two types of knowledge; tacit and explicit. This new model is described using several steps as follows:

1. The team receive and agree upon a goal (or task). For example, building a house; this may also include the set of requirements and specifications.

2. The knowledge cycle starts when the team starts the task. They should seek and search for a prior experience from someone who did the same task or a similar one (learning before). Then, the team develops their knowledge during the performance of the task (learning during). At the end of the task, they should reflect on their mistakes, successes and lessons learned (learning after).

3. All of the learning activities are connected to a knowledge bank. This Knowledge domain is the combination of the two types of knowledge: explicit and tacit. The explicit type of knowledge is stored in the system in the form of documents, processes, procedures, training manuals…etc. On the other hand, the tacit type of knowledge is acquired by the team members' minds in the form of experience and knowledge.

4. It is important to have a knowledge network, or network of experts, in order to have the knowledgeable and experienced people available and traceable whenever they are needed. This could be utilised during the "learning before" step.

5. It is important to have a supporting culture to accommodate the knowledge sharing activities. This will make or break the system.

The modified version of the Collison and Parcell (2001) model is shown in Figure 2-3.

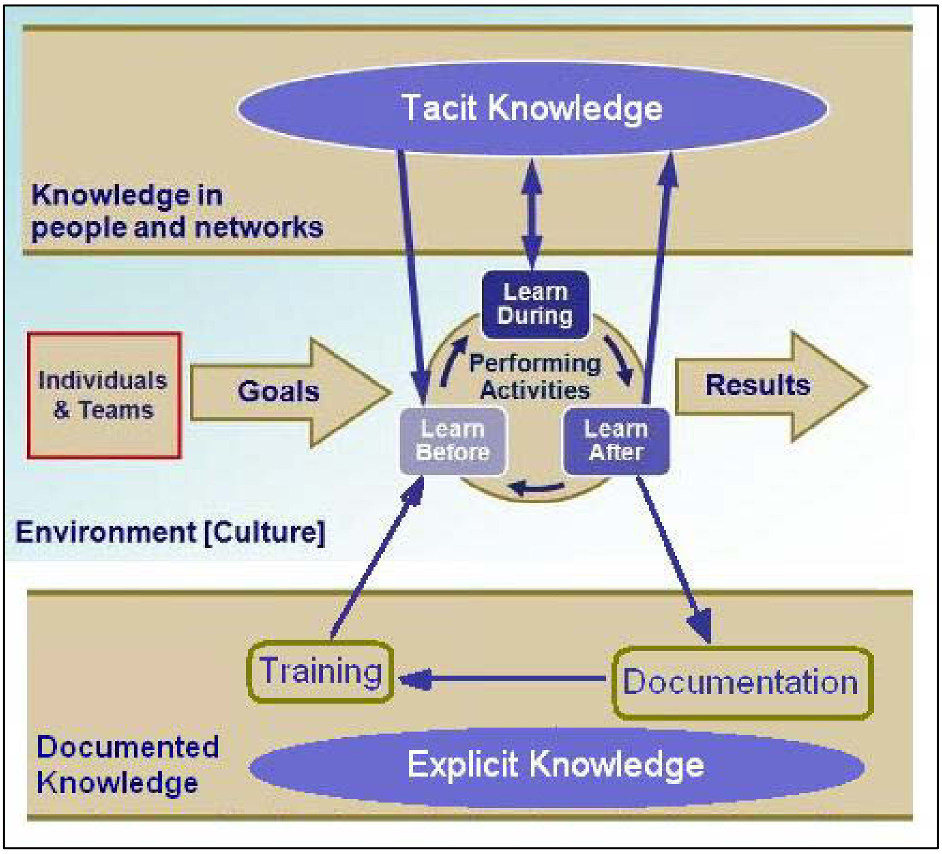


Figure 2-3 Knowledge Development Process adapted from (Collison & Parcell 2001)

Moreover, there are several proposed frameworks for KM activities in the literature. Most of those frameworks explain the knowledge development cycle. One of the frameworks is the Gupta and McDaniel (2002) framework which consists of five processes; harvesting, filtering, configuration, dissemination, and application. Another interesting framework was developed by Wiig (1999). This framework is called the "Institutional Knowledge Evolution Cycle" and consists of five stages:

1. Knowledge Development: through learning – Create Knowledge
2. Knowledge Acquisition: retained for future use – Capture Knowledge

3. Knowledge Refinement: organized and/or put it in written format to allow for further use – Organize Knowledge

4. Knowledge Distribution and Deployment: knowledge being distributed to the people concerned or "point-of-interest (POI)" people – Deploy Knowledge

5. Knowledge Leveraging: application of the knowledge – Apply Knowledge

By examining this framework and comparing it with the Collison and Parcell (2001) framework, strong similarity between the two frameworks could be exhibited. For example, Collison and Parcell's "Learning Before" stage corresponds to Wiig's stage one and two that involve Creating and Capturing knowledge. The unison between the Wiig and the Collison and Parcell framework is illustrated in Figure 2-4 which shows Collison and Parcell's (2001) three learning steps mapped onto the Wiig (1999) "Institutional Knowledge Evolution Cycle".

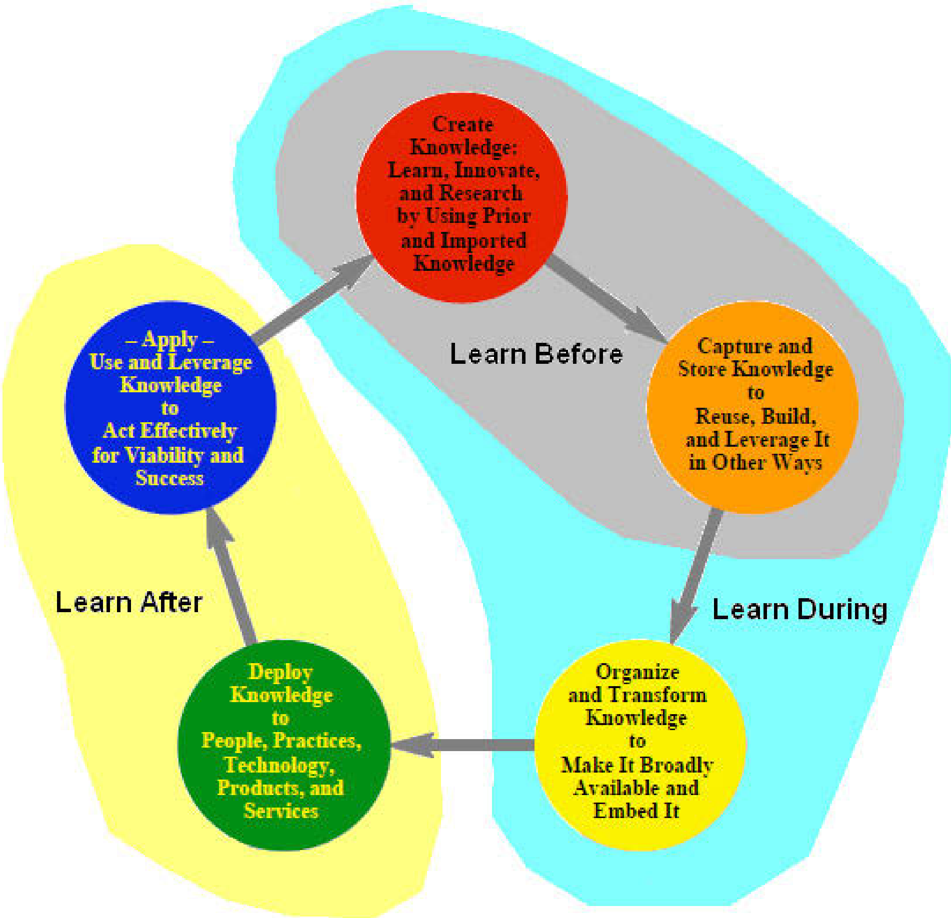


Figure 2-4 Knowledge Development Process Mapped Using Institutional Knowledge Evolution Cycle adapted from (Wiig 1999) and (Collison & Parcell 2001)

2. 3. IT-based Approach versus Operations-Based Approach

Knowledge management literature mostly refers to the solution of KM problems being primarily based on IT tools and systems (Swan et al., 2000a, Freke, 2006). However, in the past, a significant proportion of KM initiatives and projects have failed partly due to their single focus on IT-based solutions (Tsui, 2005, BenMoussa, 2009). A growing number of researchers argue that new approaches are needed to reduce the risk of failure of a KM initiative (Davenport and Glaser, 2002, BenMoussa, 2009, Tsui, 2005, Keen and Tan, 2007). By placing the main focus on IT-based solutions, insufficient attention is given to the other aspects of

KM, such as neglecting the impact of employee's willingness to share their knowledge (Swan et al., 2000b).

According to a study by Edwards, Shaw & Collier (2005), many organizations tend to utilize generic IT tools rather than dedicated IT tools for their KM approaches. This appears to be due to insufficient consideration of contextual situations in the design of those tools. IT solutions should be tailored to carefully consider KM processes and contexts (Freke, 2006).

Successful KM initiatives ought to achieve balance between management leadership, process management and people management supported by IT solutions (Tsui, 2005, Swan et al., 2000a, Freke, 2006, BenMoussa, 2009). Recent research has suggested that leadership, process and people aspects seems to containe the critical success factors for KM initiatives (Tsui, 2005, Allen, 2010, Wong, 2005, Holsapple and Joshi, 2000, Choi, 2000).

One could argue that the current gap between people/process-based KM approaches and IT-based KM approaches is merely a result of different views held by the group of KM practitioners and the group of KM theorists (Al-Mabrouk, 2006, BenMoussa, 2009, Swan et al., 2000b, Zawawi et al., 2010, Choi, 2000). Many researchers view IT-based KM tools as a vehicle for KM initiatives while leadership, process and people management build the foundations (Tsui, 2005, Swan et al., 2000a). Nevertheless, some researchers like Holm et al. (2006) seem to emphasise technology alongside people, process and management as crucial aspects of a successful KM system implementation. This appears to be in conflict with the people, process and leadership point of view. However, Holm et al. (2006) description of the technology aspect could be contained as part of the human, process and management aspects. They appear to focus on the process of utilising and employing the KM IT-system to support the KM activates.

The two different approaches are illustrated in Figure 2-5.

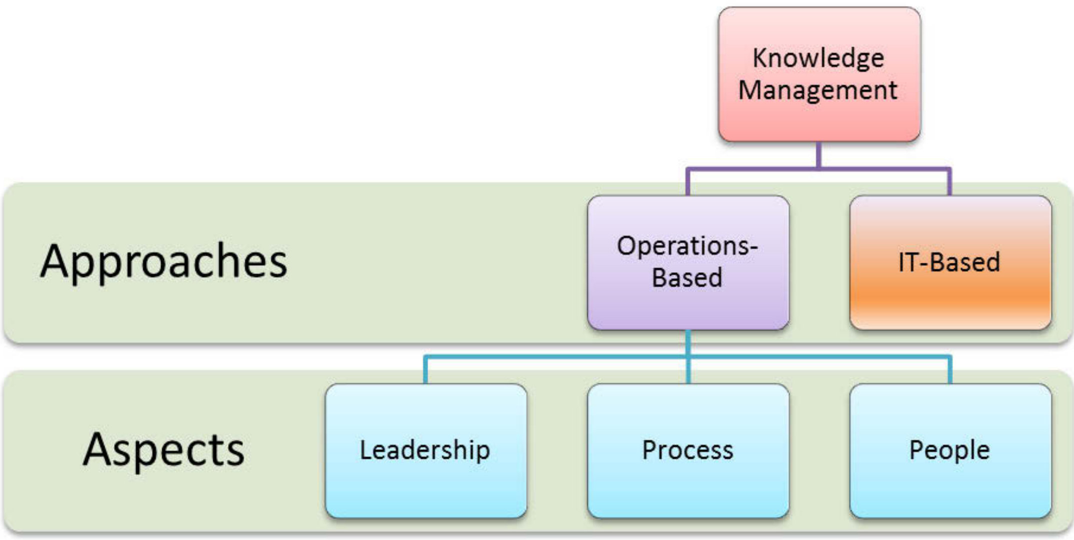


Figure 2-5 Knowledge Management Approaches

2. 4. Guidelines for a Holistic Knowledge Management Framework

The knowledge management (KM) literature review suggests that a holistic KM system incorporates a huge range of topics and perspectives. This highlights the need for a multi-disciplinary KM approach for a deeper understanding of all KM aspects (Kakabadse et al., 2003). These aspects should be considered holistically in the design of KM systems. A sound KM system design must incorporate the leadership, process and people aspects. Accordingly, guidelines for a theoretical Operations-Based Knowledge Management (OBKM) framework are proposed in Figure 2-6 (Zawawi et al., 2010) to facilitate such a design.

Based upon recent operations management system literature (Akpolat, 2010, Pitinanondha, 2008) and business excellence models (Jayamaha et al., 2009), the OBKM framework guidelines consist of three layers: approach to KM, aspects of KM, and the elements of these aspects.

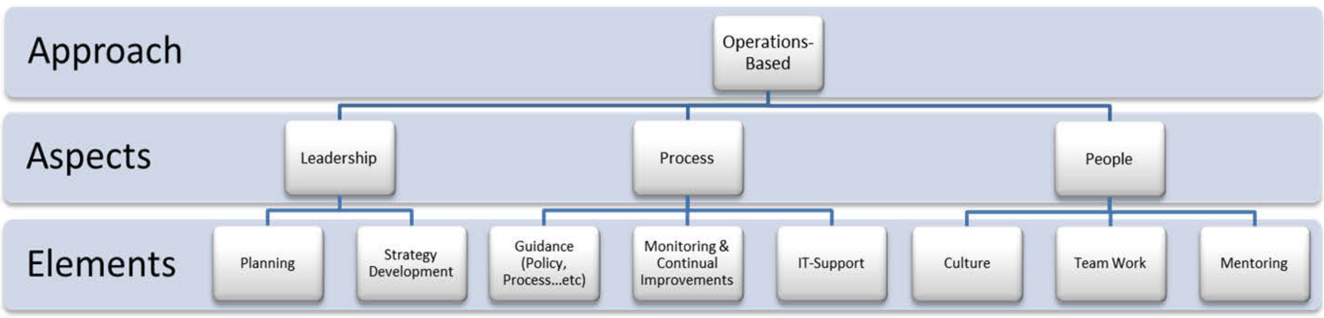


Figure 2-6 Structure Guidelines for OBKM framework

2.4.1 Leadership Aspect

The effect of leadership activities on KM performance has been the focus of recent studies. For example, Politis (2001) suggested that a "Knowledge-Enabled leader" is critical to an effective KM system. Likewise, Allen (2010) identified the effect of the front-line management behaviour on willingness of aircraft engineers to share their tacit knowledge. He found that positive management behaviour (attitude) increased employee's willingness to share their knowledge during situations of job transfer.

This aspect entails the role of management in implementing and supporting KM initiatives. Planning and strategy development are the two main elements in this aspect. Those elements will drive the whole KM system toward business goals. This is achieved by aligning the KM strategies with the business strategies while providing the leadership support.

1. **Planning** management should design and plan the KM initiatives based on the organization goals and needs (Holm et al., 2006). Top management commitment ought to be visible in those plans (Alazmi and Zairi, 2003, Davenport et al., 1998, Liebowitz, 1999). Also, employees' involvement in the plan developing process is essential. In addition, the plans and strategies should be well communicated with the employees to encourage their commitment and realization of the KM initiatives (Choi, 2000, Davenport et al., 1998, Finneran, 1999, Trussler, 1998).

2. **Strategy development** in this element, the relevant strategic actions need to be addressed for implementing and practicing KM initiatives. Moreover, KM strategies should be aligned with the organization strategy (Holm et al., 2006). Thus, the intended product of those initiatives is to achieve the organizational objectives. (Akpolat, 2004)

2.4.2 Process Aspect

Process management has also been of interest in recent research into KM. Tat and Stewart (2007) studied KM implementation processes in the Malaysian Aviation Industry and proposed a model to implement KM in that industry. This model consists of four stages; awareness cultivation, objective definition, strategy adoption and action implementation. Such research suggests that during implementation of KM initiatives, any necessary IT-tools should be designed based on the needs of the KM processes and the context of the KM systems. Without the proper understanding of the current context of the organization and the KM processes, the design of any technology tools to support KM is prone to failure (Holm et al., 2006).

The process management aspect is included to ensure better process management to overcome KM challenges embedded in the organization's systems. Guidance, monitoring and continual improvement, and IT-support systems form the main elements of this aspect.

1. **Guidance** of the KM system is done through policy, procedures and work instructions (Davenport et al., 1998, Wiig, 1996). Guidance is needed to provide the main processes of the KM initiatives. This includes the day to day activities and course of action (Holm et al., 2006).

2. **Monitoring and Continual improvement** are needed to insure that the system operates as expected (Holm et al., 2006, Holsapple and Joshi, 2000). One of the main goals of this element is to monitor performance and perform system maintenance to meet the intended goals and targets.

The system goals can be defined using key performance indicators (Choi, 2000, Holsapple and Joshi, 2000). These indicators are used to plan for system improvement.

3. **IT-support** systems are needed to provide the platform in which the KM activities and processes take place (Holm et al., 2006). The contextually sensitive IT-support systems will serve the main OBKM needs. They should include systems to support explicit and tacit knowledge sharing. Moreover, IT support systems should be tailored to achieve the KM initiatives' goals and objectives (Alazmi and Zairi, 2003, Choi, 2000, Davenport and Prusak, 1998, Holsapple and Joshi, 2000, Manasco, 1999).

2.4.3 People Aspect

KM systems rely for their success on the involvement of, interaction with, and acceptance by people (Holm et al., 2006). Neglecting the people aspect will increase the chances of failure (Harvey and Holdsworth, 2005, Swan et al., 2000a, Choi, 2000). This is evident in the recent increases of the number of researchers focusing on the people aspect of KM systems. McNichols (2008) examined the inter-generational tacit knowledge transfer within the aircraft engineering community and found two major themes that influence the knowledge transfer: (a) the relationship quality between the sender and receiver and (b) the knowledge transfer enabling conditions. She recommended three strategies to maximize aircraft engineering knowledge transfer, consisting of building a knowledge-sharing culture, establishing a mentoring program and initiating team work.

This aspect serves as a mechanism to highlight the OBKM influences and challenges from the perspective of the knowledge sender and receiver. Its elements are culture, teamwork and mentoring, and due consideration of these elements will ensure that the effectiveness of knowledge transfer between aircraft engineers is maximized.(McNichols, 2008)

1. **Culture** is considered one of the main elements that control the KM initiatives' success or failure (Collison and Parcell, 2001, Wiig, 1999). KM initiatives should nurture a knowledge sharing culture between the employees. Their willingness to share their knowledge will increase when they feel emotionally committed to the organizational vision and mission (Holm et al., 2006). Thus, management actions and behaviours need to establish a reason to care between employees (Davenport et al., 1998, Trussler, 1998). Also, they need to cultivate the feeling that employees belong to something bigger than themselves.

2. **Teamwork** is another strategy that management needs to pursue. They should facilitate and encourage a team work environment in the organization (Al-Mabrouk, 2006, Moffett et al., 2003, Wong, 2005). Furthermore, management ought to reward team achievements as well as individual achievements. Working in teams is an effective, and a cheaper, way for employees to share and communicate knowledge.

3. **Mentoring** is an effective way to share employees' knowledge. Management should support a structured mentoring program (Bassi, 1999, Holsapple and Joshi, 2000, Manasco, 1999). This is achieved by providing adequate funding and showing visible dedication to a mentoring program (Choi, 2000).

2. 5. Research Hypotheses

Based on the proposed guidelines for the OBKM framework and the review of the literature, it would appear that previous research studies have not sufficiently examined the effectiveness of a holistic KM approach that incorporate the people, process and leadership aspects. Although, many studies have discussed the critical elements for a successful KM system, none has empirically examined the importance of those elements from the perspective of aircraft engineers. The primary focus of this study is to study the effectiveness of the previously described aspects and elements with regards to the aircraft engineering field.

Several hypotheses were established to be theoretically and empirically examined. This will validate the existence of the proposed elements in an effective operations-based KM system. The hypotheses and rationale for developing each of them is as follows:

Hypothesis 1: There is a significant difference between the importance and practice of a knowledge management system – to test the level of the gap between KM current practices and KM theory.

Hypothesis 2: Strategy development has a positive impact on an effective OBKM system – to examine the importance of this element for a successful OBKM framework.

Hypothesis 3: Planning has a positive impact on an effective OBKM system – to examine the importance of this element for a successful OBKM framework.

Hypothesis 4: Guidance has a positive impact on an effective OBKM system – to examine the importance of this element for a successful OBKM framework.

Hypothesis 5: Monitoring and Continual Improvement have a positive impact on an effective OBKM system– to examine the importance of this element for a successful OBKM framework.

Hypothesis 6: IT-support has a positive impact on an effective OBKM system – to examine the importance of this element for a successful OBKM framework.

Hypothesis 7: Culture has a positive impact on an effective OBKM system – to examine the importance of this element for a successful OBKM framework.

Hypothesis 8: Teamwork has a positive impact on an effective OBKM system – to examine the importance of this element for a successful OBKM framework.

Hypothesis 9: Mentoring has a positive impact on an effective OBKM system – to examine the importance of this element for a successful OBKM framework.

Hypothesis 10: There is a significant interrelationship between the eight critical success factors of the OBKM system – to test the interrelation between each element and the effect of it.

2. 6. Summary

This chapter began by providing a generic background about Knowledge Management (KM) and its concepts. The relationship between data, information and knowledge was discussed along with the two types of knowledge. Explicit knowledge is the codified, documented and easily articulated knowledge while Tacit knowledge is the subconscious knowledge. Knowledge Management was then defined as the process of retaining employee’s knowledge and experience within the organization's boundary. While knowledge management literature focused on the IT-based KM solution, there is a noticeable move toward the holistic KM solution. A holistic Operation-Based Knowledge Management (OBKM) approach was introduced. The OBKM approach consisted of three aspects; leadership, process and people. Guidelines for a holistic OBKM framework were presented. Accordingly, ten research hypotheses were developed to be theoretically and empirically examined to validate the framework.

Chapter 3 Research Methodologies and Plan

3. 1. Introduction

This chapter describes the methodologies employed to carry out this research. Section 3.2 presents the systematic approach which was employed in this research. While section 3.3 discusses the research design and the progress of the framework developments, section 3.4 explains the method of data collection. Section 3.5 provides the details of the method of developing and testing the research hypotheses. Section 3.6 provides details of the framework development methodologies. This contains framework guidelines, convergent interviewing and literature coding analysis. On the other hand, section 3.7 presents testing methodologies of the framework which discusses focus groups and survey. Data analysis methods for preliminary data, hypotheses testing, reliability testing and validity testing are discussed also in section 3.7. Finally, section 3.8 summarizes this chapter

3. 2. Systematic Approach of This Study

The purpose of this section is to describe the systematic approach employed in this study. This approach followed the recommendations and guidelines of Flynn et al. (1990) and Sekaran and Bougie (2009), for empirical research methods in operations management.

The main objective of this research was to develop and validate a framework for better management of knowledge in the aircraft engineering field. Thus, on one hand, the framework development part of the study was carried out using literature review, convergent interviewing, literature analysis and experts focus groups. On the other hand, the framework validation process was in the form of hypotheses testing using quantitative data collected from the research survey. Consequently, in order to achieve the main objective, the following five specific objectives were addressed as mentioned earlier in section 1. 2:

Objective One:	Identify the critical elements of an effective KM system and guidelines for a theoretical OBKM framework based on literature review.
Objective Two:	Identify current managing knowledge practices in the Saudi Arabian aviation industry, especially in the aircraft engineering field.
Objective Three:	Validate the theoretical OBKM guidelines through expanded analysis of literature and develop the theoretical OBKM framework.
Objective Four:	Validate the theoretical framework using feedback obtained from experts in the Saudi Arabian industry and develop a practice-based framework.
Objective Five:	Validate the practice-based framework through an extensive survey in the Saudi Arabian aviation industry.

Hence, this research was carried out in five steps. Each step was intended to achieve one of the objectives. Finally, the integration of the five steps accomplished the main objective of the research.

Figure 3-1 illustrates the research steps, interrelations between the objectives, methodologies/tools and outcomes.

Step 1: This step was the first part of the study. The aim was to identify the critical elements of an effective KM system and develop guidelines for a theoretical OBKM framework (objective 1). Thus, an extensive literature review was utilised as a research tool for this step. The outcome was the formation of a set of guidelines for a theoretical OBKM framework discussed in chapter 2 of this dissertation (Figure 2-6).

Step 2: The goal of this step was to identify current KM practices in the Saudi Arabian aviation industry (objective 2). This includes the KM awareness, KM perception and KM culture among aircraft engineers in the Saudi Arabian aviation industry. The tool used was convergent interviewing. Several interviews with senior aircraft engineers were performed and the result was a preliminary understanding of the current practices (Zawawi et al., 2010). A detailed description of this tool is provided in section 3.6. Also, the current practices will be discussed later in chapter 4, section 4.2. This preliminary understanding was supported by the results from the industry wide survey implemented in step 5 of the research.

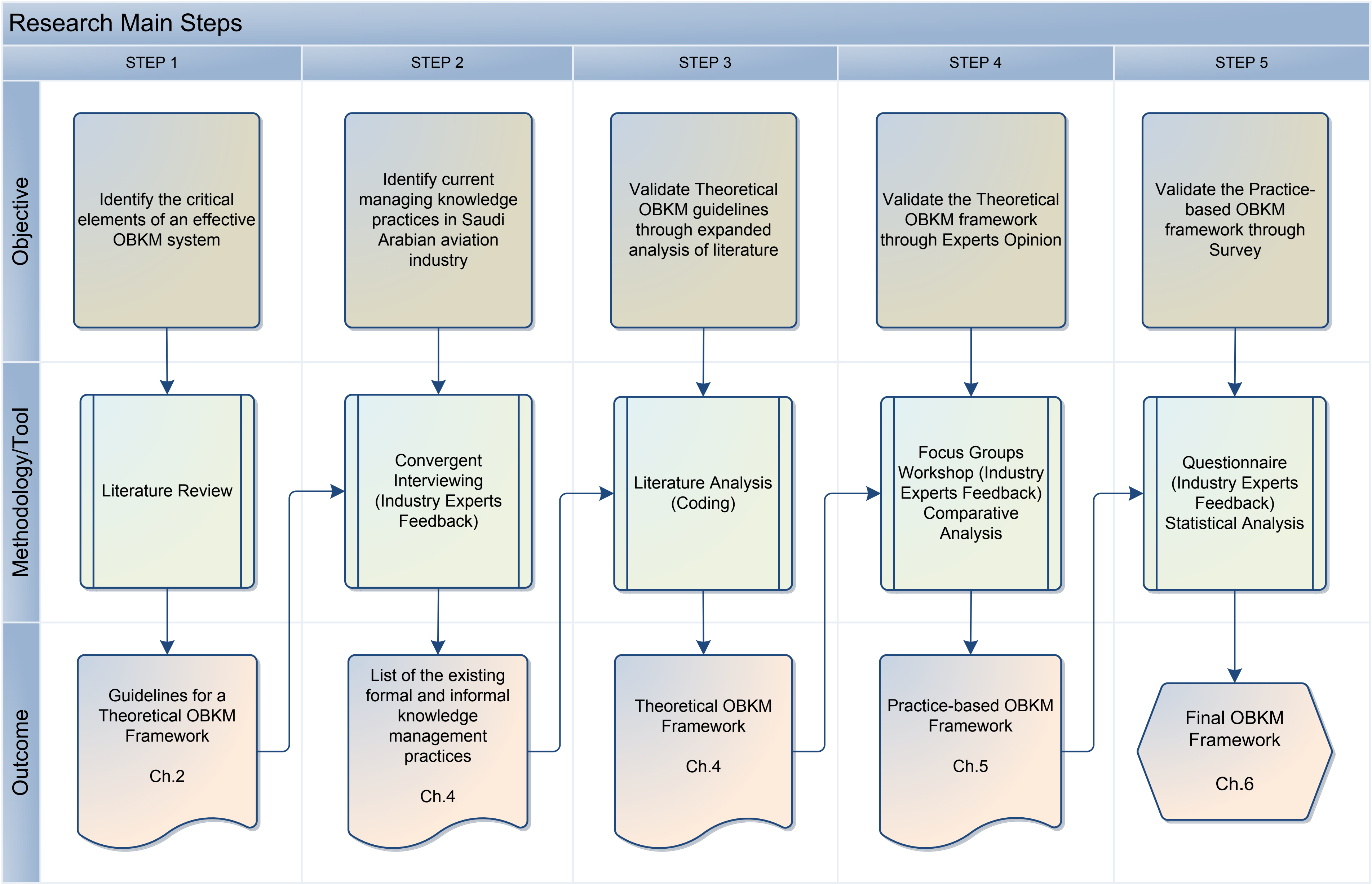


Figure 3-1 Research Methodology

Step 3: Here, the aim was to validate the theoretical OBKM guidelines and to develop the theoretical OBKM framework (objective 3). To develop this theoretical framework, the guidelines (or framework elements) developed in step 1 were further analysed. The analysis involved defining each element in terms of the theoretical critical success factors (CSF) that follow the same theme as the element. These CSF are obtained from literature and represent the critical factors for an effective implementation of a KM system. After that, the scores of the number of times this CSF was mentioned in the literature were utilised to further develop the OBKM framework. Detailed explanation of the analysis is discussed later in section 3.6 while the results and outcome of this step are elaborated in chapter 4.

Step 4: This step represents the qualitative data collection and analysis. Here, the theoretical OBKM framework is validated to develop the practice-based framework (objective 4). The methodology employed in this step involved using focus groups. Several focus groups were organized in the Saudi Arabian aviation industry and were attended by aircraft engineering experts. The goal was to obtain the critical success factors for an effective implementation of a KM system from the industry experts' point of view. Then, a similar analysis to the one used in step 3 was developed to study the focus groups statements (i.e. practice-based CSF). Detailed explanation of the analysis is discussed later in section 3.6. The outcome of this step is the practice-based OBKM framework. Chapter 5 gives a detailed elaboration of this framework.

Step 5: This step reflects the quantitative data collection and analysis. The objective was to validate the practice-based OBKM framework to obtain the final framework (Objective 5). The methodology used was an industry wide survey. Next, an extensive statistical analysis of the data collected was performed to validate each of the framework elements. Moreover, this analysis was utilised in testing the research hypotheses. Detailed explanation of the data analysis methodology is discussed later in section 3.6 while the outcomes will be discussed in chapter 6.

3. 3. Research Design and Evolution of OBKM Framework

This section provides the rationale for selecting the research methodologies. The selection is mainly driven by the research objectives which form the evolution stages of the OBKM framework. Several research instruments were employed in this study:

1- Qualitative data collection and analysis instruments (literature review, convergent interviewing and focus groups workshops)

2- Quantitative data collection and analysis instruments (literature analysis and research survey).

An easier way to explain the rational of the methodology design and selection is by using the framework evolution stages. The research objectives provide the needs while the instruments provide the means to produce the framework results. These stages are illustrated in Figure 3-2.

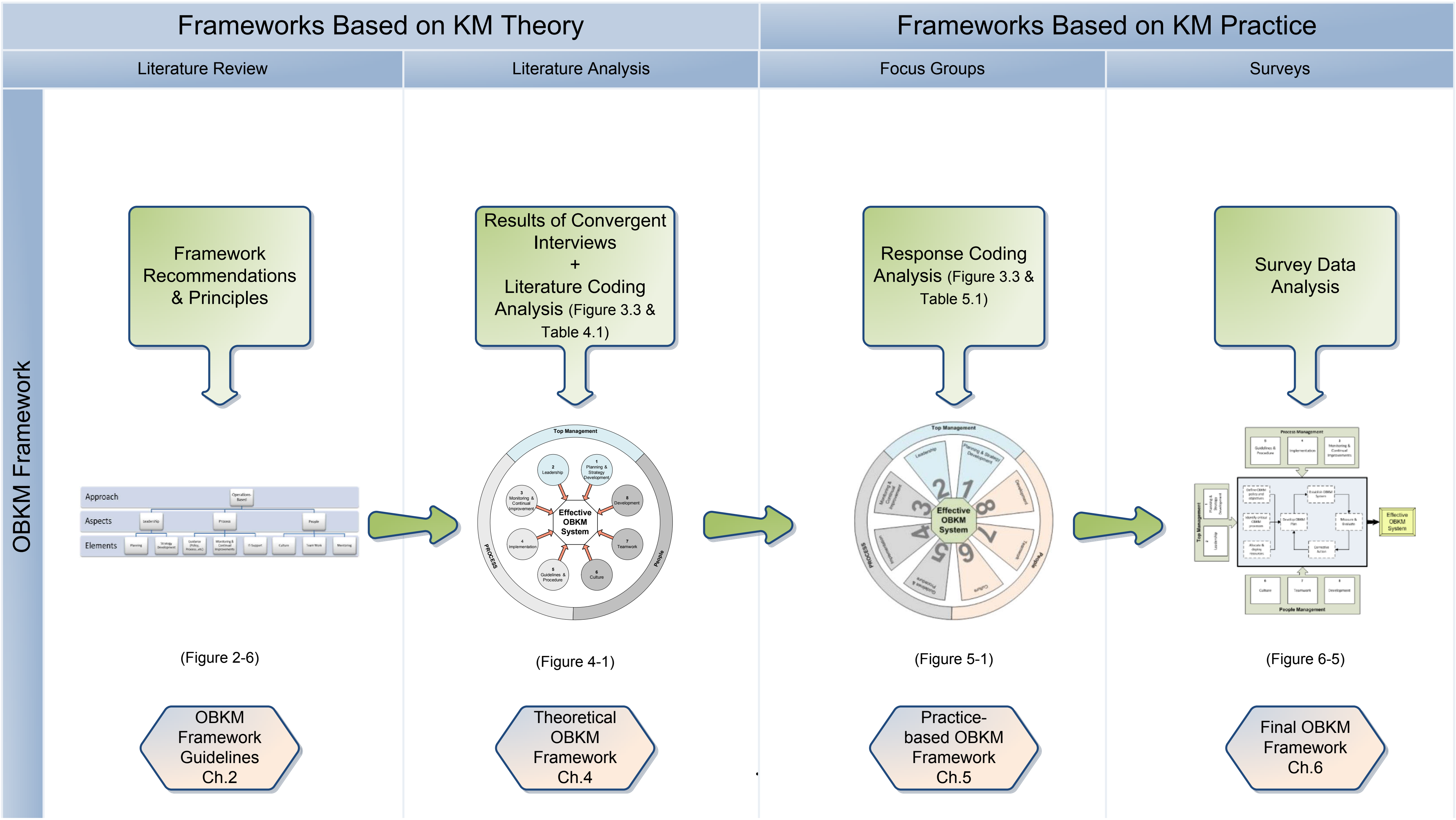


Figure 3-2 OBKM Framework Evolution

Guidelines for OBKM Framework:

Convergent interviewing is a qualitative technique used to gather qualitative information about the current knowledge management practices in the industry. After several convergent interviews with aircraft engineering experts in the industry, a general idea of the problem situation was formed. Moreover, the need for the study became clearly apparent after those interviews. The results of those interviews assisted in designing the research steps.

An extensive literature review was performed to explore the available solutions to the identified gap in KM in the Saudi Arabian aviation industry. This review uncovered a gap in the literature with regards to a holistic KM system that incorporates the people, process and management aspects of the system. Moreover, the focus in the KM literature on the IT-solutions seems to be another gap. Thus, by adapting and integrating the different KM theories, guidelines for a holistic KM framework were developed. These were proposed as guidelines for an Operations-Based Knowledge Management (OBKM) framework. These guidelines became the foundation of the framework development. Preliminary research hypotheses were developed.

Theoretical OBKM Framework:

The guidelines described above consisted of eight elements. The importance of the proposed eight guidelines needed to be validated based on the KM theorists' point of view. Hence, the Literature Analysis method was developed. It consisted of coding statements of the theoretical CSF and grouping these codes under each corresponding element. Next, scores of each code were calculated and evaluated against each other to develop a theoretical OBKM framework (discussed in chapter 4). A detailed description of the analysis method is described in section 3.6.

Practice-based OBKM Framework:

Based on the findings of the convergent interviews, the level of knowledge management awareness amongst aircraft engineers was considerably low and, at the same time, there was no common agreement on what the intentions and objectives of the knowledge management should be. As a consequence, it was decided that a workshop would provide an excellent opportunity to establish a common understanding about KM within the context of the engineering knowledge and at the same time capture data from the industry experts. Thus, a knowledge management seminar became the first part of the workshop in order to increase the participants' level of awareness. The second part of the workshop consisted of the formation of several focus groups which aimed to identify the critical success factors of the OBKM framework from the practitioners' point of view (Gottschalk, 2002). Details of the workshop and focus groups will be discussed in section 3.6. Similar to the theoretical CSF, the practice CSF were coded and scores were calculated. A practice-based OBKM framework was developed by comparing the theoretical CSF and the practice CSF. Thus, validating the theoretical framework resulted in the development of the practice framework. Research hypotheses were modified accordingly. The practice-based OBKM framework is discussed in chapter 5.

Final OBKM Framework:

Elements of the practice framework were used in designing the survey constructs and questions. The survey aimed to obtain quantitative data from industry wide participants. The questionnaire was chosen for this research because it is a convenient and inexpensive tool that covers a wider range of participants (Sekaran and Bougie, 2009, Cooper and Emory, 1995). Moreover, the questionnaire method helps in increasing information accuracy due to the greater anonymity (Kumar, 2010) and is favoured by participants for its ease and convenience (Sekaran and Bougie, 2009). A web-based survey was used in this research since it is generally yields a higher response rate compared to other survey techniques (Sekaran and Bougie, 2009). Analysis of the questionnaire data helped in testing the research hypotheses and, at the same time, validated the framework. At the end, the final OBKM framework was developed. Details of the survey technique used in this research will be discussed in section 3.6 while the final framework will be discussed in chapter 6.

3. 4. Data Collection Requirements

Due to the fact that knowledge management in the Saudi Arabian aviation industry is merely incidental and not due to any deliberate focus on knowledge management (Zawawi et al., 2010), data collection in this research was mainly primary data collection (Sekaran and Bougie, 2009). As stated earlier, this study is an empirical research which employs both qualitative and quantitative data collection and analysis techniques.

To understand in-depth detailed description of the problem in hand or the phenomena being studied, researchers generally use qualitative research methods (Silverman, 2010). Although qualitative methods provide a wealth of detailed information from a small number of cases, any more general conclusions are only propositions (hypotheses) that need to be supported (Kumar, 2010). On the other hand, quantitative research methods can then be used to seek empirical support for such research hypotheses. They provide a structured method which allows the researchers to scientifically quantify the extent of the problem or phenomena being studied. Scientific analyses of the quantitative data present fairly reliable generalizations and hypotheses testings (Sekaran and Bougie, 2009, Kumar, 2010).

Based on the research objectives, qualitative methods (convergent interviewing and focus groups) were used to explore knowledge management problems in the aircraft engineering field. The results were used to develop the quantitative methods (survey). Consequently, the survey was used to test the research hypotheses.

3. 5. Method of Developing and Testing Research Hypotheses

According to the KM literature review, it would appear that the previous research studies have either not provided or insufficiently provided a holistic KM system. The primary purpose of this research was to incorporate all the critical success factors related to the success of a KM system using an operations-based approach. It was called an Operations-Based Knowledge Management (OBKM) framework.

Eight guidelines elements for the theoretical OBKM framework were identified from the literature review. Preliminary research hypotheses were developed based on these elements; however the research hypotheses were revised according to the practice-based OBKM framework elements. This study has empirically examined the effects of these eight elements for the OBKM system implementation.

In each hypothesis, one of the framework elements was proposed to have a positive impact on an effective OBKM system. Also, it is proposed that there is a significant difference between the current practices and the perceived importance in the OBKM system. Finally, a significant interrelationship among all the elements of the framework was proposed in the final hypothesis.

The statistical data analysis was performed using IBM SPSS Statistical software version 20. Sekaran and Bougie (2009) and Forza (2002) guidelines for statistical data analysis were employed. Descriptive statistics (e.g. mean, standard deviation and frequency distribution) were used for the preliminary data analysis. Then, parametric testing, including t-test and Pearson correlations, were utilised for research hypotheses testings. The t-test was used to examine if there was any significant difference in the means of the two groups. On the other hand, the Pearson correlation test was used to investigate if there was any relationship (positive/negative) between the two variables. For these tests to achieve their purpose, the measurement instrument must be reliable and valid. Thus, reliability and validity testings of the research instrument were performed.

3. 6. Methods of Developing and Testing OBKM Framework

This section describes each of the methodologies used during the research project. While the methodologies were described in this section, results of each of the methodologies were discussed during frameworks development chapters.

3.6.1. Framework Recommendations and Principals

One of the findings of the extensive KM literature review is the need for a comprehensive framework which incorporates three main aspects of management systems (top management, process management and people management). Meeting this need for such a framework is becoming crucial for the successfulness of a KM system. Thus, by adopting the concepts of the operations management systems, quality management systems and business excellence, several guidelines for framework elements were developed to capture the whole span of the KM system elements spectrum. Each of the elements was grouped into the aspects that follow the same theme. These guidelines became the foundation of the framework development.

3.6.2. Convergent Interviewing

Convergent interviewing is a qualitative technique that can be used to gather information. Although it has many uses, it is most valuable when there is some doubt about the information which needs to be collected. Also, if it is the intention to use surveys to collect information, convergent interviewing can help decide what questions to ask in the survey. Convergent interview technique involves face-to-face interviews while leaving much of the questions unstructured to allow for further exploration and understanding of the topic. This technique is valuable for under-research areas (Rao and Perry, 2003). Several convergent interviews were performed with several aircraft engineering experts in the industry, to explore the research topic and the level of knowledge management awareness and current practice in the industry. Appendix 1 shows some of the interview notes.

3.6.3. Literature Coding Analysis

In the third research step, the proposed guidelines for OBKM framework were further developed and validated through an expanded review of KM literature and detailed analysis of the framework elements. This yielded the theoretical OBKM framework elements. The verification process is shown in Figure 3-3 and consisted of several steps. Major studies in the KM critical success factors were used in this analysis. More than twenty recent studies in the field of knowledge management CSF were included in this study. After studying these papers, it is felt that a comprehensive range of research ideas has been obtained, ideas are being repeated and including extra studies will not add to the findings of this research.

The methodology of analysing the framework elements was adopted from Sekaran and Bougie(2009). Figure 3-3 depicts this analysis methodology which consists of the following activities:

- Summarizing the statements provided by KM scholars and industry experts
- Coding the statements using codes developed before examining the data, i.e. a priori codes.
- Identifying and removing outliers using a data cleansing procedure (Hernández and Stolfo, 1998).
- Grouping the codes into elements of the OBKM framework.

Each set of the critical success factors affecting KM implementation were summarized into statements. Those statements were then coded using 23 a priori codes. Table 3-1 shows the framework elements and corresponding codes. This method has been employed again during analysis of the focus groups data.

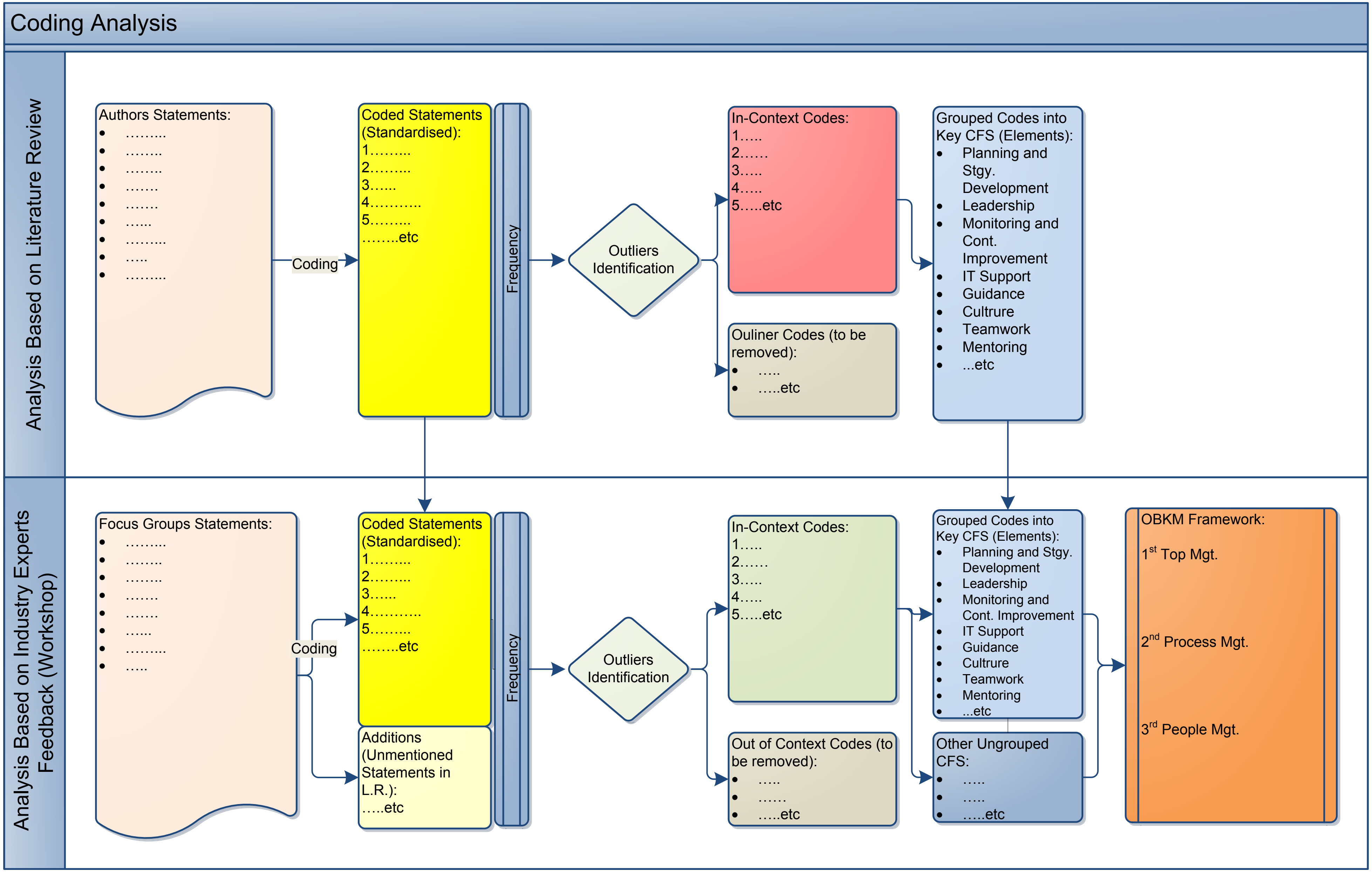


Figure 3-3 Coding Analysis (Used for Theoretical and Practice-Based frameworks)

Table 3.1 OBKM Framework Elements and A Priori Codes

OBKM Aspects	Framework Elements	A Priori Codes
Top Management	1-Planning and Strategy Development	Knowledge Policy &Strategy
		Resources Allocation & Planning Management
		Strategy Alignment
	2-Leadership	Commitment
		Support
Process Management	3-Monitoring and Continual Improvement	Measuring & Audit
		Control
		Continual Improvement
	4-Implementation	IT-Tools
		Managing Change
		Organization Infrastructure
	5-Guidelines & Procedure	Knowledge Identification & Architecture
		Procedure
People Management	6-Culture	Organizational Culture
		Knowledge Sharing Friendly Culture
	7-Teamwork	Trust& Transparency
		Communication
		Sharing Knowledge
	8- Development	Training, Education & Motivation
		Rewards & Recognition

3.6.4. Focus Groups

Since the proposed theoretical OBKM framework is an amalgamation of the theoretical critical KM success factors, it needs to be tested and validated. It was decided that an empirical verification process in the form of a workshop (focus groups) should be designed to capture data from the experts inside and outside the relevant industry (Gottschalk, 2002). This has been achieved through qualitative data collection (focus groups). These focus groups were attended by aircraft engineers and managers employed within the Saudi Arabian aviation industry and their responses were analysed and reflected against the theoretical OBKM framework. This section discusses the focus group's workshop conducted within the Saudi Arabian aircraft engineering division.

The workshop which consisted of 10 focus groups was aimed to introduce the participants to the concepts of KM. At the same time, the workshop helped the researcher to establish a better view of the current knowledge management practice within the Saudi Arabian aviation industry. Due to the fact that knowledge management appears to be immature in the Saudi Arabian aviation industry and there is no common perception about knowledge management among the aircraft engineers (Zawawi et al., 2010), the workshops provided an excellent opportunity to establish a common understanding about knowledge management within the context of engineering. The main objectives of the workshop were:

- Introducing knowledge management concepts to the aircraft engineering industry.
- Raising the awareness of the importance of engineering knowledge to the organizations and the potential risk of losing it.
- Reaching a common perception of the meaning of knowledge and knowledge management.
- Determining the current (formal or informal) knowledge management practices.

- Identifying the challenges and success factors of implementation of knowledge management systems.

The workshop consisted of two parts; a knowledge management seminar and focus groups. The knowledge management seminar provided an introductory background about the problem of the diminishing aircraft engineering knowledge, knowledge management concepts and tools, and the Operation-Based Knowledge Management (OBKM) concepts. Additional details are provided in Appendix 2.

In the second part of the workshop, 10 focus groups were formed to discuss and identify the critical success factors of knowledge management systems. Using David Morgan's guidelines and concepts (Morgan, 1997) for focus groups, each group was asked two questions:

1. What are the critical/important things that will make the implementation of a knowledge management system successful?
2. What are the typical things that usually make the implementation of a knowledge management system difficult?

The first question refers to the success factors for the knowledge management systems while the second question refers to the challenges. Each group recorded and presented their inputs. Responses were reviewed and further analysed based on their explanation during the groups' presentations. As the research progressed core ideas and themes emerged.

The theoretical OBKM framework represents knowledge management theorists' perception of the critical success factors affecting KM system implementation. The ideas gained from the workshop were incorporated into the theoretical framework and the result of this process was a practice-based OBKM framework. As depicted in Figure 3-3 of section 3.6.3, the same methodology (Sekaran and Bougie, 2009) was also used to analyse the industry experts' feedback obtained from focus groups. This verification process consists of several steps, statements summarizing and coding, outlier analysis and grouping analysis. This analysis yielded the practice-based OBKM framework shown later in chapter 5.

3.6.5. Survey

The practice-based OBKM framework had to be validated by incorporating perceptions from an industry wide survey. While this section describes the survey implementation method, chapter 6 shows detailed analysis and results of the data gathered from the survey.

Population

Cooper and Emory (1995) indicated that the targeted population could be determined from the research problem and objectives. In this research, the targeted population is the aircraft engineers working in organizations operating in the civil aviation industry in Saudi Arabia. The General Authority of Civil Aviation (GACA) in Saudi Arabia listed 90 approved organizations (GACA, 2003). Only five of those organizations are based in Saudi Arabia and are still in operation. Through direct communication with the human resources departments of those organizations, the total number of aircraft engineers working in the Saudi Arabian civil industry was found to be 137 engineers (at the time of the research). As stated earlier, this industry was mainly dominated by one organization. Around half of the Saudi Arabian aircraft engineers are employed within this organization. The rest of the organizations employ from 10 to 30 engineers each. Thus, due to the small population of aircraft engineers, it was decided to include the whole population rather than sampling (Sekaran and Bougie, 2009).

Questionnaire Development

In an empirical research, development of a proper and reliable questionnaire is one of the main tasks. Suitable wording of the questions, appropriate content, proper sequencing of the questions and level of sophistication are some of the main areas to be addressed in questionnaire development (Sekaran and Bougie, 2009, Fowler Jr, 2008). The development of this questionnaire was influenced by guidelines of the management research and explicitly in the area of operations management (Flynn et al., 1990, Forza, 2002, Sekaran and Bougie, 2009, Pitinanondha, 2008). However, the design of the research questionnaire was driven by the theoretical constructs of this study. The survey questionnaire used in this research consisted of two main sections, Section A, general personal and organizational information and Section B, knowledge management current practices and importance. Appendix 3 shows screen images of the web-based survey.

Section A: General (Organizational and Personal Information)

This section consisted of questions related to general background information of the respondents and their organizations. Those questions were designed to capture the level of experience of the respondents, their organization's field of work and their level of knowledge management familiarity. In addition, this section aimed to explore the respondents' opinion with regards to the overall effectiveness of the current knowledge management activities.

Section B: Knowledge Management Current Practices and Importance

This section consisted of 33 statements divided into three topics, Top Management, Process Management and People Management. Those statements were designed to capture the respondents' perceptions of the OBKM system factors applicability in their organizations and their opinions with regards to the importance of those factors for the successful implementation of the OBKM system. Those statements were developed based on the A Priori codes and eight critical success factors established from the focus groups' results. Respondents were asked to rate each statement on a five point 'Likert Scale'.

- For the first rating, under the 'IN MY ORGANIZATION' part, the respondents were asked to give an extent to which they agree that the statement applies to their organization. The scale ranged from (1) 'Strongly Disagree' to (5) 'Strongly Agree'.
- For the second rating, under 'IMPORTANCE', they were asked to rate the extent to which they agree that the statement reflects what is important to

the success of managing knowledge activities. The scale ranged from (1) ‘Not important at all’ to (5) ‘Vital’

Pilot Testing

Sekaran and Bougie (2009) urge that pilot testing of the questionnaire be conducted to ensure the feasibility of the research instrument scale. Thus, copies of the questionnaire were distributed to three Saudi Arabian aviation industry experts and two copies to University of Technology Sydney academics to pilot test the survey questionnaire. They were asked to assess and comment on the questionnaire in several areas. Those areas were, structure, ease of understanding, pre-existing knowledge requirement, level of technicality, confidentiality issues and length of the questionnaire. Feedback given from the assessors was used to modify and improve the questionnaire.

The main highlighted issues were the wording used which needed to be clarified and the level of difficulty of the statements. While several statements were rewritten, some statements were explained in a simpler way. Another issue raised by one of the industry experts was the technicality of the statements. However, the official language used in the aviation industry in Saudi Arabia is English. Acting on the industry expert’s suggestion, Arabic translated statements were added under the English statements. The translation was done by an accredited translator from the National Accreditation Authority for Translators and Interpreters (NAATI). A copy of the translated questionnaire is shown in Appendix 3.

Ethics Approval

In order to meet Commonwealth legislative requirements in Australia, The University of Technology Sydney (UTS) requires that all research studies involving human subjects must have written approval from the UTS Human Research Ethics Committee (HREC). Thus, a completed application form was forwarded to the UTS HREC for approval. The written approval was issued without any modification to the research activities. A copy of the HREC approval letter is shown in Appendix 4.

Web-Based Survey

Emails containing the URL link of the online survey were mailed to the five organizations identified in the Saudi Arabian aviation industry. The emails were directed to the Aircraft Engineering managements in those organizations. They contained a brief description of the research goals and objectives, purpose of the research, intended use of the data collected, and researcher's contact information. Copy of the email is shown in Appendix 5.

Response Rate Improvement

Initially, a total of 16 (11.7%) completed questionnaires were received. For this type of research an 11% response rate is considered low and mitigating actions could increase the rate. A recent research by Baruch and Holtom (2008) suggested that a benchmark of 35-40% response rate for the online survey is acceptable in organizational research.

It was consistently reported that follow-ups for the contacts is the most effective and powerful technique in increasing the response rate (Deutskens et al., 2004, Dillman, 2000, Heberlein and Baumgartner, 1978, Schaefer and Dillman, 1998, Yammarino et al., 1991). While Dillman (2000) suggested sending four follow-ups to the participants, this should be done with care. On the other hand, Solomon (2001) urges that sending multiple follow-ups will have a diminishing return. Decreased quality of the responses and causing annoyance to potential participants are some of the diverse effects of the repeated follow-ups. Another aspect of increasing the response rate is the timing of the follow-up. Dillman (2000) recommends that the optimum first follow-up should be after one week. However, some urge that there is no significant difference between the early and the late follow-up (Deutskens et al., 2004).

Consequently, the first follow-up telephone calls and emails to the organization's aircraft engineering managers were sent after one week. This improved the response rate to 25.5% (35 questionnaires). Additionally, another set of follow-up emails were sent after two weeks. As the weeks progressed, the total number of respondents increased to 48 which is equivalent to a 35 % response rate.

3.7. Survey Data Analysis Methods

This section presents the statistical data analysis methodologies used to analyse the data gathered by the research survey. This includes hypotheses testing methods, reliability testing and validity testing.

3.7.1 Hypotheses Testing

The statistical data analysis was performed using IBM SPSS Statistical software version 20. Sekaran and Bougie (2009) and Forza (2002) guidelines for statistical data analysis were employed. Descriptive statistics (e.g. mean, standard deviation and frequency distribution) were used for the preliminary data analysis. Then, parametric testing, including t-test and Pearson correlations, were utilised for research hypotheses testings. The t-test was used to examine if there was any significant difference in the means of the two groups. On the other hand, the Pearson correlation test was used to investigate if there was any relationship (positive/negative) between the two variables. For these tests to achieve their purpose, the measurement instrument must be reliable and valid. Thus, reliability and validity testings of the research instrument were performed.

3.7.2 Reliability Testing

According to Sekaran and Bougie (2009), reliability of the research instrument refers to the stability and consistency with which the instrument measures the concept and helps to assess the accuracy of a measurement. There are two types of measures used for assessing reliability, stability of measures and internal consistency measures (Cooper and Emory, 1995, Sekaran and Bougie, 2009). The internal consistency of measures was used in this research.

a) Stability of Measures

Stability of measures refers to the ability of the research instrument to measure the same results over time. Two methods to test stability of the research instrument are the test-retest method and parallel-form reliability. The test-retest method measures the consistency of the results by repetition of the same measure applied to the same respondent over time. However, the parallel-form (or alternative) method measures the consistency between the results of two sets of equivalent measures applied to the same respondents over time.

b) Internal Consistency of Measures

The internal consistency method measures the consistency between the variables as a set, and the individual variables all capable of measuring the same construct. Sekaran and Bougie (2009) point out that Cronbach's Coefficient Alpha is the most popular measure for the internal consistency method. Cronbach's Coefficient Alpha is a reliability measure that ranges from 0 to 1. High internal consistency should have values of a coefficient alpha greater than 0.7 (Sekaran and Bougie, 2009, Hair et al., 1998).

Cronbach's Coefficient Alpha is most widely used for reliability testing among researchers and it was employed in this research. A value of 0.7 or above is considered adequate for the purpose of this research.

3.7.3 Validity Testing

Validity refers to the extent to which an instrument correctly measures the intended research concept. Validity testing can be grouped into three types of tests; Content Validity, Construct Validity and Criterion-Related Validity (Sekaran and Bougie, 2009). All of the three tests were utilised in this research.

a) Content Validity

Testing for content validity examines the extent to which the instrument measures the entire domain of the constructs of interest. This is a subjective evaluation of the instrument and cannot be measured numerically. A panel of judges (experts) could evaluate the content validity of the research instrument (Sekaran and Bougie, 2009). The content validity of this research was evaluated in several stages; extensive literature review, industry experts focus groups, and pilot testing by academics and experts.

b) Construct Validity

To test for construct validity is to test to what extent the instrument measures what it is designed to measure and to test that proper identification of the dependent and independent variables were included in the study. Convergent validity and discriminant validity are the two types of construct validity. Convergent validity is established when there is a high correlation between two instruments measuring the same concept while discriminant validity is established when the instrument empirically finds that two variables that are supposed to be unrelated are, in fact, unrelated (Sekaran and Bougie, 2009). This was achieved in this research by using the principle component factor analysis. Data reduction procedure using SPSS was performed for the items of each factor separately. An item loading value of 0.3 or above is adequate for convergent validity while an eigenvalue of 1.0 is adequate for discriminant validity.

c) Criterion-Related Validity

Criterion-Related validity tests the power of the instrument to predict the differentiated variables that are known to be different. In this study, the criterion-related validity was achieved by using multiple regression analysis to determine whether the OBKM critical success factors were related to an effective OBKM system. The independent variables were the respondents' input 'practice data' while the dependant variables were the means of the 'importance data' for each respondent. The multiple correlation coefficient 'r' can range from -1 to +1 where -1 indicates a negative (reverse) relationship, 0 indicates no relationship and +1 indicates a positive relationship (Hair et al., 1998).

3.8. Summary

This chapter has presented the research methodologies of this study. The research methodology was structured into five stages, establish theoretical foundation, preliminary data collection to identify current practices, literature analysis, qualitative data collection and analysis (focus groups), and quantitative data collection and analysis (survey). Based on the research objectives, this research is an empirical research built on a theoretical foundation. This research involved several primary data collection stages to gather as much information as possible due to the fact that the knowledge management in the Saudi Arabian aviation industry is rarely mentioned in the literature. Also, it included several theory validation processes. A combination of qualitative and quantitative data collection methods was used for the data collection.

Qualitative data collection was carried out in the form of convergent interviewing and followed by several focus groups attended by aircraft engineering experts from the Saudi Arabian aviation industry. On the other hand, quantitative data collection was carried out using a general survey. Results from the focus groups were used to develop the survey. A web-based questionnaire survey was chosen to collect data from a wide range of aircraft engineers in the industry. Due to the small size of the aircraft engineering population, it was decided to involve all the population in the survey rather than sampling. A pilot study was carried out to ensure the feasibility of the research instrument and test the reliability of the scale. Written ethical approval was obtained. Emails containing the URL link of the online survey were mailed to the five organizations identified in the Saudi Arabian aviation industry. Follow-up telephone calls and emails to the organization's aircraft engineering managers were sent to increase the response rate. Finally, the procedures for preliminary data analysis, testing the hypotheses and testing the goodness of the data were described in greater details in the chapter.

Chapter 4 Theoretical OBKM Framework

4.1 Introduction

This chapter describes the development process of the theoretical OBKM framework. Section 4.2 presents the results of the convergent interviews in the form of KM current practices. Section 4.3 describes the theoretical guidelines used in developing the framework which was obtained from the literature review. While section 4.4 discusses the development of the theoretical OBKM framework, section 4.5 explains the meanings of the eight elements of the framework. Finally, section 4.6 summarizes this chapter

4.2 KM Current Practices in Saudi Arabian Aviation Industry

This section represents the results of the convergent interviews performed at one of the organizations in the Saudi Arabian aviation industry. The results of those interviews assisted in discovering the problem in the industry (the gap) and helped in designing the research steps. Appendix 1 shows some of the convergent interview notes.

KM Awareness

As in other countries, the Saudi Arabian aviation industry faces the challenges of an aging work force. There is an increasing awareness that this will cause a problem due to a widening skills gap and knowledge loss. However, this does not seem to be complemented by the awareness that knowledge management concepts and methods may help mitigate the negative impact on the organization of such issues. Furthermore, knowledge management is mostly confused with information management. This appears to be the result of insufficient understanding of the KM concepts. More importantly, it is becoming increasingly apparent that the aviation industry has failed to implement systems to successfully source, capture and share aircraft engineering knowledge. Consequently, sources of aircraft engineering knowledge are less obvious and, at the same time, the importance of the engineering knowledge as a competitive advantage less apparent.

KM Perception

While there is insubstantial awareness of the KM concepts in the industry, it is commonly believed that knowledge management is beneficial for the industry. The perceived benefits of better knowledge management include:

- Reduction of aircraft maintenance downtimes through knowledge sharing. Engineers will have broader knowledge base to perform their tasks and as a result the time needed to accomplish the task will be reduced.
- Reduction or elimination of silo behaviour in handling expert knowledge. Consequently, this will mitigate the impact of experts retiring.
- Reduction of the learning curve of a new graduate or recruit to fully function as an aircraft engineer.

KM Culture

The aviation industry is a highly regulated industry. The industry follows rigorous guidelines for data recording and reporting of any maintenance action, incident and accident (Harvey and Holdsworth, 2005, Shaw and Smith, 2003) to ensure the airworthiness of aircrafts and for monitoring the quality of the outcome. This data is required to be accurate and readily available and accessible to operators, engineers and maintainers (Harvey and Holdsworth, 2005). Therefore, every organization in the industry needs to have systems to manage and distribute this recorded (explicit) knowledge.

In the Saudi Arabian aviation industry, such explicit knowledge is managed by IT systems which keep records and store aircraft engineering documentation. It is widely accepted that aircraft engineering explicit knowledge is relatively well managed in the aviation industry. In contrast, aircraft engineering tacit knowledge management seems to be relatively underdeveloped. The learning environment in the aviation industry, especially between aircraft engineers, depends on a mentor-apprentice relationship or “tribal learning” (Shaw and Smith, 2003). This unique learning behaviour where engineers learn tacit knowledge through experimenting, i.e. by following and imitating experienced engineers, “the tribal elders” (Shaw and Smith, 2003) is also called on-the-job training. The absence of a senior engineer may disrupt the whole process and will increase the learning cost and time of such training. Rehiring retired engineering experts, for instance, as consultants is a reactive practice to mitigate the problem.

As described by Collison and Parcell (2001), a knowledge sharing culture is a focal point in KM initiatives. In the Saudi Arabian aviation industry, it seems to be a norm to reward individual performance rather than team performance. This imposes a challenge to promoting a knowledge sharing culture. Another challenge is due to the wide-spread perception in the industry that knowledge is a source of power. Thus, sharing knowledge means sharing power.

Finally, there are some additional points relevant to the consideration of KM culture in the industry. For example, like many other industries the Saudi Arabian aviation industry is a male-dominated culture. Perception of KM initiatives and systems by different genders may impose some challenges. For instance according to Ong and Lai (2006), male and female employees may perceive e-learning systems differently. Consequently, any research must consider such possible gender-based difference mechanisms.

Summary

From the above discussion it can be concluded that knowledge management appears to be immature in the Saudi Arabian aviation industry. Moreover, aircraft engineering knowledge seems to be implicitly managed, in a more or less ad hoc manner. Through a comparison of the current practices in the industry and KM theories, the following gaps were identified:

- The level of knowledge management awareness among aircraft engineers is low.

- There is a perception that KM is beneficial. However, there is no common agreement on what are the KM intentions and objectives ought to be.
- The current modest KM practices, where they exist, are merely incidental to everyday operations, and not due to any deliberate focus on knowledge management.

4.3 Theoretical Guidelines for OBKM Framework

The extensive knowledge management (KM) literature review presented in Chapter 2 suggests that a holistic KM system incorporates a very large range of topics and perspectives. The review of the KM literature leads to the understanding that in the knowledge management literature, most KM solutions appear to focus primarily on IT-based tools and systems. Moreover, it seems that the current gap between IT-based KM approaches and people/process-based KM approaches is merely the result of different views held by the group of KM practitioners and KM theorists

The above discussion highlights the need for a multi-disciplinary KM approach for a deeper understanding of all KM aspects. These aspects should be considered holistically in the design of KM systems. A sound KM system design must incorporate the leadership, process and people aspects. Accordingly, guidelines of the theoretical Operations-Based Knowledge Management (OBKM) framework were proposed to facilitate such a design. Based upon recent operations management system literature (Akpolat, 2010, Pitinanondha, 2008) and business excellence models (Jayamaha et al., 2009), this approach consists of three layers: approaches to KM, aspects of KM, and the eight elements of these aspects.

One of the main characteristics of this framework is that it is operations-based and supported by IT solutions. It aims to overcome the current gap (identified in the literature review) between IT-based KM approaches and people/process-based KM approaches by creating a balance between leadership, process and people management.

4.4 The Theoretical OBKM Framework

In the next research step of this research, the proposed theoretical guidelines for OBKM framework were further developed and validated through an expanded review of KM literature and detailed analysis of the framework elements. This yielded the theoretical OBKM framework elements. The methodology was explained in details in section 3.6.3.

The literature coding analysis results led to the identification of four additional codes (inductive codes), viz. Marketing, KM Influences, KM Coordination and Macro-Environment. These four inductive codes, however, could not be added to any of the eight elements. Also the four inductive codes appear driven by the contextual content of the studies.

Since these codes had a very low frequency of occurrence and were irrelevant to the focus of this research they have been removed based on the process of data cleansing (Hernández and Stolfo, 1998). For example, Al-Mabrouk (2006) mentioned Marketing as a critical success factor of KM systems. Within the studied references, he is unique in his view of marketing activities having a direct impact on KM system success. The identified codes in section 3.6.3 were grouped into eight key elements taking into account the framework guidelines.

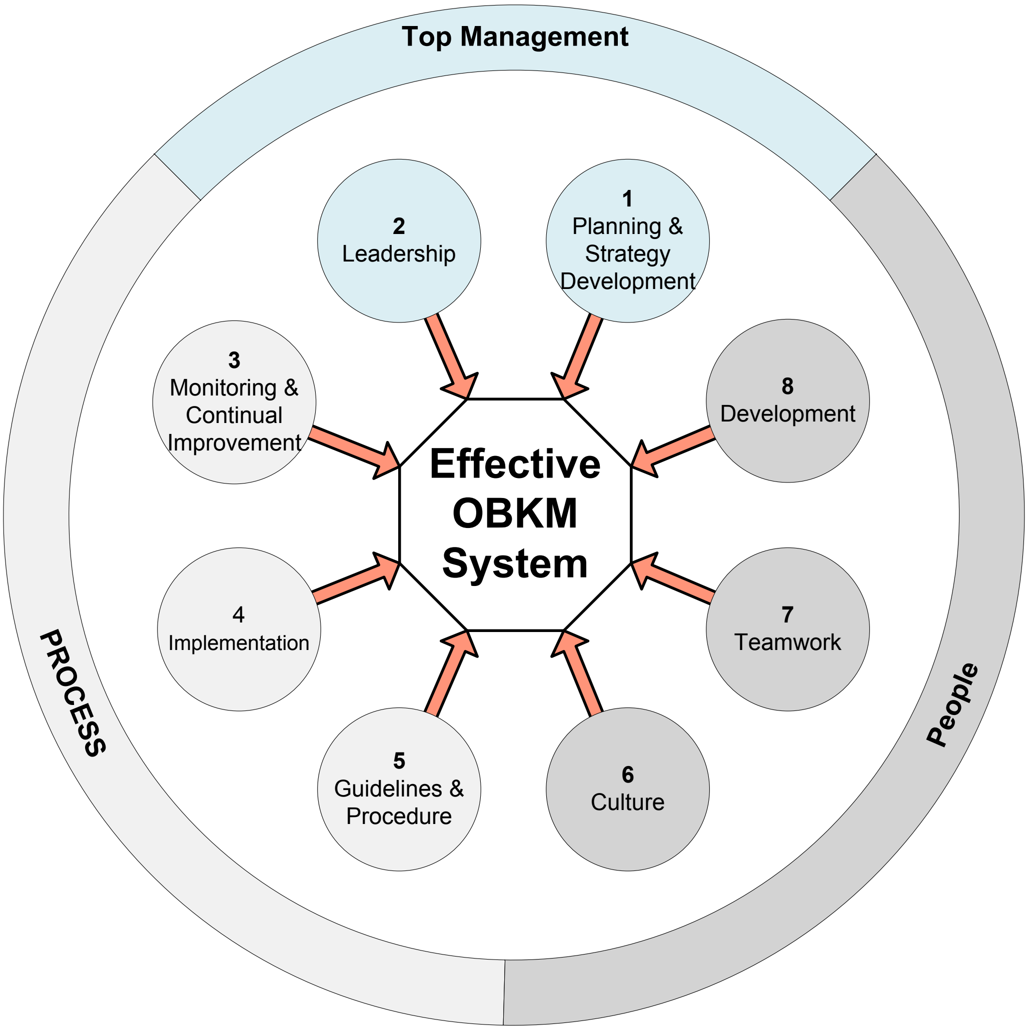


Figure 4-1 Theoretical OBKM Framework

The guidelines elements were modified according to the findings of this analysis. The "Planning" and "Strategy Development" elements were merged into one element. Moreover, a new "Leadership" element was introduced. Also, instead of

“IT-Support” as a separate element, a more general “Implementation” element was introduced which incorporates the IT-Infrastructure, Managing Change and Organization-Infrastructure codes. Finally, “Mentoring” element was modified to “Development” to included training, education, mentoring, and rewards and recognitions. The remaining codes were directly grouped into the rest of the elements. Figure 4-1 depicts these elements in the theoretical OBKM framework.

Table 4.1 shows the frequency occurrence of each element in the KM literature. Accordingly, two points were noted:

I. All of the eight (elements) were considered important by the scholars. However, the *“2-Leadership”, “3- Monitoring and Continual Improvement”, 7-Teamwork”* and *“8-Development”* elements are considered the least important elements for the successful implementation of a KM system.

II. During the analysis, it was found that Information Technology (IT) was the highest mentioned element. This supports the argument that most KM literature appears to focus primarily on IT-based tools and systems, and largely ignores the other aspects of KM (Zawawi et al., 2010).

Table 4.1 Theoretical Framework Analysis

References	1- Planning and Strategy Development	2- Leadership	3- Monitoring and Continual Improvement	4-Implementation	5- Guidelines & Procedure	6-Culture	7- Teamwork	8- Development
Wiig (1996)	•		•	•	•			
Davenport et al. (1998)	•	•		•	•	•	•	•
Davenport &Prusak (1998)		•		•	•	•	•	•
Morey (1998)			•	•	•			
Trussler (1998)	•	•		•	•	•	•	•
Finneran (1999)					•	•	•	
Liebowitz (1999)	•	•		•	•	•		•
Manasco (1999)	•		•	•	•		•	
Bassi (1999)	•				•		•	•
Choi (2000)		•	•	•	•	•	•	•
Skyrme (1997)	•	•	•	•	•	•	•	
Skyrme&Amidon (1997)	•	•		•	•	•		•
Heisig (2001)	•	•			•	•	•	
Alazmi&Zairi (2003)	•	•		•	•	•		
Alkhavan et al.(2006)	•	•	•	•	•	•	•	•
Alkhavan et al.(2009)	•		•	•	•	•	•	•
Wong (2005)	•	•	•	•	•	•	•	•
Al-Mabrouk (2006)	•	•	•	•	•	•	•	•
Holsapple& Joshi (2000)	•	•	•					
Hasanali (2002)	•	•	•	•	•	•		
Mathi (2004)	•	•	•	•	•	•		
Moffett et al. (2003)	•			•	•	•	•	•
Tobin (2003)	•			•		•		•
No. of References to **Each Element**	**19**	15	12	**19**	**21**	**18**	14	13

(Appendix 6 shows detailed Table)

4.5 Elements of the Theoretical OBKM Framework

The coding analysis of the literature led to the modification of the framework guidelines. As a result, eight new elements were proposed. Theoretical critical success factors from KM literature were grouped and categorised under those modified elements where those elements represent the proposed theoretical critical success factors of this study.

4.5.1 Planning and Strategy Development

Planning is the critical and core process of thinking, forecasting and managing the activities required to achieve desired goals. Akpolat (2004) argues that the strategic alignment of plans to business strategies is one of the major concerns for organizations to achieve their set of goals.

For a successful KM system implementation organizations should have a defined and documented policy for managing knowledge and should view managing knowledge as a critical tool in managing the organization's business processes (Davenport et al., 1998, Manasco, 1999, Skyrme and Amidon, 1997, Heisig, 2001, Wong, 2005, Al-Mabrouk, 2006, Holsapple and Joshi, 2000, Mathi, 2004, Moffett et al., 2003). Moreover, policy for managing knowledge should be understood, implemented and maintained at all levels of the organization (Wiig, 1996, Bassi, 1999, Alazmi and Zairi, 2003, Akhavan et al., 2006, Tobin, 2003). Top management should prepare a well-defined plan and provide adequate resources for the implementation of managing knowledge activities (Liebowitz, 1999, Skyrme, 1997, Akhavan et al., 2009, Wong, 2005, Al-Mabrouk, 2006, Holsapple and Joshi, 2000, Hasanali, 2002). Objectives for managing organizational knowledge should be tied to the business objectives (Davenport et al., 1998, Skyrme, 1997, Skyrme and Amidon, 1997). Finally, KM activities are included in the overall business strategy (Trussler, 1998, Liebowitz, 1999, Heisig, 2001, Tobin, 2003).

The codes and the associated concepts corresponding to this element are:

1- Knowledge Policy & Strategy: this code is associated with following concepts:

   i. KM is viewed as a critical tool in managing organization's business processes.

   ii. The organization has a defined and documented KM policy.

   iii. KM policy is understood, implemented and maintained at all levels of the organization.

2- Resources Allocation & Planning Management this code is associated with following concepts:

   i. Top Management has a well-defined plan for KM system implementation.

   ii. Top management provides adequate resources for KM activities.

3- Strategy Alignment this code is associated with following concepts:

    i. KM objectives are tied to the business objectives.

    ii. KM strategies are included in the overall business strategy.

4.5.2 Leadership

Leadership is the ability of individuals to influence and support others to accomplish desired goals or targets (Chemers and Ayman, 1993). Top management commitment is essential to the success of managing knowledge initiatives (Davenport and Prusak, 1998, Trussler, 1998, Choi, 2000, Alazmi and Zairi, 2003, Akhavan et al., 2006, Holsapple and Joshi, 2000). While top management should drive and champion management of knowledge across the organization (Davenport et al., 1998, Liebowitz, 1999, Skyrme, 1997, Skyrme and Amidon, 1997, Akhavan et al., 2006, Wong, 2005, Al-Mabrouk, 2006, Hasanali, 2002), they should encourage and facilitate knowledge sharing between the employees (Davenport et al., 1998, Trussler, 1998, Skyrme, 1997, Heisig, 2001, Akhavan et al., 2006, Wong, 2005). This could be done by embracing the latest management theories and principles (Liebowitz, 1999, Choi, 2000, Holsapple and Joshi, 2000, Mathi, 2004).

The codes and the associated concepts corresponding to this element are:

1- Commitment this code is associated with following concepts:

   i. Top management is committed to the success of KM initiatives.

   ii. Management strives to use the latest management theory and principles.

2- Support this code is associated with following concepts:

   i. Top management drives and champions KM across the organization.

   ii. Sharing Knowledge between the employees is encouraged and facilitated by top management.

4.5.3 Monitoring and Continual Improvement

Monitoring and continual improvement of a system ensures all the system processes perform as expected (Flynn et al., 1990). Monitoring and continual improvement is considered by many as a critical success factor for a successful KM system (Wiig, 1996). Therefore, key performance metrics for KM should be identified and used to plan for improvement (Morey, 1998, Choi, 2000, Skyrme, 1997, Wong, 2005, Al-Mabrouk, 2006, Holsapple and Joshi, 2000, Hasanali, 2002, Mathi, 2004). Also, organizations should identify KM standards and should address any gaps with the current practices (Akhavan et al., 2009, Holsapple and

Joshi, 2000). These standards should be regularly reviewed against global best practices (Choi, 2000, Akhavan et al., 2009). Finally, Achievement of KM objectives should be assessed regularly (Manasco, 1999, Skyrme, 1997, Akhavan et al., 2006).

The codes and the associated concepts corresponding to this element are:

1- Measuring & Audit this code is associated with following concepts:

   i. Key performance metrics for KM are identified and used.

   ii. Achievement of KM objectives is assessed regularly.

2- Control this code is associated with following concepts:

   i. KM standards are identified and used.

   ii. Gaps between organization's KM practices and organization's KM standards are addressed.

3- Continual Improvement this code is associated with following concepts:

   i. Organization's KM standards are regularly reviewed against global best practices.

   ii. KM performance results are used to plan improvements in KM.

4.5.4 Implementation

Organizations should implement the established KM system plan. During the implementation process, organizations should develop adequate and effective IT-tools for managing knowledge which is considered essential for a successful KM system (Akhavan et al., 2009, Alazmi and Zairi, 2003, Al-Mabrouk, 2006, Choi, 2000, Davenport et al., 1998, Davenport and Prusak, 1998, Hasanali, 2002, Liebowitz, 1999, Manasco, 1999, Mathi, 2004, Moffett et al., 2003, Morey, 1998, Skyrme, 1997, Skyrme and Amidon, 1997, Trussler, 1998, Wiig, 1996, Wong, 2005). Also, input from staff should be sought for any proposed changes to KM practices (Choi, 2000, Tobin, 2003). Moreover, organizational structure and facilities (physical and non-physical) should be adequate and effective for KM in the organization (Akhavan et al., 2009, Alazmi and Zairi, 2003, Al-Mabrouk, 2006, Choi, 2000, Davenport and Prusak, 1998, Manasco, 1999, Trussler, 1998, Wong, 2005).

The codes and the associated concepts corresponding to this element are:

1- IT-Tools this code is associated with following concept:

   i. IT-tools for managing knowledge are adequate and effective.

2- Managing Change this code is associated with following concept:

   i. Input from staff is sought for the proposed changes to KM practices.

3- Organization Infrastructure this code is associated with following concept:

    i. Organizational structure and facilities (physical and non-physical) are adequate and effective for managing knowledge in the organization.

4.5.5 Guidelines and Procedure

A guideline is a statement put forward to set a standard or determine a course of action while a procedure is a set of commands that shows how to accomplish a task. Guidelines and procedure element is considered as a critical success factor of a KM system. Thus, KM procedures should be integrated and embedded into the organizational management systems (Akhavan et al., 2006, Al-Mabrouk, 2006, Bassi, 1999, Hasanali, 2002, Manasco, 1999, Mathi, 2004, Skyrme, 1997, Wong, 2005) taking into consideration where employee's knowledge and experiences from one area is useful in other areas in the workplace (Akhavan et al., 2006, Alazmi and Zairi, 2003, Choi, 2000, Davenport et al., 1998, Davenport and Prusak, 1998, Finneran, 1999, Skyrme, 1997, Skyrme and Amidon, 1997, Trussler, 1998). Also, there should be well established procedures for identifying and managing useful knowledge (Akhavan et al., 2009, Akhavan et al., 2006, Alazmi and Zairi, 2003, Davenport and Prusak, 1998, Heisig, 2001, Liebowitz, 1999, Manasco, 1999, Moffett et al., 2003, Morey, 1998, Skyrme, 1997, Trussler, 1998, Wiig, 1996).

The codes and the associated concepts corresponding to this element are:

1- Knowledge Identification & Architecture this code is associated with following concept:

    i. Employees knowledge and experiences from one area is useful in other areas in the workplace.

2- Procedure this code is associated with following concepts:

    i. There are well established procedures to for identifying and managing useful knowledge.

    ii. Knowledge Management procedures are integrated and embedded into the organizational management systems.

4.5.6 Culture

Culture refers to the cumulative deposit of knowledge, experience, beliefs, values, attitudes, meanings, roles, relations, concepts of the universe, and material objects and possessions acquired by a group of people in the course of generations through individual and group striving. Nelson and Quick (2006) define organizational culture as "the pattern of basic assumptions that are considered valid and that are taught to new members as the way to perceive, think, and feel in the organization". Organizational culture where employees are supportive of KM practices is essential to the successful OBKM system (Akhavan et al., 2009, Akhavan et al., 2006, Alazmi and Zairi, 2003, Al-Mabrouk, 2006, Choi, 2000, Davenport et al., 1998, Davenport and Prusak, 1998, Finneran, 1999, Hasanali, 2002, Heisig, 2001, Liebowitz, 1999, Mathi, 2004, Moffett et al., 2003, Skyrme, 1997, Skyrme and Amidon, 1997, Tobin, 2003, Trussler, 1998, Wong, 2005).

The codes and the associated concepts corresponding to this element are:

1- Organizational Culture this code is associated with following concepts:

   i. Organizational culture is key to sharing knowledge between employees.

   ii. Unfair workload distribution prevents knowledge sharing between employees.

2- Knowledge Sharing Friendly Culture this code is associated with following concept:

   i. Employees are supportive of KM practices.

4.5.7 Teamwork

Teamwork is the combined action of a group of people working together to achieve a goal. Good teamwork is essential for a successful KM system (Choi, 2000, Wong, 2005, Moffett et al., 2003). Sharing knowledge between team members helps organizational learning and retains knowledge (Davenport and Prusak, 1998, Finneran, 1999, Bassi, 1999, Akhavan et al., 2006). Moreover, trust and transparency (Davenport and Prusak, 1998, Akhavan et al., 2006), and good communication (Davenport et al., 1998, Trussler, 1998, Manasco, 1999, Skyrme, 1997, Akhavan et al., 2006) between team members is crucial to knowledge sharing.

The codes and the associated concepts corresponding to this element are:

1- Trust & Transparency this code is associated with following concept:

   i. Trust and Transparency is essential to knowledge sharing.

2- Communication this code is associated with following concept:

   i. Good communication within teams is key for knowledge sharing.

3- Sharing Knowledge this code is associated with following concept:

   i. Sharing knowledge between team members is helping organizational learning and retains knowledge.

4.5.8 Development

Proper human resources development is considered vital for the successful KM system (Akhavan et al., 2009, Wong, 2005, Moffett et al., 2003). Thus, for a successful KM system, knowledge sharing, training and education should be part of staff development programs (Davenport and Prusak, 1998, Trussler, 1998, Bassi, 1999, Choi, 2000, Skyrme and Amidon, 1997, Akhavan et al., 2006, Wong, 2005, Al-Mabrouk, 2006, Tobin, 2003). Also, a mentoring system (i.e. On The Job Training) is considered one of the effective tools for retaining knowledge in organizations (Peyman et al., 2006, Shaw and Smith, 2003). Moreover, a well-established rewards and sanctions system related to knowledge sharing practices is essential (Davenport et al., 1998). Furthermore, knowledge sharing related performance should be part of the staff appraisal and performance management system (Trussler, 1998, Liebowitz, 1999).

The codes and the associated concepts corresponding to this element are:

1- Training, Education & Motivation this code is associated with following concepts:

    i. KM training and education is part of staff development program.

    ii. Mentoring system (i.e. On The Job Training) is an effective tool for retaining knowledge in organization.

2- Rewards & Recognition this code is associated with following concepts:

    i. Rewards and sanctions for knowledge sharing practices are well established.

ii. KM related performance is part of staff appraisal and performance management system.

4.6 Summary

This chapter introduced the result of integrating the OBKM framework guidelines obtained from literature review along with the result of the coding analysis of the KM critical success factors literature. This led to the development of the theoretical OBKM framework. This framework consisted of three aspects and eight elements. The elements are, Planning and Strategy Development, Leadership, Monitoring and Continual Improvement, Implementation, Guidance and Procedure, Culture, Teamwork and Development. This framework became the base framework for the rest of the study.

Chapter 5 Practice-based OBKM Framework

5.1 Introduction

This chapter discusses the development processes of the practice-based OBKM framework based on the coding analysis of the focus groups results. Section 5.2 presents focus groups implementation and analysis. In addition, section 5.3 introduces the resulting practice-based OBKM framework. Accordingly, the modified hypotheses are depicted in section 5.4. Finally, section 5.5 summarizes this chapter

5.2 Focus Groups Implementation

Since the proposed OBKM framework is a theoretical exposé of the critical KM success factors, it needs to be tested and validated. It was decided that an empirical verification process in the form of a workshop (focus groups) should be designed to capture data from the experts inside and outside the relevant industry (Gottschalk, 2002). This has been achieved through qualitative data collection (focus groups). Focus groups results were analysed and reflected against the proposed theoretical OBKM framework. These focus groups were attended by 63 aircraft engineers and managers employed within the Saudi Arabian aviation industry. This section discusses the data analysis and results of the KM focus groups workshop conducted within the Saudi Arabian Aircraft Engineering Division while the methodology of the data analysis was discussed in Chapter 3.

The statements gathered by the authors during the Knowledge Management Workshop were coded using the theoretical a priori codes shown in Table 3.1. During the examination of the focus group's responses, some statements were found that did not fit into the pre-developed codes. As a result, they were coded using inductive codes (i.e. new codes). Some of those additions were removed during the data cleansing process.

While some of these additional codes were outliers, four of them provided valuable insight into the industry experts' perception of the critical success factors of KM systems. These codes were:

1- Career Development

2- Fair Workload

3- Adequate Manpower

4- Adequate Top Management

During the focus groups presentations, there was some emphasis on these codes. For example, more than half of the groups mentioned *Adequate Manpower* as a critical success factor of KM systems. Further investigation into these new codes was needed.

Table 5.1 shows the frequencies of occurrence of the eight framework elements in the focus groups responses. The results of Table 5.1 seemed to correspond with the theoretical framework (Table 4.1). Based on the number of references to each element, all of the elements seemed to be equally important except for the "3-

Monitoring and Continual Improvement". This element was the least important in the experts' feedback. This was probably due to the fact that most of the attendees were technical and hands-on employees who did not perceive monitoring and continual improvement as important as the top management perceived it. They were probably more concerned with the daily tasks and deadlines.

Table 5.1 Practice-based Framework Analysis

Experts Groups	1- Planning and Strategy Development	2- Leadership	3- Monitoring and Continual Improvement	4-Implementation	5- Guidelines & Procedure	6-Culture	7- Teamwork	8- Development
Group 1	•	•		•	•	•	•	•
Group 2	•			•		•	•	•
Group 3	•	•	•	•	•	•	•	•
Group 4	•	•	•	•	•	•		•
Group 5		•		•	•	•	•	•
Group 6	•	•	•	•	•	•	•	•
Group 7	•	•		•	•	•	•	
Group 8	•	•	•	•	•	•	•	•
Group 9	•			•	•	•	•	•
Group 10	•	•	•	•	•	•	•	•
No. of References to **Each Element**	**9**	**8**	5	**10**	**9**	**10**	**9**	**9**

(Appendix 7 shows detailed table)

Industry experts' focus groups provided some valuable critical success factors that are rarely mentioned in KM literature. The four additional codes identified earlier gave a valuable insight into the industry experts' perceptions. These codes were Career Development, Fair Workload, Adequate Manpower and Adequate Top Management. For example, the experts stressed the importance of a fair workload. This referred to the fairness of distributing the tasks and the available time and capabilities to finish those tasks. It was their view that fairness of work distribution directly affects knowledge sharing between employees. The eligibility of this point will be confirmed later during the industry wide survey. It was decided to incorporate these four additional codes into the proposed practice-based OBKM framework.

The "Career Development" code was integrated into element number 8-Development since it belongs to the same theme. Also, the "Fair workload" code was added to number 6-Culture. Finally, "Adequate Manpower" and "Adequate Top Management" codes were added to the Planning and Strategy Development, and Leadership elements respectively.

In contrast to the KM scholars' critical success factors, the "8-Development" element was considered one of the most important elements by the industry experts. This could be due to the fact that the industry experts mentioned "Career Development" as a critical code during grouping process of the new codes. Moreover, the industry experts perceived the "2-Leadership" and" 7-Teamwork" elements as important. This was verified by a broader survey of the industry as part of the last step of the research.

5.3 Practice-based OBKM Framework

Based on the comparison of the industry expert's responses with the author's references, it can be concluded that the results highlighted similarities between theoretical views and those of industry experts. Since all eight elements were confirmed, the theoretical framework was considered as validated by the industry experts. The new framework was called Practice-based OBKM framework (Figure 5-1)

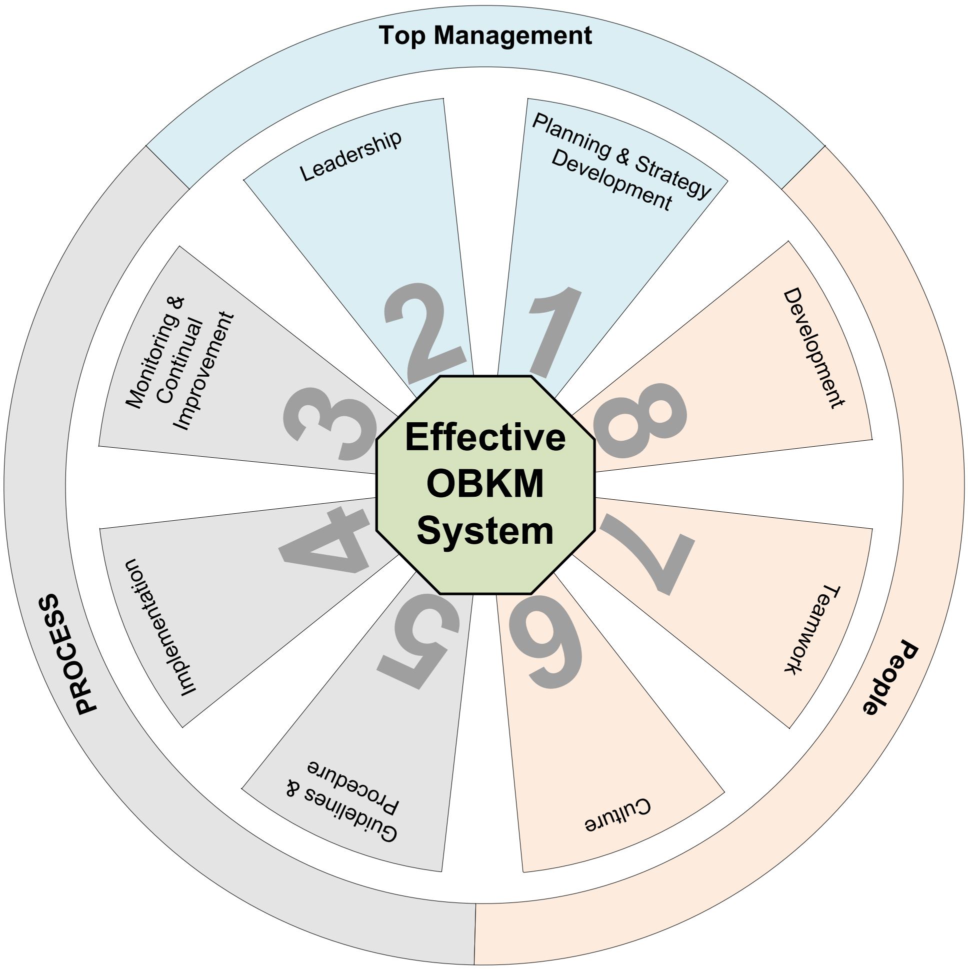


Figure 5-1 Practice-based OBKM Framework

Top Management Aspect

This aspect entailed the role of management in leading, implementing and supporting KM initiatives. Planning and Strategy Development and Leadership were the two main elements in this aspect that will drive the whole KM system toward the achievement of business goals. This is enabled by aligning the KM strategies with the business strategies while providing leadership support.

Process Management Aspect

The process management aspect was included to ensure better process management to overcome any challenges embedded in the organization's systems. Guidelines and Procedure, Monitoring and Continual Improvement, and Implementation formed the main elements of this aspect. The contextually sensitive IT-support systems were intended to serve the main OBKM needs. It included systems to support explicit and tacit knowledge sharing.

People Management Aspect

This aspect served as a mechanism to highlight the OBKM influences and challenges from the perspective of the knowledge of the sender and receiver. Its elements were Culture, Teamwork and Development, and due to the consideration of these elements, the effectiveness of knowledge transfer between aircraft engineers was maximized.

In the final stage of this research, the practice-based framework was tested and validated using a suitable research instrument. A survey questionnaire was designed where the codes were used to generate survey questions. This survey was made available for a much larger community of aircraft engineers in Saudi Arabia to obtain quantitative data for further statistical analysis. Using the results of the statistical analysis, the final OBKM framework was developed.

5.4 Modified Research Hypotheses

The theoretical and practice-based OBKM frameworks have eight elements driven from the literature framework guidelines. Each framework was a new evolution of the previous one. Thus the modified elements of the OBKM framework – Planning and Strategy Development, Leadership, Monitoring and Continual Improvement, Implementation, Guidance and Procedure, Culture, Teamwork and Development – were empirically tested to examine the effects of these eight factors on the OBKM system implementation.

Based on the proposed OBKM framework and review of the literature, the following hypotheses were the finalized research hypotheses.

Hypothesis 1: There is a significant difference between the importance and practice of a knowledge management system.

Hypothesis 2: Planning and strategy development have a positive impact on an effective OBKM system.

Hypothesis 3: Leadership has a positive impact on an effective OBKM system.

Hypothesis 4: Monitoring and Continual Improvement have a positive impact on an effective OBKM system.

Hypothesis 5: Implementation has a positive impact on an effective OBKM system.

Hypothesis 6: Guidance and Procedure have a positive impact on an effective OBKM system.

Hypothesis 7: Culture has a positive impact on an effective OBKM system.

Hypothesis 8: Teamwork has a positive impact on an effective OBKM system.

Hypothesis 9: Development has a positive impact on an effective OBKM system.

Hypothesis 10: There is a significant interrelationship between the eight critical success factors of the OBKM system.

5.5 Summary

This chapter discussed the development process of the practice-based OBKM framework. This process was driven by the analysis developed during the development of the theoretical framework however, it was utilised here again. Focus groups provided a valuable insight into the practitioners' perceptions of what is critical for a successful KM system. This yielded four new codes that never been mentioned in the literature yet the experts considered them as critical. Those four codes were incorporated in the practice based framework. The validity of these codes will be tested during the development of the final OBKM framework.

Chapter 6 Final OBKM Framework

6.1 Introduction

This chapter presents the results and discussion of the research survey. Section 6.2 describes the general background of the survey respondents. Sections 6.3 and 6.4 respectively discuss and address the reliability and validity testing of the research instrument. Section 6.5 provides the research survey results and presents the critical success factors of the practice-based OBKM framework. Section 6.6 presents the research hypothesis testing analysis. Section 6.7 discusses conclusions and recommendations gathered from the survey. It also provides guidelines for OBKM system implementation. Finally, section 6.8 provides the summary.

6.2 General Characteristics of Respondents

As discussed in the research methodology chapter, this research focuses on the aircraft engineers working for organizations from the Saudi Arabian civil aviation industry. Due to the fact that the whole population of the aircraft engineers in this industry is around 137 engineers working in five organizations, the URL link of the web-based questionnaire was emailed to the organizations. A total of 16 completed questionnaires were received. This yielded a response rate of 11.7% (16/137). This response rate was low and considered below the organizational research response rate benchmark (around 35-40%) (Baruch and Holtom, 2008). Follow-up telephone calls were made and reminders emails were sent to the organizations to increase the response rate. This improved the response rate to

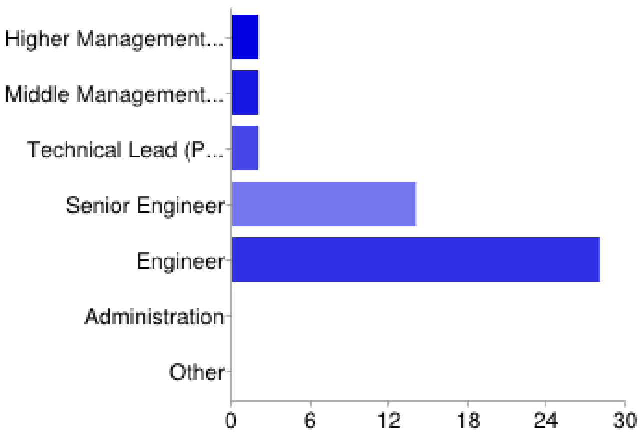
35% (48/137) which complies with the organizational research response rate benchmark and is acceptable for the purpose of this study. The results of this study were analysed using IBM SPSS Statistical Software version 20. Appendix 8 provides the questionnaire coding sheet.

Background of the Respondents

In the first section of the survey questionnaire, the participants were asked several background questions. These questions were designed to find out the respondent's years of experience, position in the organization, field of work, familiarity with knowledge management and initial perception of the current knowledge management situation in the organization. Although these questions gave an insight into the participant's background, they did not provide any traceable information that could be used to identify the participants. This ensured the anonymous status of the participants.

Moreover, two questions were designed to determine the untargeted (outliers) respondents. For example, one question was designed to identify the respondents from other countries other than the targeted country in this research. The other question detected the respondents from out of the research focus background, i.e. military background, where the scope of this research was focusing on the civil aviation industry. None of the 48 participant's data was excluded. All of the participants were within the scope of this research.

Figure 6-1 shows the breakdown of the survey participants based on their position in the organization. While around 12% of the participants were in management positions, most of the participants (88%) were engineers. Only 6% of the participants were unfamiliar with the knowledge management concepts. Also, those in the management positions considered themselves either “very familiar” or “familiar” with knowledge management. On the other hand, around 21% of the joiner engineers showed less confidence with regards to familiarity with knowledge management concepts and tools. This is illustrated in Figure 6-2. The high level of familiarity with knowledge management could be ascertained from the Knowledge Management Workshop performed by the researcher.



Higher Management (Division Head)	**2**	4%
Middle Management (Section Head, Chief Engineer)	**2**	4%
Technical Lead (Principle Engineer)	**2**	4%
Senior Engineer	**14**	29%
Engineer	**28**	58%
Administration	**0**	0%
Other	**0**	0%

Figure 6-1 Participants Position in the Organization

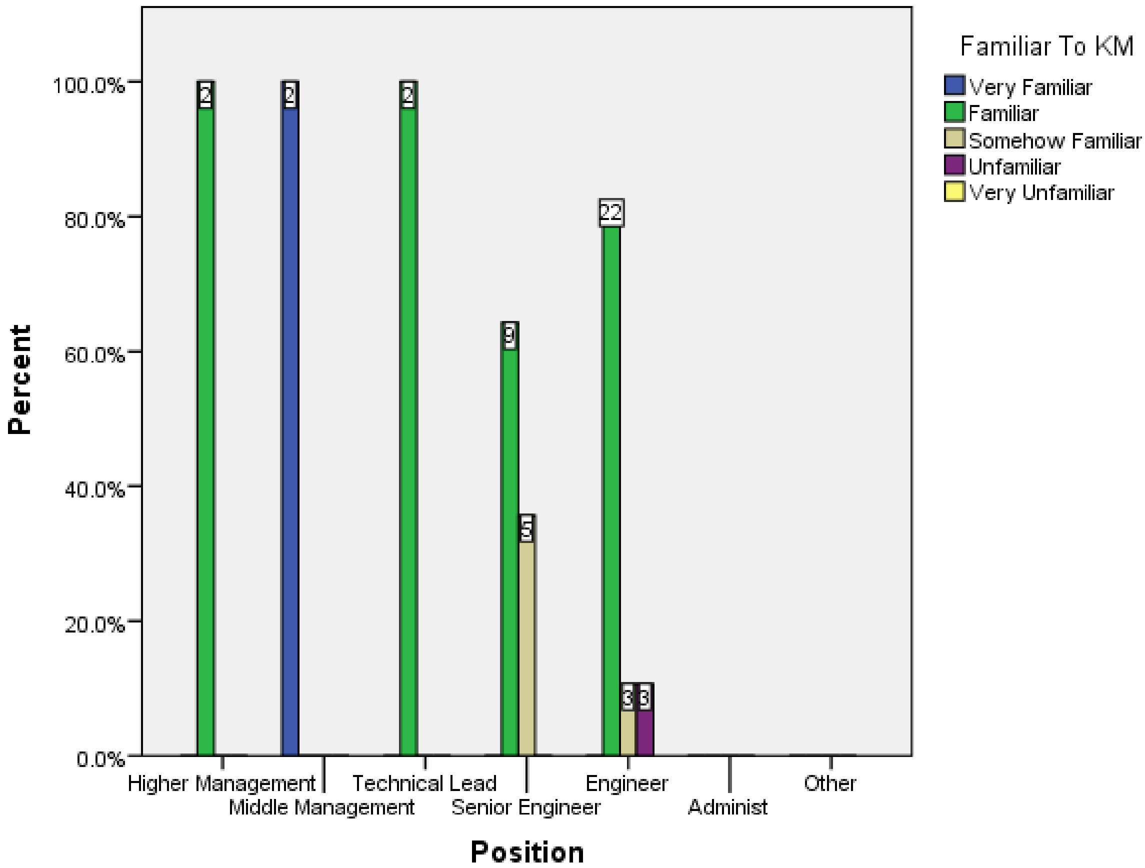
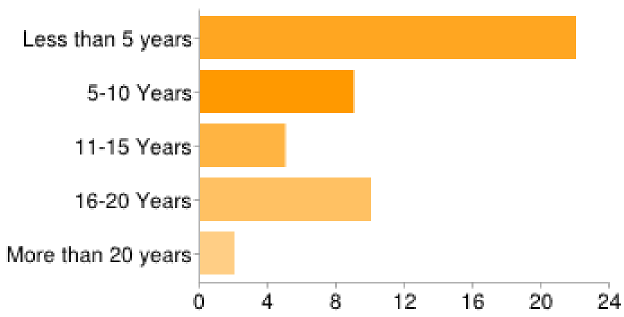


Figure 6-2 Percentage of Familiarity to KM

Looking into Figure 6-3, 65% of the participants had 10 years or less of experience. Moreover, around two thirds of these participants had less than 5 years of experience. This could support the argument proposed in chapter 1 that the Saudi Arabian aviation is suffering from the loss of more experienced aircraft engineers. Nevertheless, around 77% of the participants believe that "none" to "some" of the aircraft engineering experience was retained within the organization (Figure 6-4).



Less than 5 years	**22**	46%
5-10 Years	**9**	19%
11-15 Years	**5**	10%
16-20 Years	**10**	21%
More than 20 years	**2**	4%

Figure 6-3 Years of Experience

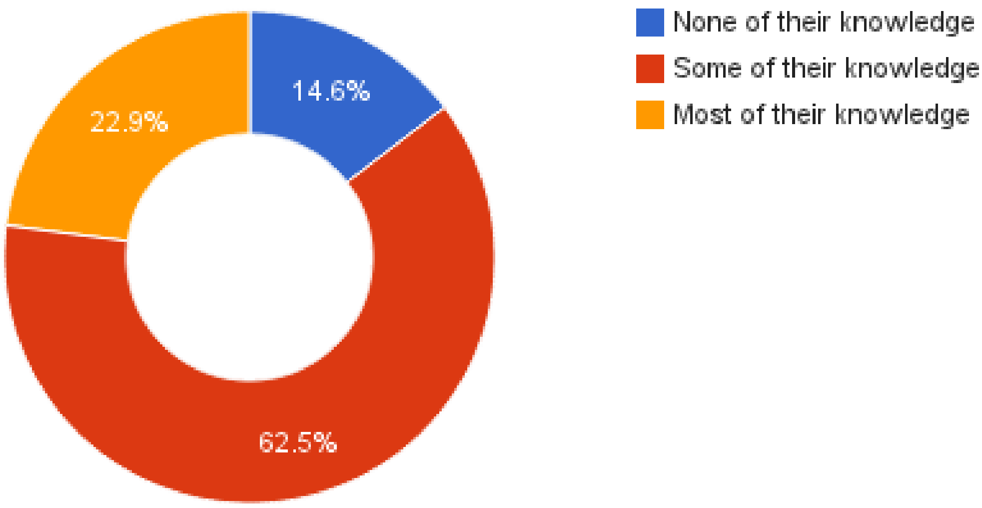


Figure 6-4 Level of Knowledge Retention After an Engineer Leaves the Organization

6.3 Reliability Testing of Reponses

The reliability of the research instrument was tested using Cronbach's alpha model for internal consistency. The Cronbach's alpha is a basic reliability measure with values ranging from 0 to 1. In most cases, high internal consistency is indicated by Cronbach's alpha value greater than 0.7 (Sekaran and Bougie, 2009, Hair et al., 1998).

Table 6.1 Internal Consistency Analysis Results

Factors		Number of Items	Reliability of Construct	Potential Item for Elimination
F 1.	**Planning & Strategy Development**	7	0.870	None
F 2.	**Leadership**	4	0.844	None
F 3.	**Monitoring & Continual Improvement**	6	0.940	None
F 4.	**Implementation**	3	0.794	None
F 5.	**Guidance and Procedure**	3	0.821	None
F 6.	**Culture**	3	0.725	None
F 7.	**Teamwork**	3	0.879	None
F 8.	**Development**	4	0.824	None

In the research instrument, a five scale instrument (Likert Scale) was used to measure the eight OBKM critical success factors (constructs). Each of the factors consisted of several items. The reliability analysis of each of those factors was performed separately using the SPSS program. The reliability of the research instrument was tested using Cronbach's alpha model for internal consistency. The Cronbach's alpha is a basic reliability measure with values ranging from 0 to 1. In most cases, high internal consistency is indicated by Cronbach's alpha value greater than 0.7 (Sekaran and Bougie, 2009, Hair et al., 1998).

Table 6.1 presents Cronbach's alpha values for those factors. The reliability coefficients vary from 0.725 to 0.940 which reflect a high level of internal consistency and reliability. Thus all the constructs were demonstrated to be satisfactory in regard to internal consistency and reliability. Appendix 11 shows the SPSS reliability analysis.

6.4 Testing Validity of Responses

Sekaran and Bougie (2009) recommended three types of tests to validate the research instrument. These are content validity, construct validity and criterion-related validity. This study performed all three of these tests.

6.4.1 Content Validity

To test for content validity is to examine the extent to which the instrument measures the entire domain of the constructs of interest. This is a subjective evaluation of the instrument and cannot be measured numerically. A panel of judges (experts) could evaluate the content validity of the research instrument (Sekaran and Bougie, 2009).

In this study, content validity of the survey was evaluated in several stages during the development of the survey questionnaire. An extensive literature review in the knowledge management and operation management fields was the basis for developing the eight theoretical critical success factors of the OBKM framework. Those factors were then refined and validated to capture the practitioner side using several industry experts' focus groups. In addition, a pilot study of the research instrument was performed by industry experts and academics to evaluate the content validity as part of the final validation process. The detailed process of developing the research questionnaire was addressed in the research methodology in chapter (3). Therefore, it was strongly believed that this research instrument was valid for measuring the entire domain of the eight OBKM system constructs.

6.4.2 Construct Validity

To test for construct validity is to test to what extent the instrument measures that which it is designed to measure. Also, it is to test that proper identification of the dependent and independent variables were included in the study. This was achieved by using the principle component factor analysis. Data reduction procedure using SPSS was performed for the items of each factor separately. The respondents' 'practice' data input were used for this analysis. Table 6.2 shows the results from the analysis. Moreover, detailed SPSS out of the factor analysis is provided in Appendix 9.

Table 6.2 Construct Validity Analysis Results

Factors		Eigen-Values	Variance Explained %	Item for Elimination	Initial Factor Loading for Component 1
F 1.	**Planning and Strategy Development**	5.903	84.331	None	0.852-0.967
F 2.	**Leadership**	2.849	71.217	None	0.789-0.905
F 3.	**Monitoring and Continual Improvement**	5.116	85.273	None	0.817-0.954
F 4.	**Implementation**	2.102	70.065	None	0.725-0.933
F 5.	**Guidance and Procedure**	2.088	69.613	None	0.595-0.934
F 6.	**Culture**	1.909	63.626	None	0.705-0.913
F 7.	**Teamwork**	2.563	85.428	None	0.890-0.967
F 8.	**Development**	2.682	67.052	None	0.751-0.900

From the results obtained, all of the factors satisfied the construct validity criteria of eigenvalues greater than 1.0 and factor loading greater than 0.30 (Pitinanondha, 2008, Nunnally et al., 1967). This implied that all of the factors were uni-factorial and none were removed. Therefore, these results demonstrated that this research instrument was valid for measuring OBKM constructs.

6.4.3 Criterion-Related Validity

This tests the power of the instrument to predict the differentiated variables that are known to be different. In this study, the criterion-related validity was achieved by using multiple regression analysis to determine whether the OBKM critical success factors were related to an effective OBKM system. The SPSS regression analysis procedure was used for this analysis. The independent variables were the respondents' input 'practice data' while the dependant variables were the means of the 'importance data' for each respondent. The calculated multiple correlation coefficient 'r' of the eight factors represents a measure of an effective OBKM system and was found to be 0.999 which indicates a very strong positive relationship (analysis results shown in Appendix 10). This result reflects a high degree of criterion-related validity (Sekaran and Bougie, 2009). Detailed SPSS Multiple Regression Analysis is provided in Appendix 10.

Based on these tests, it could be concluded that this research instrument was reliable and capable of measuring what it was intended to measure.

6.5 Results of the OBKM Survey

The survey was designed to measure the respondents' perceptions of critical success factors of the OBKM system. Moreover, it was intended to measure the level of OBKM current practice in the industry. This section evaluates the respondents' perceptions of the practice and the importance of the critical success factors of the OBKM system. Descriptive statistics (data mean and standard deviation) were calculated for all items.

6.5.1 Perceptual Responses to OBKM Practices

The mean and standard deviation of the current practices for the OBKM system factors are shown in

Table 6.3. The mean values ranged from 2.04 to 3.07 which corresponded to a low level of OBKM practice in the industry. The highest 'practice' factor was 'Teamwork' while the second highest was 'Culture'. The third factor was 'Guidance and Procedure' and the lowest was 'Monitoring and Continual Improvement'. Although the 'Teamwork' mean result was only 3.07, 'Teamwork' was perceived as the highest (best) OBKM practice factor among the eight factors. This could be explained by understanding the participants' background and working environment. As mentioned earlier, aircraft engineers and engineers in general have several specific characteristics. For example, they have a science-based education, deal with a complex work tasks, and their work environment involve high risk tasks and decisions. Thus, the participants observation of the necessity of good team work suggests better knowledge sharing between team members. It can be concluded that there is a low level of OBKM as a current

practice in the Saudi Arabian aviation industry with respect to aircraft engineering.

Table 6.3 Mean Practice Results

Factors		Mean	Standard Deviation	Ranking
F 1.	**Planning and Strategy Development**	2.46	1.14	7
F 2.	**Leadership**	2.47	1.01	6
F 3.	**Monitoring and Continual Improvement**	2.04	0.94	8
F 4.	**Implementation**	2.48	0.99	4
F 5.	**Guidance and Procedure**	2.49	0.94	3
F 6.	**Culture**	3.00	0.86	2
F 7.	**Teamwork**	3.07	1.16	1
F 8.	**Development**	2.47	0.98	5

6.5.2 Perceptual Responses to OBKM Importance

The mean and standard deviation of the level of importance of the OBKM critical success factors perceived by the respondents are shown in Table 6.4. The mean values of the factors ranged from 4.57 to 4.80 which corresponded to very important OBKM critical success factors. ‘Teamwork’, ‘Development’ and ‘Culture’ were perceived to be the top three most important factors. Although the lowest factor was ‘Monitoring and Continual Improvement’, it had a mean score of 4.57/5 which was perceived to be very important. All the OBKM critical success factors scored high means with only small variances which shows general agreement on the eight OBKM critical success factors.

Table 6.4 Mean Importance Results

Factors		Mean	Standard Deviation	Ranking
F 1.	**Planning and Strategy Development**	4.71	0.45	4
F 2.	**Leadership**	4.70	0.42	5
F 3.	**Monitoring and Continual Improvement**	4.57	0.57	8
F 4.	**Implementation**	4.69	0.49	6
F 5.	**Guidance and Procedure**	4.67	0.49	7
F 6.	**Culture**	4.74	0.39	3
F 7.	**Teamwork**	4.80	0.40	1
F 8.	**Development**	4.79	0.40	2

6.6 Testing Research Hypotheses

A holistic OBKM framework is a large concept consisting of eight critical success factors. Further analysis of these factors was needed to achieve a better understanding of the OBKM system. Three methods were used in testing the research hypotheses.

- First, the difference between the participants perception of importance and current practices for each of the proposed factors of OBKM system is tested using Pairwise t-test procedure (Hypothesis 1).

- Second, for hypotheses 2 to 9, each of the factors was tested to confirm a positive impact on an effective OBKM system. This includes checking the overall mean of each factor. In order for the Hypothesis to be supported, the overall mean of the factor should be over 4 in a 5-point Likert scale (Sekaran and Bougie, 2009). Then, Pairwise comparison method suggested by Sekaran and Bougie (2009) was used to identify the most important items for each factor. Any significantly different items were excluded from the factor.

- Third, the interrelationship between the eight factors of the OBKM framework was studied using Pearson Correlation analysis (Hypotheses 10) .

SPSS results for testing each of the hypotheses is shown in Appendix 12.

Hypothesis 1: There is significant difference between the importance and practice of a knowledge management system.

It was noticed from the previous section, that the aircraft engineers seemed to place a high degree of importance on all the OBKM factors while the level of the managing knowledge practices was very different. To determine statistically if there was a significant difference between the extent of managing knowledge practices and the way the OBKM factors were perceived, a Pairwise t-test procedure from SPSS was used to compare the means.

The results shown in Table 6.5, indicate that there was a significant difference between the level of practice and the perception of importance. Thus, Hypothesis 1 is supported. It can be concluded that while the aircraft engineers were aware of the importance of OBKM critical success factors, they were finding it difficult to successfully implement those factors.

Table 6.5 Comparison Statistics for Practice and Importance

Factors		Practice Mean	Importance Mean	*t*-test *p*-value	$t_{Critical}$	Results
1. 1.	**Planning & Strategy Development**	2.46	4.71	0.000	-12.459	Sig.
1. 2.	**Leadership**	2.47	4.70	0.000	-13.974	Sig.
1. 3.	**Monitoring and Continual Improvement**	2.04	4.57	0.000	-14.660	Sig.
1. 4.	**Implementation**	2.48	4.69	0.000	-12.604	Sig.
1. 5.	**Guidance and Procedure**	2.49	4.67	0.000	-14.568	Sig.
1. 6.	**Culture**	3.00	4.74	0.000	-12.634	Sig.
1. 7.	**Teamwork**	3.07	4.80	0.000	-10.494	Sig.
1. 8.	**Development**	2.47	4.79	0.000	-14.493	Sig.

Hypothesis 2: Planning and strategy development have a positive impact on an effective OBKM system.

As shown in Table 6.6, the mean values for each of the 7 items under Factor 1 (Planning and Strategy Development) ranged from 4.56 to 4.85. Item 1.1 ‘The organization has a defined and documented KM policy’ has the highest mean of 4.85. The overall mean of Factor 1 is 4.71. Thus, Hypothesis 2 was supported.

Table 6.6 Mean Results of Each Item in Factor 1

Factor 1: Planning & Strategy Development	Mean	Standard Deviation
1. 1. The organization has a defined and documented KM policy	4.85	0.357
1. 2. Managing knowledge is viewed as a critical tool in managing an organization's business processes	4.81	0.491
1. 3. Policy for managing knowledge is understood, implemented and maintained at all levels of the organization	4.79	0.410
1. 4. Top Management has a well-defined plan for the implementation of managing knowledge activities	4.75	0.668
1. 5. Top management provides adequate resources for managing knowledge activities	4.67	0.694
1. 6. Objectives for managing organizational knowledge are tied to the business objectives	4.56	0.741
1. 7. Managing knowledge activities are included in the overall business strategy	4.56	0.712
Overall Mean for Factor 1	**4.71**	

The detailed pairwise comparison analysis of the entire 7 items is shown in Table 6.7. The results show that only items 1.6 'Objectives for managing organizational knowledge are tied to the business objectives' and 1.7 'Managing knowledge activities are included in the overall business strategy' are significantly different from the rest of the items. The other items were not significantly different.

Table 6.7 Pairwise Comparison Statistics for Items in Factor 1

Compare Mean	*t*-test *p*-value	Result
Item 1.1 vs. Item 1.2	0.598	Not Sig.
Item 1.1 vs. Item 1.3	0.182	Not Sig.
Item 1.1 vs. Item 1.4	0.256	Not Sig.
Item 1.1 vs. Item 1.5	0.060	Not Sig.
Item 1.1 vs. Item 1.6	0.003	Sig.
Item 1.1 vs. Item 1.7	0.000	Sig.
Item 1.2 vs. Item 1.3	0.659	Not Sig.
Item 1.2 vs. Item 1.4	0.554	Not Sig.
Item 1.2 vs. Item 1.5	0.090	Not Sig.
Item 1.2 vs. Item 1.6	0.006	Sig.
Item 1.2 vs. Item 1.7	0.017	Sig.
Item 1.3 vs. Item 1.4	0.674	Not Sig.
Item 1.3 vs. Item 1.5	0.159	Not Sig.
Item 1.3 vs. Item 1.6	0.010	Sig.
Item 1.3 vs. Item 1.7	0.003	Sig.
Item 1.4 vs. Item 1.5	0.044	Sig.
Item 1.4 vs. Item 1.6	0.130	Not Sig.
Item 1.4 vs. Item 1.7	0.048	Sig.
Item 1.5 vs. Item 1.6	0.375	Not Sig.
Item 1.5 vs. Item 1.7	0.280	Not Sig.
Item 1.6 vs. Item 1.7	1.000	Not Sig.

p-value <0.05 is significantly different

Based on these research findings it has been clearly demonstrated that the organization should have a defined and documented policy for managing knowledge and should view managing knowledge as a critical tool in managing an organization's business processes. Moreover, policy for managing knowledge should be understood, implemented and maintained at all levels of the organization. Finally, top management should prepare a well-defined plan and provide adequate resources for the implementation of managing knowledge activities.

Hypothesis 3: Leadership has a positive impact on an effective OBKM system.

As shown in Table 6.8, the mean values for each of the 4 items under Factor 2 (Leadership) ranged from 4.65 to 4.75. Item 2.2 'Management strives to use the latest management theory and principles' and item 2.4 'Sharing Knowledge between the employees is encouraged and facilitated by top management' have the highest mean of 4.75. The overall mean of Factor 2 is 4.70. Thus, Hypothesis 3 was supported.

Table 6.8 Mean Results of Each Item in Factor 2

	Factor 2: Leadership	Mean	Standard Deviation
2. 1.	**Top management is committed to the success of managing knowledge initiatives**	4.67	0.476
2. 2.	**Management strives to use the latest management theory and principles**	4.75	0.438
2. 3.	**Top management drives and champions management of knowledge across the organization**	4.65	0.601
2. 4.	**Sharing knowledge between the employees is encouraged and facilitated by top management**	4.75	0.526
	Overall Mean for Factor 2	**4.70**	

Table 6.9 shows the detailed pairwise comparison analysis of the 4 items. The results show that there was no significant difference between all items. Thus, top management commitment is seen as essential to the success of managing knowledge initiatives. This strongly suggests that while top management should drive and champion management of knowledge across the organization, they should also encourage and facilitate knowledge sharing between the employees. This could be done by embracing the latest management theories and principles.

Table 6.9 Pairwise Comparison Statistics for Items in Factor 2

Compare Mean	*t*-test *p*-value	Result
Item 2.1 vs. Item 2.2	0.209	Not Sig.
Item 2.1 vs. Item 2.3	0.659	Not Sig.
Item 2.1 vs. Item 2.4	0.209	Not Sig.
Item 2.2 vs. Item 2.3	0.229	Not Sig.
Item 2.2 vs. Item 2.4	1.000	Not Sig.
Item 2.3 vs. Item 2.4	0.058	Not Sig.

p-value <0.05 is significantly different

Hypothesis 4: Monitoring and Continual Improvement have a positive impact on an effective OBKM system.

As shown in Table 6.10, the mean values for each of the 6 items under Factor 3 (Monitoring and Continual Improvement) ranged from 4.50 to 4.67. Item 3.2 'Achievement of management of knowledge objectives is assessed regularly' scored the highest mean of 4.67. The overall mean of Factor 3 is 4.57. Thus, Hypothesis 4 was supported.

Table 6.10 Mean Results of Each Item in Factor 3

Factor 3: Monitoring and Continual Improvement		Mean	Standard Deviation
3. 1.	**Key performance metrics for management of knowledge are identified and used**	4.60	.610
3. 2.	**Achievement of management of knowledge objectives is assessed regularly**	4.67	.476
3. 3.	**Managing knowledge standards are identified and used**	4.56	.616
3. 4.	**Gaps between organization's management of knowledge practices and organization's management of knowledge standards are addressed**	4.52	.618
3. 5.	**Organization's management of knowledge standards are regularly reviewed against global best practices**	4.56	.712
3. 6.	**Management of knowledge performance results are used to plan improvements in managing knowledge**	4.50	.799
	Overall Mean for Factor 3	**4.57**	

A detailed pairwise comparison analysis of the entire 6 items is shown in Table 6.11. Although, the results show that item 3.2 'Achievement of management of knowledge objectives is assessed regularly' is significantly different from item 3.4 'Gaps between organization's management of knowledge practices and organization's management of knowledge standards are addressed', the rest of the items show no significant differences to any of these items.

These results clearly demonstrated that key performance metrics for management of knowledge should be identified and used to plan for improvement. Also, organizations should identify managing knowledge standards and should address any gaps within the current practices. These standards should be regularly reviewed against global best practices. Finally, achievement of management of knowledge objectives should be assessed regularly.

Table 6.11 Pairwise Comparison Statistics for Items in Factor 3

Compare Mean	*t*-test *p*-value	Result
Item 3.1 vs. Item 3.2	0.083	Not Sig.
Item 3.1 vs. Item 3.3	0.569	Not Sig.
Item 3.1 vs. Item 3.4	0.209	Not Sig.
Item 3.1 vs. Item 3.5	0.420	Not Sig.
Item 3.1 vs. Item 3.6	0.322	Not Sig.
Item 3.2 vs. Item 3.3	0.058	Not Sig.
Item 3.2 vs. Item 3.4	0.007	Sig.
Item 3.2 vs. Item 3.5	0.096	Not Sig.
Item 3.2 vs. Item 3.6	0.088	Not Sig.
Item 3.3 vs. Item 3.4	0.159	Not Sig.
Item 3.3 vs. Item 3.5	1.000	Not Sig.
Item 3.3 vs. Item 3.6	0.371	Not Sig.
Item 3.4 vs. Item 3.5	0.533	Not Sig.
Item 3.4 vs. Item 3.6	0.767	Not Sig.
Item 3.5 vs. Item 3.6	0.518	Not Sig.

p-value <0.05 is significantly different

Hypothesis 5: Implementation has a positive impact on an effective OBKM system.

Shown in Table 6.12, the mean values for each of the 3 items under Factor 4 (Implementation) ranged from 4.56 to 4.81. Item 4.1 'IT-tools for managing knowledge are adequate and effective' scored the highest mean of 4.81. The overall mean of Factor 4 is 4.69. Thus, Hypothesis 5 was supported.

Table 6.12 Mean Results of Each Item in Factor 4

Factor 4: Implementation		Mean	Standard Deviation
4. 1.	**IT-tools for managing knowledge are adequate and effective**	4.81	0.394
4. 2.	**Input from staff is sought for the proposed changes to management of knowledge practices**	4.69	0.589
4. 3.	**Organizational structure and facilities (physical and non-physical) are adequate and effective for managing knowledge in the organization**	4.56	0.712
	Overall Mean for Factor 4	**4.69**	

A detailed pairwise comparison analysis of the three items is shown in Table 6.13. The results from this table show that item 4.3 'Organizational structure and facilities (physical and non-physical) are adequate and effective for managing knowledge in the organization' was significantly different from the other item. Thus, adequate and effective IT-tools for managing knowledge are seen as essential for a successful OBKM system. Also, input from staff should be sought for any proposed changes to management of knowledge practices.

Table 6.13 Pairwise Comparison Statistics for Items in Factor 4

Compare Mean	*t*-test *p*-value	Result
Item 4.1 vs. Item 4.2	0.083	Not Sig.
Item 4.1 vs. Item 4.3	0.017	Sig.
Item 4.2 vs. Item 4.3	0.032	Sig.

p-value <0.05 is significantly different

Hypothesis 6: Guidance and Procedure have a positive impact on an effective OBKM system.

As shown in Table 6.14, the mean values for each of the 3 items under Factor 5 (Guidance and Procedure) ranged from 4.60 to 4.79. Item 5.2 'There are well established procedures for identifying and managing useful knowledge' scored the highest mean of 4.79. The overall mean of Factor 5 is 4.67. Thus, Hypothesis 6 was supported.

Table 6.14 Mean Results of Each Item in Factor 5

Factor 5: Guidance and Procedure	Mean	Standard Deviation
5. 1. Employee's knowledge and experiences from one area is useful in other areas in the workplace	4.63	0.087
5. 2. There are well established procedures for identifying and managing useful knowledge	4.79	0.059
5. 3. Managing knowledge procedures are integrated and embedded in the organizational management systems	4.60	0.098
Overall Mean for Factor 5	**4.67**	

A detailed pairwise comparison analysis of the three items is shown in Table 6.15. The results from this table show that there was significant difference among the items for factor 5 except between item 5.1 'Employee's knowledge and experiences from one area is useful in other areas in the workplace' and item 5.3 'Managing knowledge procedures are integrated and embedded in the organizational management systems'. Based on these results it has been shown that in a successful OBKM system, managing knowledge procedures should be integrated and embedded into the organizational management systems taking into consideration where an employee's knowledge and experiences from one area are useful in other areas in the workplace.

Table 6.15 Pairwise Comparison Statistics for Items in Factor 5

Compare Mean	*t*-test *p*-value	Result
Item 5.1 vs. Item 5.2	0.004	Sig.
Item 5.1 vs. Item 5.3	0.799	Not Sig.
Item 5.2 vs. Item 5.3	0.027	Sig.

p-value <0.05 is significantly different

Hypothesis 7: Culture has a positive impact on an effective OBKM system.

As shown in Table 6.16, the mean values for each of the 3 items under Factor 6 (Culture) ranged from 4.71 to 4.79. Item 6.2 'Unfair workload distribution prevents knowledge sharing between employees' scored the highest mean of 4.79. An important point could be observed here. As mentioned in Chapter 3, this item was not cited by the KM literature. This item was repeatedly mentioned in the

KM focus groups with the industry experts. Accordingly, this result supports the industry experts' point of view. The overall mean of Factor 6 is 4.74. Thus, Hypothesis 7 was supported.

Table 6.16 Mean Results of Each Item in Factor 6

Factor 6: Culture	Mean	Standard Deviation
6. 1. Organizational culture is key to sharing knowledge between employees	4.73	0.065
6. 2. Unfair workload distribution prevents knowledge sharing between employees	4.79	0.059
6. 3. Employees are supportive of managing knowledge practices	4.71	0.084
Overall Mean for Factor 6	**4.74**	

A detailed pairwise comparison analysis of the three items is shown in Table 6.17. The results from this table show that there was no significant difference among the items for factor 6. This demonstrated that organizational culture where employees are supportive of managing knowledge practices is essential to the successful OBKM system. Nevertheless, unfair workload distribution is seen to prevent knowledge sharing between employees.

Table 6.17 Pairwise Comparison Statistics for Items in Factor 6

Compare Mean	*t*-test *p*-value	Result
Item 6.1 vs. Item 6.2	0.371	Not Sig.
Item 6.1 vs. Item 6.3	0.811	Not Sig.
Item 6.2 vs. Item 6.3	0.159	Not Sig.

p-value <0.05 is significantly different

Hypothesis 8: Teamwork has a positive impact on an effective OBKM system.

As shown in Table 6.18, the mean values for each of the 3 items under Factor 7 (Teamwork) ranged from 4.73 to 4.85. Item 7.1 'Trust and Transparency in teams is essential to knowledge sharing' scored the highest mean of 4.85. The overall mean of Factor 7 is 4.79. Thus, Hypothesis 8 was supported.

Table 6.18 Mean Results of Each Item in Factor 7

Factor 7: Teamwork	Mean	Standard Deviation
7. 1. Trust and Transparency in teams is essential to knowledge sharing	4.85	0.051
7. 2. Good communication within teams is key for knowledge sharing	4.81	0.057
7. 3. Sharing knowledge between team members helps organizational learning and retains knowledge	4.73	0.083
Overall Mean for Factor 7	**4.79**	

A detailed pairwise comparison analysis of the three items is shown in Table 6.19. The results from this table show that there was significant difference between item

7.1 ‘Trust and Transparency in teams is essential to knowledge sharing’ and item 7.3 ‘Sharing knowledge between team members helps organizational learning and retains knowledge’. This result shows good communication between teams builds trust and transparency which is essential to the success of the OBKM system. Also, good communication within teams helps organizational learning and retains knowledge.

Table 6.19 Pairwise Comparison Statistics for Items in Factor 7

Compare Mean	*t*-test *p*-value	Result
Item 7.1 vs. Item 7.2	0.322	Not Sig.
Item 7.1 vs. Item 7.3	0.013	Sig.
Item 7.2 vs. Item 7.3	0.159	Not Sig.

p-value <0.05 is significantly different

Hypothesis 9: Development has a positive impact on an effective OBKM system.

As shown in Table 6.20, the mean values for each of the 4 items under Factor 8 (Development) ranged from 4.73 to 4.83. Item 8.2 ‘Mentoring system (i.e. On The Job Training) is an effective tool for retaining knowledge in organization’ and item 8.3 ‘Rewards and sanctions for knowledge sharing practices are well established’ have the highest mean of 4.83. The overall mean of Factor 8 is 4.77. Thus, Hypothesis 9 was supported.

Table 6.20 Mean Results of Each Item in Factor 8

Factor 8: Development		Mean	Standard Deviation
8. 1.	**Knowledge sharing training and education is part of staff development program**	4.73	0.077
8. 2.	**Mentoring system (i.e. On The Job Training) is an effective tool for retaining knowledge in organization**	4.83	0.054
8. 3.	**Rewards and sanctions for knowledge sharing practices are well established**	4.83	0.075
8. 4.	**Knowledge sharing related performance is part of staff appraisal and performance management system**	4.75	0.076
	Overall Mean for Factor 8	**4.78**	

Table 6.21 shows the detailed pairwise comparison analysis of the 4 items. The results show that there was no significant difference between all items. Thus, for a successful OBKM system, it has been shown that knowledge sharing, training and education should be part of a staff development program. Also, a mentoring system (i.e. On The Job Training) was considered to be one of the effective tools for retaining knowledge in organizations. Moreover, a well-established rewards and sanctions for knowledge sharing practices was essential where knowledge sharing related performance should be part of the staff appraisal and performance management system.

Table 6.21 Pairwise Comparison Statistics for Items in Factor 8

Compare Mean	*t*-test *p*-value	Result
Item 8.1 vs. Item 8.2	0.200	Not Sig.
Item 8.1 vs. Item 8.3	0.200	Not Sig.
Item 8.1 vs. Item 8.4	0.710	Not Sig.
Item 8.2 vs. Item 8.3	1.000	Not Sig.
Item 8.2 vs. Item 8.4	0.159	Not Sig.
Item 8.3 vs. Item 8.4	0.290	Not Sig.

p-value <0.05 is significantly different

Hypothesis 10: There is a significant interrelationship between the eight critical success factors of the OBKM system.

To examine the interrelationship between the eight factors of the OBKM system, Pearson Correlation analysis was utilized (Forza, 2002). The correlation coefficient '*r*' was calculated (Table 6.22) for each of the factors in pairs where the correlation coefficient was significant at the 0.01 level (2-tailed). The results ranged from 0.571 to 0.933, indicating a statistically significant interrelationship between all the factors. As a result, hypothesis 10 was fully supported.

It can be seen that factor 4 (Implementation) and factor 8 (Development) scored the strongest interrelationship (r = 0.933). Moreover, factor 1 (Planning and Strategy Development) and factor 4 (Implementation) was the second highest (r = 0.927) while the interrelationship between factor 1 (Planning and Strategy Development) and factor 8 (Development) scored the third strongest (r = 0.901).

From the study results, it has been clearly demonstrated that effective and successful OBKM system implementation relies on proper top management's planning and strategy development and on the effective development of the organization's human resources. Moreover, human resources development is strongly influenced by top management's planning and strategy development with respect to the OBKM system.

Table 6.22 Correlation Analysis Results of OBKM System Factors

Factor	1	2	3	4	5	6	7	8
1	1							
2	0.761	1						
3	0.819	0.869	1					
4	0.927	0.750	0.781	1				
5	0.881	0.713	0.814	0.765	1			
6	0.860	0.654	0.803	0.773	0.832	1		
7	0.772	0.717	0.736	0.571	0.811	0.742	1	
8	0.901	0.740	0.701	0.933	0.736	0.687	0.572	1

Correlation Coefficient is significant at the 0.01 level (2-tailed).

6.7 OBKM System Implementation Guidelines

The ten hypotheses tested and analysed in the previous sections were deduced using survey data gathered from aircraft engineers in the Saudi Arabian aviation industry and all ten were shown to be supported. Moreover, several conclusions could be drawn here:

(a) The majority of the participants have less than 10 years of experience which seems to reflect the current experience level in the industry. This observation, in addition to the fact that a large proportion of the experienced engineers were retiring, signifies the need for an effective OBKM system.

(b) The current modest KM practices, where they exist, are merely incidental to everyday operations, and not due to any deliberate focus on knowledge management whilst the awareness of the importance of managing knowledge is increasing. 'Teamwork', 'Development' and 'Culture' were perceived to be the top three most critical success factors among all the other factors. These factors together form the people management aspect.

(c) The proposed eight factors in this study – planning and strategy development, leadership, monitoring and continual improvement, implementation, guidance and procedure, culture, teamwork and development – were all found to be critical to the successful deployment of an OBKM system. Also, strong interrelationships between all the factors were present.

Based on the above findings and discussions, the practice-based OBKM framework was verified. The integration of the framework and the operation management system, Plan-Do-Check-Act (PDCA), model – also, known as the Deming Cycle – facilitated the development of a final OBKM framework (Moen and Norman, 2006, Shim and Siegel, 1999). The schematic of this frame work is illustrated in Figure 6-5. It consists of the eight critical success factors and is connected to seven processes. The interaction between the factors and processes will ensure effective implementation of the OBKM system.

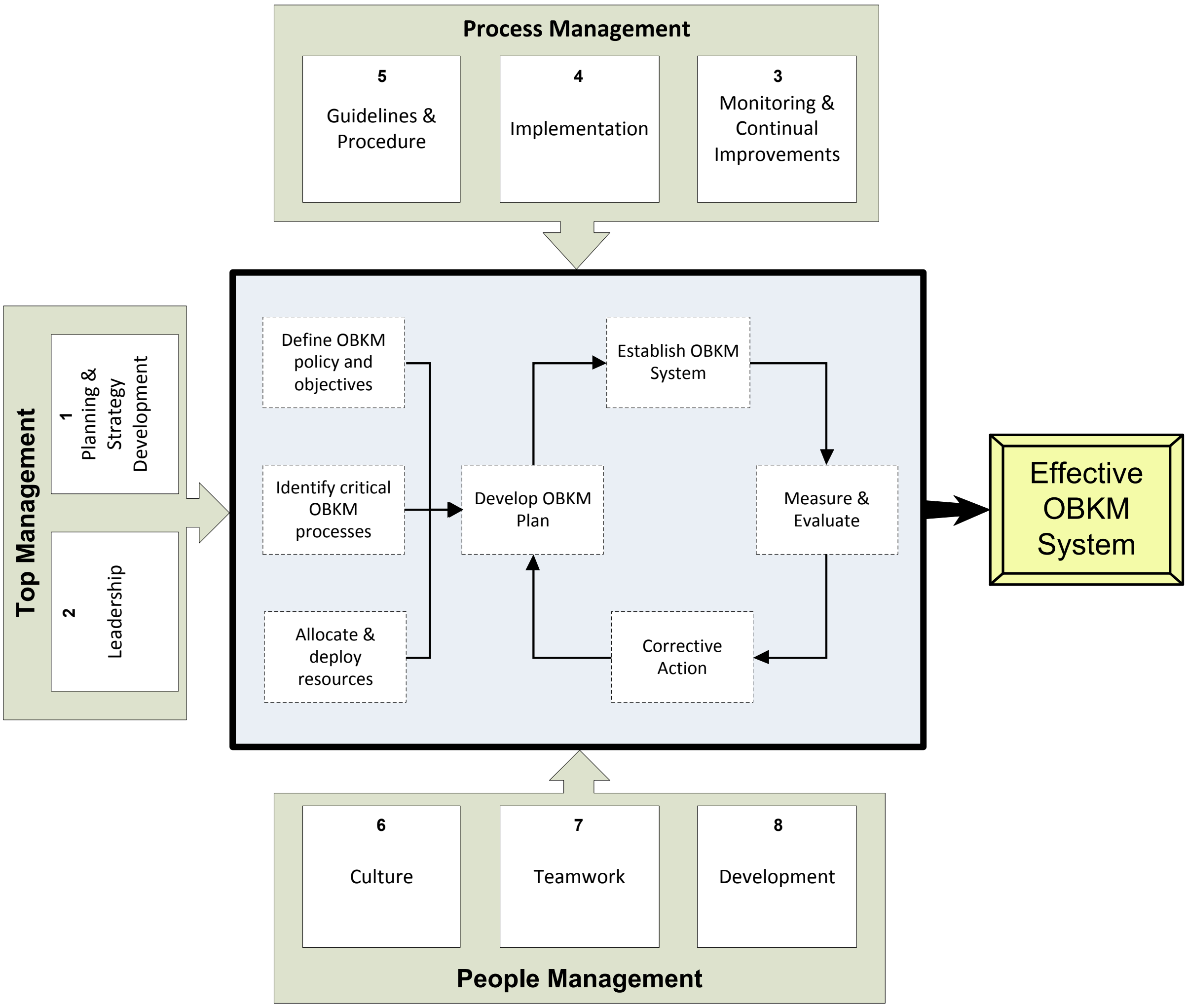


Figure 6-5 Final OBKM Framework

6.7.1 Top Management

Top Management is a vital aspect of any successful management system. Likewise, the effectiveness of an OBKM system is subject to the top management aspect. Without adequate top management commitment and support, any attempt to implement a new management system is likely to fail. Although top management leadership and commitment are important to the success of the OBKM system, appropriate implementation plan and strategy alignment are vital contributors to the success of the system. The main role of top management is to drive and champion management of knowledge across the organization. Top management should also provide leadership and commitment to the success of the OBKM system. This could be partly accomplished by allocating adequate resources for the implementation of managing knowledge activities. Nevertheless, top management is responsible for defining policy and developing objectives for the OBKM system. Moreover, they should ensure that policy and objectives for managing knowledge are understood, implemented and maintained at all levels of the organization. While top management should view managing knowledge as a critical tool in managing an organization's business processes, top management should also encourage and facilitate knowledge sharing between the employees. This could be done by embracing the latest management theories and principles.

6.7.2 Process Management

Another critical aspect of every management system is the process management aspect. Systems are made of several processes which interact between each other to accomplish the goals of those systems. Careful management of these processes seem to be important in determining the success of the systems. Monitoring and continual improvement is a critical success factor of an OBKM system. Thus, key performance metrics for the management of knowledge should be identified and used to plan for improvement. Also, organizations should identify managing knowledge standards and should address any gaps within the current practices. These standards should be regularly reviewed against global best practices. Achievement of management of knowledge objectives should be assessed regularly.

An OBKM system implementation process is another critical success factor. Hence, adequate and effective IT-tools for managing knowledge are essential for a successful OBKM system. Also, input from staff should be sought for any proposed changes to management of knowledge practices. On the other hand, OBKM system guidance and procedure is considered critical to the success of the system. Therefore, in a successful OBKM system, managing knowledge procedures should be integrated and embedded into the organizational management systems taking into consideration where employee's knowledge and experiences from one area would be useful in other areas of the workplace.

6.7.3 People Management

Human resources management is a cornerstone of the successful implementation of a management system. Thus, employees' involvement is needed in an OBKM system. However, it is necessary to provide appropriate staff development and training. For a successful OBKM system, knowledge sharing training and education should be part of the staff development program. Also, a mentoring system (i.e. On The Job Training) is considered one of the effective tools for retaining knowledge in an organization. Moreover, a well-established rewards and sanctions for knowledge sharing practices is essential where knowledge sharing related performance should be part of a staff appraisal and performance management system.

The employees' willingness to share their knowledge should be supported by a strong organizational culture. Thus, an organizational culture where employees are supportive of managing knowledge practices is essential to the successful OBKM system. Nevertheless, unfair workload distribution prevents knowledge sharing between employees. Finally, teamwork activities provide the arena whereby employees share their knowledge. Therefore, good communication between teams builds trust and transparency which is essential to the success of the OBKM system. Also, good communication within teams helps organizational learning and retains knowledge.

6.8 Summary

This chapter has presented the results and discussion of the research survey conducted on the aircraft engineers working in the Saudi Arabian aviation industry. Also, reliability and validity testing of the research instrument were addressed, which concluded that the research instrument was reliable and valid to measure what it was intended to measure. Initial analysis of the results revealed that the aircraft engineers have not performed practices they perceived important for the knowledge management system. This was demonstrated by the significant difference between the means of managing knowledge practices and the perceived importance. Further analysis of the survey results and hypotheses testing confirmed the reality of the eight critical success factors – Planning and Strategy Development, Leadership, Monitoring and Continual Improvement, Implementation, Guidance and Procedure, Culture, Teamwork and Development – proposed by the practice-based OBKM framework. These factors were found to be significantly interrelated to each other. Based on the analysis results, the Final OBKM framework was developed which included implementation guidelines. These guidelines are generic guidelines which provide an overview of the approach to effective implementation of an OBKM system. However, further refinement and customization of the framework could be made for a particular case study. Nevertheless, this framework is believed to have the potential to be greatly beneficial for many organizations endeavouring to implement an effective OBKM system.

Chapter 7 Summary and Conclusions

7. 1. Introduction

This chapter presents the summary of the research findings, research conclusions and research evaluation. Accordingly, section 7.2 provides the summary of this research. Section 7.3 discusses the main conclusions obtained from this study. Section 7.4 offers a brief evaluation of this study where limitations of the study and the future of the research are discussed. Finally, the original contribution to knowledge in this research is presented in section 7.5.

7. 2. Brief Summary of this Research

Aircraft engineering experience (knowledge) is considered to be a valuable asset to organizations in the aviation industry. Although few organizations in the aviation industry have attempted to manage aircraft knowledge, lessons could be learned from various KM initiatives in other industries. It seems that many organizations have attempted to manage knowledge while few of these organizations have successfully accomplished it. This lack of success seems to be the result of a misconception about knowledge concepts and perceptions. It appears that those organizations have focused on “off the shelf” IT solutions for their knowledge management problems. They appear to have overlooked the bigger problem of the operational side of knowledge sharing. This seems the case in the aviation industry. A problem in the industry has been identified.

From the extensive literature review, it seems that this oversight is shared by many KM researchers. Driven by many failed KM initiatives, many KM researchers seem to have started to focus more on the other aspects of the KM system rather than the IT aspect of KM. Some argued that the top management aspect has a "lion's share" effect on the success of the KM initiatives while others presumed that human resources management is the vital success factor in KM systems. A third group believed that some sort of process management will solve the problem. Some of these studies reached their conclusions based on observing and studying the successful KM examples in the industries they were studying. A gap in the literature has been identified.

It became more evident that there was no empirical research dealing with the holistic aspects of a KM system from the perspective of engineering knowledge in the aviation industry. The need for an empirical study in successful aircraft engineering knowledge management was founded on the apparent problem in the aviation industry and the identified gap in the KM literature.

This study has acknowledged the ideas of all of the three groups. However, it suggested a new holistic approach to incorporate all of the three aspects in the literature; top management, process management and people management. Moreover, it tried to include all the relevant critical success factors of successful KM systems. These factors were grouped and themed based on adapting the operations management elements. This new approach was called Operations-Based Knowledge Management (OBKM). Therefore, the main objective of this study was to develop a framework for better management of knowledge in the aircraft engineering field.

To achieve the research objective, three research questions were proposed as follows:

- What is Operations Based Knowledge Management (OBKM)?
- What are the current knowledge management practices in the Saudi Arabian aviation industry in the aircraft engineering field?
- What are the critical success factors required for effective OBKM system implementation?

As the first step of this research, an extensive literature review of KM concepts and theoretical success factors, and operations management elements was conducted. Based on this review, eight elements were proposed to be important for the success of an OBKM system. Those elements form guidelines for an OBKM framework.

In the second step of the research, several interviews with aviation industry experts in Saudi Arabia were conducted to explore the current KM practices and introduce the OBKM framework guidelines. To achieve this, a convergent interviewing technique was used to allow for concept development. The feedback from the interviews was helpful in further developing the theoretical framework.

This yielded eight modified elements which are Planning and Strategy Development, Leadership, Monitoring and Continual Improvement, Implementation, Guidance and Procedure, Culture, Teamwork and Development.

Step three of the study consisted of the validation analysis of the modified elements. The validation analysis was based on literature analysis. More than 23 recent studies in the field of knowledge management critical success factors were included in this study. After studying these papers it seemed that ideas for research had been comprehensively identified, similar ideas were reoccurring and additional studies would not have added to the findings of this research. Each critical success factor was coded and grouped under one element based on the theme of the elements to yield a theoretical OBKM framework. The codes developed in this analysis were reused for the subsequent research steps.

To validate the theoretical framework, it was decided to use an empirical validation process in the form of focus groups and capture inputs from industry experts in the fourth research step. These focus groups were attended by 63 aircraft engineers and managers employed within the Saudi Arabian aviation industry. The responses were analysed and reflected against the theoretical OBKM framework. The same methodology used in the theoretical validation of the framework was also utilized to analyse the industry experts' feedback obtained from the focus groups. Since all eight elements were confirmed, the theoretical framework was considered as validated by the industry experts. As a result the practice-based OBKM framework was introduced. Additionally, the codes used in the analysis were employed as constructs during the development of the industry wide survey in the final step of the research.

In the final step of this research, an industry wide survey was carried out to test and validate the proposed practice-based framework. A survey questionnaire was designed where the codes were used as constructs to generate survey questions. This survey was made available for the community of aircraft engineers in the Saudi Arabian aviation industry to obtain quantitative data for statistical analysis. 48 questionnaires were returned with a response rate of 35%.

The measurement instrument was evaluated for the goodness of the data. Reliability testing and analysis were performed using an internal consistency method. Validity analysis also consisted of content, construct and criterion-related analysis performed to evaluate the instrument. As a result of these analyses, it was concluded that the research instrument was reliable and valid for measuring the constructs.

The statistical data analysis was performed using IBM SPSS Statistical software version 20. Preliminary data analysis was performed using descriptive data analysis (e.g. mean, standard deviation and frequency distribution) before hypotheses testing. For hypotheses testing, parametric testing, including *t*-test and Pearson correlations were utilised.

Analysis of results revealed that the aircraft engineers have not undertaken practices they perceived important for the knowledge management system. This was demonstrated by the significant difference between the means of managing knowledge practices and their perceived importance. Further analysis of the survey results and hypotheses testing confirmed the existence of the eight critical success factors – Planning and Strategy Development, Leadership, Monitoring and Continual Improvement, Implementation, Guidance and Procedure, Culture, Teamwork and Development – proposed by the practice-based OBKM framework. These factors were found to be significantly interrelated. Based on the analysis results, the Final OBKM framework was developed which included implementation guidelines. These guidelines are generic guidelines which provide an overview of the approach to an effective implementation of an OBKM system. The framework itself is generic enough to be used for application within industries other than the aircraft industry. However, further refinement and customization of the framework could be made for a particular case study. Nevertheless, this framework is believed to be greatly beneficial for many organizations needing to implement an effective OBKM system.

Finally, it is necessary to evaluate this study from the point of view of answering the three research questions that define the research objective. The first question 'What is OBKM?' was answered on the basis of the literature review. The defined OBKM concepts and elements were used throughout the research activities. Question two: 'What are the current knowledge management practices in the Saudi Arabian aviation industry in the aircraft engineering field?' and question three 'What are the critical success factors for an effective OBKM system implementation?' were answered using the results from the focus groups and research survey. The current managing knowledge practices in the Saudi Arabian aviation industry were identified.

7. 3. Research Conclusions

Several conclusions were obtained from this research. Firstly, in the Saudi Arabian aviation industry, the level of KM awareness amongst aircraft engineers is low. Whilst there is a perception that KM is beneficial, there is no common agreement on what the KM intentions and objectives should be. The current modest KM practices, where they exist, are merely incidental to everyday operations, and not due to any deliberate focus on knowledge management.

Secondly, the measurement survey instrument used in this study is reliable and valid for measuring what it was intended to measure. It could be used for future studies in the OBKM system implementation area.

Thirdly, several conclusions were acquired from the statistical data analysis.

a) Most of the respondents believe that the current practices are insufficient in retaining most of the aircraft engineering knowledge.

b) Initial analysis of the results revealed that the aircraft engineers have not preformed practices they perceived important for the knowledge management system. 'Teamwork' factor is the most practised and considered the most important by them.

c) Further analysis of the survey results and hypotheses testing confirmed the existence of the eight critical success factors – Planning and Strategy Development, Leadership, Monitoring and Continual Improvement, Implementation, Guidance and Procedure, Culture, Teamwork and Development.

d) These factors were found to be significantly positively interrelated with each other.

7. 4. Limitation and Future Research Prospective

This study has been completed. However, it is important to evaluate it based upon its limitations. The limitations of this research are as follows:

- This research is investigative where it identifies the 'what" of the OBKM system but not 'why'.
- While the response rate (35%) of the survey is acceptable for these types of studies, this might limit the representativeness of the findings and of its generalizations.

Prospective research direction is recommended as follows:

- This research could be extended to other countries and industries to examine whether situation replicate.

- Replicating the empirical part of the study for a greater geographical diversity or including different industries would be helpful in validating the theoretical OBKM framework proposed in this dissertation.
- Examine the effectiveness of the OBKM system implementation using a set of longitudinal studies would be valuable.
- An in-depth case study could be conducted in an organization in the Saudi Arabian aviation industry to gain more insight into using this OBKM framework in practice.

7. 5. Research Contributions

The original contribution to knowledge that this research makes is shown as follows:

- A reliable and valid research instrument has been developed.
- A verified practice-based OBKM framework for retaining individual aircraft engineering knowledge within organizational knowledge in the context of the civil aviation industry has been developed.
- The Eight factors critical to the success of an OBKM system implementation in the Saudi Arabian aviation industry were identified.
- Insights into the current KM practices in the Saudi Arabian aviation industry, especially in the aircraft engineering field, were provided.
- A model and guidelines for an OBKM system implementation was proposed in the Saudi Arabian aviation industry.

This research established the foundation for KM researchers to continue in their future research on OBKM system implementation. Additionally, the results of this research could be used by the practitioners to effectively implement an application of the OBKM framework.

References

AKHAVAN, P., HOSNAVI, R. & SANJAGHI, M. E. 2009. Identification of knowledge management critical success factors in Iranian academic research centers. *Education, Business and Society: Contemporary Middle Eastern Issues,* 2**,** 276-288.

AKHAVAN, P., JAFARI, M. & FATHIAN, M. 2006. Critical success factors of knowledge management systems: a multi-case analysis. *European Business Review,* 18**,** 97-113.

AKPOLAT, H. 2004. *Six Sigma in Transactional and Service Environments*, Gower Pub Co.

AKPOLAT, H. 2010. Systematic Management Of Operational Risks – An Australian Study. *International journal of logistic and transport,* 4**,** 7-14.

AL-MABROUK, K. Critical Success Factors Affecting Knowledge Management Adoption: A Review of the Literature. Innovations in Information Technology, 2006. IEEE, 1-6.

ALAVI, M. & LEIDNER, D. E. 2001. Review: Knowledge Management and Knowledge Management Systems: Conceptual Foundations and Research Issues. *MIS Quarterly,* 25**,** 107-136.

ALAZMI, M. & ZAIRI, M. 2003. Knowledge management critical success factors. *Total Quality Management and Business Excellence,* 14**,** 199-204.

ALLEN, S. R. 2010. *The effect of management actions on knowledge transfer within the aerospace industry.* PhD PhD, Walden University.

ARKELL, D. 2007. Get our heads into it. *Boeing Frontiers.* Chicago, IL: Boeing.

BARSKY, N. P. & MARCHANT, G. 2000. The most valuable resource-measuring and managing intellectual capital. *Strategic Finance Magazine,* 81**,** 58-62.

BARUCH, Y. & HOLTOM, B. C. 2008. Survey response rate levels and trends in organizational research. *Human Relations,* 61**,** 1139-1160.

BASSI, L. J. 1999. Measuring knowledge management effectiveness. *The knowledge management yearbook,* 2000**,** 422-427.

BENMOUSSA, C. 2009. Moving Beyond Traditional Knowledge Management: A Demand-Based Approach. *Journal of Knowledge Management Practice,* 10.

BURGER, P. 2004. Critical success factors for knowledge management in government enterprises: a case study of success at the Department of Commerce. *SYSTALEX E-Gov Knowledge Management Exhibition Booth,* 214.

CARTER, C. 2004. When your Gurus Walk Out the Door. *KM Review,* 7**,** 16-19.

CHEMERS, M. M. & AYMAN, R. E. 1993. *Leadership theory and research: Perspectives and directions*, Academic Press.

CHOI, Y. S. 2000. *An empirical study of factors affecting successful implementation of knowledge management.* PhD, The University of Nebraska - Lincoln.

COLLISON, C. & PARCELL, G. 2001. *Learning to Fly: Practical Lessons from one of the World's Leading Knowledge Companies,* Milford, CT, Capstone Publishing.

COOPER, D. R. & EMORY, C. W. 1995. Business Research Methods, Chicago: Richard D. Irwin. Inc.

DAVENPORT, T. H., DE LONG, D. W. & BEERS, M. C. 1998. Successful knowledge management projects. *Sloan Management Review,* 39**,** 43-57.
DAVENPORT, T. H. & GLASER, J. 2002. Just-in-Time Delivery Comes to Knowledge Management. *Harvard Business Review,* 80**,** 107-111.
DAVENPORT, T. H. & PRUSAK, L. 1998. *Working knowledge : how organizations manage what they know,* Boston, MT, Harvard Business School Press.
DESOUZA, K. C. & AWAZU, Y. 2006. Knowledge management at SMEs: five peculiarities. *Journal of Knowledge Management,* 10**,** 32-43.
DEUTSKENS, E., DE RUYTER, K., WETZELS, M. & OOSTERVELD, P. 2004. Response rate and response quality of internet-based surveys: an experimental study. *Marketing letters,* 15**,** 21-36.
DIAKOULAKIS, I. E., GEORGOPOULOS, N. B., KOULOURIOTIS, D. E. & EMIRIS, D. M. 2004. Towards a holistic knowledge management model. *Journal of Knowledge Management,* 8**,** 32-46.
DILLMAN, D. A. 2000. *Mail and internet surveys: The tailored design method*, Wiley New York.
DRUCKER, P. F. 1991. The New Productivity Challenge. *Harvard Business Review,* 69**,** 69-79.
EDWARDS, J. S., SHAW, D. & COLLIER, P. M. 2005. Knowledge management systems: finding a way with technology. *Journal of Knowledge Management,* 9**,** 113-125.
FINNERAN, T. 1999. A component-based knowledge management system. *The Data Administration Newsletter (TDAN. COM).* June 1, 1999 ed.
FLYNN, B. B., SAKAKIBARA, S., SCHROEDER, R. G., BATES, K. A. & FLYNN, E. J. 1990. Empirical research methods in operations management. *Journal of Operations Management,* 9**,** 250-284.
FORZA, C. 2002. Survey research in operations management: a process-based perspective. *International Journal of Operations & Production Management,* 22**,** 152-194.
FOWLER JR, F. J. 2008. *Survey research methods*, SAGE Publications, Incorporated.
FREKE, V. 2006. *Definitions, Reuse and Technology: How Context Impacts Technology Support for Knowledge Management.* PhD PhD, Griffith University.
GACA. 2003. *List of GACA Approved Repair Stations* [Online]. [Accessed 03 Nov 2011 2012].
GOH, S. C. 2002. Managing effective knowledge transfer: an integrative framework and some practice implications. *Journal of Knowledge Management,* 6**,** 23-30.
GOTTSCHALK, P. 2002. Empirical Validation Procedure for the Knowledge Management Technology Stage Model. *Informing Science,* 5**,** 189-218.
GUPTA, A. & MCDANIEL, J. 2002. Creating competitive advantage by effectively managing knowledge: a framework for knowledge management. *Journal of Knowledge Management Practice,* Vol. 3.
HAIR, J. F., ANDERSON, R. E., TATHAM, R. L. & BLACK, W. C. 1998. Multivariate data analysis. Upper Saddle River, NJ: Prentice Hall.
HARVEY, D. J. & HOLDSWORTH, R. Knowledge management in the aerospace industry. Professional Communication Conference, 2005. IPCC 2005. Proceedings. International, 10-13 July 2005 2005. 237-243.

HASANALI, F. 2002. Critical success factors of knowledge management. *Knowledge Management Advantage* [Online]. Available: http://polaris.umuc.edu/mts/TMAN/TMAN_636/articles/csfs.pdf [Accessed 01 Feb 2012].

HEBERLEIN, T. A. & BAUMGARTNER, R. 1978. Factors affecting response rates to mailed questionnaires: A quantitative analysis of the published literature. *American Sociological Review***,** 447-462.

HEISIG, P. 2001. Business process oriented knowledge management. *Knowledge Management: Best Practices in Europe, Berlin.*

HERNÁNDEZ, M. A. & STOLFO, S. J. 1998. Real-world Data is Dirty: Data Cleansing and The Merge/Purge Problem. *Data Mining and Knowledge Discovery,* 2**,** 9-37.

HISLOP, D. 2002. Mission impossible? Communicating and sharing knowledge via information technology. *Journal of Information Technology (Routledge, Ltd.),* 17**,** 165-177.

HOLM, J., PHILLIP, O., DENIS, M. & MANFRED, W. 2006. Creating architectural approaches to knowledge management: an example from the space industry. *Journal of Knowledge Management,* 10**,** 36-51.

HOLSAPPLE, C. W. & JOSHI, K. D. 2000. An investigation of factors that influence the management of knowledge in organizations. *The Journal of Strategic Information Systems,* 9**,** 235-261.

JAYAMAHA, N., GRIGG, N. & MANN, R. 2009. A study of the validity of three major business excellence models in the Asia Pacific region. *Total Quality Management & Business Excellence,* 20**,** 1213-1227.

KAKABADSE, N. K., KAKABADSE, A. & KOUZMIN, A. 2003. Reviewing the knowledge management literature: Towards a toxonomy. *Journal of Knowledge Management,* 7**,** 75-91.

KEEN, P. & TAN, M. 2007. Knowledge Fusion: A Framework for Extending the Rigor and Relevance of Knowledge Management. *International Journal of Knowledge Management,* 3**,** 1-17.

KUMAR, R. 2010. *Research methodology: a step-by-step guide for beginners*, Sage Publications Limited.

LA BELLA, A., CANZANO, D. & GRIMALDI, M. Critical capabilities and performance in the aerospace industry: a knowledge management approach. Aerospace Conference, 2004. Proceedings. 2004 IEEE, 6-13 March 2004 2004. 3962-3969 Vol.6.

LIEBOWITZ, J. 1999. Key ingredients to the success of an organization's knowledge management strategy. *Knowledge and Process Management,* 6**,** 37-40.

LIEBOWITZ, J. & MEGBOLUGBE, I. 2003. A set of frameworks to aid the project manager in conceptualizing and implementing knowledge management initiatives. *International Journal of Project Management,* 21**,** 189-198.

MANASCO, B. 1999. The knowledge imperative: Leverage it or lose it. *The Interactive management & economics resources* [Online]. Available: http://webcom.com/quantera/empires5.html.

MAQSOOD, T. 2006. *The role of knowledge management in supporting innovation and learning in construction.* RMIT University.

MATHI, K. 2004. *Key success factors for knowledge management.* Master, UNIVERSITY OF APPLIED SCIENCES/ FH KEMPTEN.

MCNICHOLS, D. 2008. *Tacit Knowledge: An examination of intergenerational knowledge transfer within an aerospace engineering community.* D.M. D.M., University of Phoenix

MOEN, R. & NORMAN, C. 2006. Evolution of the PDCA cycle.

MOFFETT, S., MCADAM, R. & PARKINSON, S. 2003. An empirical analysis of knowledge management applications. *Journal of Knowledge Management,* 7**,** 6-26.

MOREY, D. 1998. Knowledge management architecture. *Handbook of Data Management, Auerbach.*

MORGAN, D. L. 1997. *Focus groups as qualitative research*, Sage Publications, Inc.

MORRISON, M. 2008. *Jobs aplenty in booming Gulf business aviation market* [Online]. Available: http://www.flightglobal.com/.

NATIONAL-SCIENCE-BOARD. 2010. *Science & Engineering Indicators 2010* [Online]. Available: http://www.nsf.gov/statistics/seind10/c3/c3h.htm [Accessed 20 Jul 2010.

NELSON, D. & QUICK, J. 2006. *Organizational Behavior: Foundations, Realities, & Challenges. Southwestern*, Thomson Publishing.

NICOLAS, R. 2004. Knowledge management impacts on decision making process. *Journal of Knowledge Management,* 8**,** 20-31.

NONAKA, I. 1994. A Dynamic Theory of Organizational Knowledge Creation. *Organization Science,* 5**,** 14-37.

NONAKA, I. & PELTOKORPI, V. 2006. Objectivity and subjectivity in knowledge management: a review of 20 top articles. *Knowledge and Process Management,* 13**,** 73-82.

NONAKA, I. & TAKEUCHI, H. 1995. *The knowledge-creating company : how Japanese companies create the dynamics of innovation,* New York Oxford University Press.

NUNNALLY, J. C., BERNSTEIN, I. H. & BERGE, J. M. T. 1967. *Psychometric theory*, McGraw-Hill New York.

ONG, C.-S. & LAI, J.-Y. 2006. Gender differences in perceptions and relationships among dominants of e-learning acceptance. *Computers in Human Behavior,* 22**,** 816-829.

PEYMAN, A., MOSTAFA, J. & MOHAMMAD, F. 2006. Critical success factors of knowledge management systems: a multi-case analysis. *European Business Review,* 18**,** 97-113.

PITINANONDHA, T. 2008. *Operational risk management (ORM) systems - An Australian study.* PhD PhD, University of Technology, Sydney.

POLANYI, M. 1966. *The Tacit Dimension,* Garden City, N.Y, Doubleday.

POLITIS, J. D. 2001. The relationship of various leadership styles to knowledge management. *Leadership & Organization Development Journal,* 22**,** 354-364.

POWELL, J. H. & SWART, J. 2005. This is what the fuss is about: a systemic modelling for organisational knowing. *Journal of Knowledge Management,* 9**,** 45-58.

PRUSAK, L. 2001. Where did knowledge management come from? *IBM Systems Journal,* 40**,** 1002-1007.

RAO, S. & PERRY, C. 2003. Convergent interviewing to build a theory in under-researched areas: principles and an example investigation of Internet usage

in inter-firm relationships *Qualitative Market Research: An International Journal,* 6**,** 236-247.
SCHAEFER, D. R. & DILLMAN, D. A. 1998. Development of a standard e-mail methodology: Results of an experiment. *Public opinion quarterly***,** 378-397.
SCHULTZE, U. Investigating the contradictions in knowledge management. Information Systems: Current Issues and Future Changes, 1999 Helsinki, Finland. 155-174.
SEKARAN, U. & BOUGIE, R. 2009. *Research Methods for Business: A Skill Building Approach*, John Wiley & Sons.
SHAW, G. P. & SMITH, D. Y. 2003. Don't let knowledge and experience fly away: Leveraging scarce expertise to support ongoing competitiveness in the aerospace and defense industry. Available: www. accenture.com [Accessed 9 May 2010].
SHIM, J. K. & SIEGEL, J. G. 1999. *Operations management*, Barrons Educational Series Incorporated.
SILVERMAN, D. 2010. *Qualitative research*, SAGE Publications Limited.
SKYRME, D. 1997. Knowledge management: making sense of an oxymoron. *Management Insights* [Online].
SKYRME, D. & AMIDON, D. 1997. The knowledge agenda. *Journal of Knowledge Management,* 1**,** 27-37.
SOLOMON, D. J. 2001. Conducting web-based surveys. *Practical assessment research and evaluation,* 7.
STANDARDS-AUSTRALIA 2005. Knowledge management – a guide. *AS 5037–2005.* Sydney, Australia: Standards Australia.
STEWART, T. A. 1997. *Intellectual capital: the new wealth of organizations*, Doubleday.
SVEIBY, K.-E. 2001. A knowledge-based theory of the firm to guide in strategy formulation. *Journal of intellectual capital,* 2**,** 344-358.
SWAN, J. & NEWELL, S. Linking Knowledge Management and Innovation. *In:* HANSEN, H. R., BICHLER, M. & MAHRER, H., eds. European Conference on Information Systems, 2000 Vienna. Vienna University of Economics and Business Administration, 591-598.
SWAN, J., NEWELL, S. & ROBERTSON, M. Knowledge Management - When Will People Management Enter the Debate? Hawaii International Conference on System Sciences, 2000a. 3026-3026.
SWAN, J., NEWELL, S. & ROBERTSON, M. Limits of IT-driven Knowledge Management Initiatives for Interactive Innovation Processes: Towards a Community-Based Approach. Hawaii International Conference on System Sciences, 2000b Hawaii. pp. 3026-3026.
TAT, L. W. & STEWART, H. 2007. Knowledge management in the Malaysian aerospace industry. *Journal of Knowledge Management,* 11**,** 143-151.
TOBIN, T. 2003. Ten principles for knowledge management success. *Gartner Inc* [Online]. Available: http://www.inst-informatica.pt/servicos/informacao-e-documentacao/biblioteca-digital/areas-aplicacionais/gestao-do-conhecimento/whitepaper-tenprinciples.pdf.
TRUSSLER, S. 1998. The rules of the game. *Journal of Business Strategy,* 19**,** 16-19.
TSUI, E. 2005. The role of IT in KM: where are we now and where are we heading? *Journal of Knowledge Management,* 9**,** 3-6.

TUOMI, I. 1999. Data Is More Than Knowledge: Implications of the Reversed Knowledge Hierarchy for Knowledge Management and Organizational Memory. *Journal of Management Information Systems,* 16**,** 103-117.

WIIG, K. M. 1996. *On the management of knowledge* [Online]. Available: http://www.km-forum.org/what_is.htm [Accessed 20 Jan 2012.

WIIG, K. M. 1997. Knowledge management: Where did it come from and where will it go? *Expert Systems with Applications,* 13**,** 1-14.

WIIG, K. M. 1999. *Comprehensive knowledge management* [Online]. . Available: http://www.knowledgeresearch.com/downloads/compreh_km.pdf [Accessed 22 Jun 2009].

WONG, K. Y. 2005. Critical success factors for implementing knowledge management in small and medium enterprises. *Industrial Management & Data Systems,* 105**,** 261-279.

YAMMARINO, F. J., SKINNER, S. J. & CHILDERS, T. L. 1991. Understanding mail survey response behavior a meta-analysis. *Public opinion quarterly,* 55**,** 613-639.

ZANDER, U. & KOGUT, B. 1995. Knowledge and the speed of the transfer and imitation of organizational capabilities: An empirical test. *Organization Science,* 6**,** 76-92.

ZAWAWI, R., AKPOLAT, H. & BAGIA, R. 2010. Managing Knowledge in Aircraft Engineering. *International Journal of Business and Economics,* 2**,** 161-174.

Appendices

Appendix 1: Convergent Interviews

Meeting with E. E.

Name:	[redacted]
Position:	Principle Aircraft Engineer
Mobile:	+966 [redacted]
Email	[redacted]

Meeting Details

- Date : 23 Dec 2009
- Time : 1:00 to 2:00 pm
- Attendee: [redacted] (Senior Aircraft Engineer -A) the most senior engineer in [redacted] Airlines.

Topics Discussed

- Aircraft Engineering Work Flow
- Current KM Practices in [redacted] Airlines
- Explicate and Tacite Knowledge
- KM Importance in the Aviation industry

Interview Questions:

Q1- tell me about your self.

- Name: [redacted]
- Education background: B.S . In Aeronautical Engineering from [redacted]
- Work experience: Worked for [redacted] **25 years**
  Worked for [redacted] for 5 Years.
  Worked for [redacted] for 8 years
- Current Position: Principle Aircraft Engineer at *Aircraft Structure Engineering Support* department.

Q2- Describe the nature of your job?

Our job in the Aircraft Engineering support department is to provide technical support to the online aircrafts or the urgent maintenance requests. So, we are the firefighters of the aircraft engineering division. We have to solve and answer every request as fast as possible. Experience plays big part of our job. Currently my job is engineering advisor and on job trainer.

Q3- Do you have a formal or informal Knowledge Management System at your department?

At the moment, there are no formal KM systems in [redacted] As part of the FAA regulations (FAR 121) we have to **keep records** of every action on every aircraft and every part in it. So, you might call this system as an **informal explicate KM initiative**. Also, We have the **OJT** (on job training). This is by pairing junior engineers to senior engineers so, senior engineers evaluate and approve the junior engineers work. you might call this system as an **informal tacit KM initiative**. Finally, I have introduced Engineering Base Knowledge Program (EBKP). This program provides engineers with the needed base knowledge t perform their job. f

Q4-Why do you think it is important to manage engineering knowledge in the aviation industry?

There are several reasons for that:

- The is a cost-driven industry. Better KM reduce the cost of the operation.
- engineering is Experience is the focal point in the Aircraft Engineering
- For a new hire to fully function as an Aircraft Engineering he needs around 3-4 years of experience.
- Around 60% of the senior engineering (baby boomers)workforce in the aviation industry will retire or retired within this several years

- The time for engineering actions is directly effecting the aircrafts delays. Experienced engineers will reduce the delay times.

Q5- From your point of view, What would be the challenges and critical success factors for an effective engineering KM system in [redacted]?

These are some of what I can think of right now:

- Awareness
- Higher management full commitment
- Knowledge Sharing Culture. Without the willingness of engineer to share their knowledge, any KM inactive will fail.
- Simplified Infra structure. Useful and Easy to understand system that provide the needed information on time on location.
- Link the KM strategy to [redacted] strategies.

My Observation and Analysis

- High level of awareness of the KM concepts
- He feels the need for preserve Engineering knowledge
- He distinguish the difference between Tacit and explicate Engineering Knowledge
- Lack of tacit knowledge sharing system in [redacted]
- Engineering Experiences is been lost with people retirement and transfer

Meeting with A. R.

Name:	[redacted]
Position:	Aircraft Structure Support Engineer
Mobile:	+966 [redacted]
Email	[redacted]

Meeting Details

- Date : 12 Dec 2009
- Time : 1:00 to 2:00 pm
- Attendee: [redacted]
  (Specialist Aircraft Engineer A.)

Topics Discussed

- Aircraft Engineering Work Flow
- Current KM Practices in [redacted] Airlines
- Explicate and Tacit Knowledge

Interview Questions:

Q1- tell me about your self.

- Name: [redacted]
- Education background: B.S . In Mechanical Engineering from [redacted]
- Work experience: Worked for [redacted] for 5 years. Worked for [redacted] Airlines from 1997 to present **(12 Years)**.
- Current Position: Specialist Structural Aircraft Engineer at *Aircraft Structure Engineering Support* Department.

Q2- Describe the nature of your every day job?

My job s to provide Engineering Support to any damaged aircraft. I answer the engineering requests and provide repair designs for structural aircraft damages. In this department, Our job is to support the Online aircrafts (AOG).

Q3- Do you have a formal or informal Knowledge Management System at your department?

We have an engineering documentation system (Electronic document storage system). There we keep all the issued engineering documents like ERS, ER, EA, EO…etc. I think this sort of a formal system to keep engineering knowledge but we don't call it KM system.

Q4-Why do you think it is important to store the Engineering records?

Its part of our **Department procedure manual** (DPM) copy attached. More, It's an FAA requirement. I believe that it will **help others working on a similar problems**.

Q5- Could you describe how this system might help you solving similar problems?

First, when I receive a new task, I **search the Engineering documents** for similar problem by searching the titles and the ATA numbers. When I found a similar problem, I will compare it to my problem and most probably **I need to contact the engineer** who issued the previous document. Other than that, I need to adapt a new solution. Which will extend the time needed to solve the problem.

Q6-Do you think that this system is effective in helping others solving similar problems?

From my experience, it is **important to contact the engineer** who issued the original document to understand his solution. However, some times you **cannot contact the engineer** because he in on overseas assignment or left the company.

Q7- Why do you think it is important to contact the author of the document?

It is faster. More, most of the times his experience of this problem helps **speedup the process** and most importantly **prevent mistakes.**

Q8- Is there any other system to capture this engineering experience?

There is no such system but we manage to learn from our senior engineers.

Q9- Do you think that when a senior engineer leave the airline, his experience will be lost?

Some of his experience will be transferred to his succour through learning and on job training (OJT).

Q10- How much do you think is captured?

I think 50%!.

My Observation and Analysis

- little awareness of the KM concepts
- He feels the need for preserve Engineering knowledge
- He do not distinguish the difference between Tacit and explicate Engineering Knowledge
- Lack of tacit knowledge sharing system in [redacted] Airlines [redacted]

Meeting with Y. S.

Name:	[redacted]
Position:	Chief Aircraft Engineer
Mobile:	+966 [redacted]
Email	[redacted]

Meeting Details

- Date : 5 Jan 2010
- Time : 1:00 to 2:00 pm
- Attendee: [redacted] (Senior Aircraft Engineer A)

Topics Discussed

- Aircraft Engineering Knowledge
- Current KM Practices in [redacted] Airlines
- Retirement Procedure
- KM Importance in the [redacted] industry

Interview Questions:

Q1- tell me about your self.

- Name: [redacted]
- Education background: B.S . In Aeronautical Engineering from [redacted] University at [redacted]
- Work experience: Worked for [redacted] Airlines from 1986 to present (**22 years**)
- Current Position: Chief Aircraft Engineer at *Aircraft Structure and Interior Engineering Support* department.

Q2- Describe the nature of your job?

My job is to manage the aircraft structure and interior engineering support department. I report to the Engineering General Manager This department is responsible about providing technical support to any out-of-manual structural and interior issues and damages for [redacted] fleet. Time is critical in our job. The time needed to perform our tasks has direct impact to the flights delay time. The faster we perform our job the shorter the flight delay time. Experience plays big part of our job.

Q3- Do you have a formal or informal Knowledge Management System at your department?

We don't have a formal KM system but we have other systems to manage the engineering knowledge in this department. We are following the FAA rules and regulations in our airlines. Therefore, we keep record of any engineering actions on any aircraft. These records is located in the Engineering Documentation Database. More, we assign every new recruit to a senior engineer in his field and we call it on job training (OJT). Recently, we have introduced a new induction program to provide new engineers with the basic knowledge needed to perform his job. This program is called Engineering Base Knowledge Program (EBKP) and it is managed by our senior engineer Mr. [redacted].

Q4- Is there any system to capture engineering experience?

The main benefit of the OJT is to transfer engineering experience (knowledge) from senior engineers to juniors. More, the EBKP will reduce the knowledge gap between junior and senior engineers.

Q5- Do you think that when an engineer leave the airline, his experience will be lost?

Not all of his experience knowledge will be lost. Some of his experience will be transferred to his succour through OJT.

Q6- Do you think that these programs are effective to capture the engineering knowledge?How much do you think is captured?

I believe that some of the important knowledge is captured however, most of the knowledge is difficult to capture. These programs or any similar programs needs the willingness to share engineer's own knowledge with others. I think that we could capture and transfer (roughly) 40% of the important engineering knowledge or Know-how in this department.

Q7- When someone leaves the airline, is there any system to capture the his knowledge? Exit interview?

We do not have exit interviews but from my experience, exit interviews have little value in capturing his knowledge. After all, he decided to leave the airline and he don't care anymore about his future in it.

My Observation and Analysis

- Some awareness of the KM concepts
- He feels the need for preserve Engineering knowledge
- Lack of formal tacit knowledge sharing system in [redacted] Airlines [redacted]
- Engineering Experiences is been lost with people retirement and transfer
- There is NO exit interviews in the retirement/resignation procedure
- Current informal programs is not effective enough (40%)

Meeting with B. G.

Name:	[redacted]
Position:	Principle Aircraft Engineer
Mobile:	+966 [redacted]
Email	[redacted]

Meeting Details

- Date : 7 Jan 2010
- Time : 1:00 to 2:00 pm
- Attendee: [redacted] (Senior Aircraft Engineer -B)

Topics Discussed

- Aircraft Engineering Knowledge
- Current KM Practices in [redacted] Airlines
- Informal team Knowledge sharing.

Interview Questions:

Q1- tell me about your self.

- Name: [redacted]
- Education background: B.S . In Aeronautical Engineering from [redacted] University at [redacted]
- Work experience: Worked for [redacted] Airlines from 1992 to present (**18 years**)
- Current Position: Principle Aircraft Engineer at *Aircraft Structure Engineering Support* department.

Q2- Describe the nature of your job? Your department?

My job is to manage the aircraft structure engineering support department. I report to the Chief Aircraft Engineer.

Our job in this department is to :

- Provide Engineering technical Support to any structural damage in the aircraft.
- Answer the engineering requests and provide repair designs for structural aircraft damages.
- Support the Online aircrafts (AOG).

Being fast is the name of the game. We only accept experienced aircraft engineers in this unit. An engineer should have work in Engineering reliability department for some time to be eligible to work here. We provide our services to [redacted] fleet 24/7. It is a knowledge intense work environment.

Our team consists of five engineers and me. We have three highly qualified engineers. Each of them have an experience of five years minimum in this department and another two years in the aircraft engineering field. Also, there are two on job trainees. Our offices are open plan type. We share our experiences and lessons with each other. This unit is deferent to other engineering units.

Q3-Do the engineers share their experience with each other in your department? how?

Yes they share what they learned doing their tasks. However, this is done informally. The following are some ways to share the experience within our department:

- Usually when an engineer have a new problem in hand, he search for a prior solutions to a similar problem. When he found a similar one, he then discuss his problem with the original engineer to learn from his experience.
- Due to the open office arrangement, it is easy to discuss your problem with all the team. Most of the time, you could find your solution during these discussions.
- When an engineer came back from a recovery, he tell his recovery story to his colleges. You could learn new things from these stories.
- Mistakes in our department are critical therefore, any mistake will be discussed and will be known to the team.

However, due to time constrains, we sometimes cannot share or find the needed experience which cost us precious time.

Q4- Is there any system to capture this engineering experience? Are those lesson learned, recovery stories, mistakes ...etc documented?

No there is NO formal system to capture their experience OR to document it.

Q5- Do you think that when an engineer leave the airline or your department, his experience will be lost?

Yes I believe that his experience is lost. Although, we share as much as we can, we still need to have the experienced engineer to perform the task.

My Observation and Analysis

- Little awareness of the KM concepts
- He feels the need for preserve Engineering knowledge
- He do not distinguish the difference between Tacit and explicate Engineering Knowledge
- There are no formal tacit knowledge sharing system in [redacted] Airlines [redacted]
- There is some informal KM activities in his department (chatting about important tasks, share lessons learned, achievements...etc)

Appendix 2: Knowledge Management Workshops (Focus Groups)

A2.1. Knowledge Management Workshop Agenda

08:30 - 09:00	Registration and Refreshments (Handout, Nametags, ….etc)
09:00 - 09:10	Welcome Speech and Introduction to KM Workshop
09:10 - 10:00	Six Sigma and KM
10:00 - 10:30	COFFEE BREAK
10:30 - 11:30	Six Sigma and KM
11:30 - 12:30	Knowledge Management Seminar
12:30 - 14:00	LUNCH BREAK
14:00 - 15:30	Focus Group Sessions
15:30 - 15:45	Results Discussion and Summary

A2.2. Workshop Steps

STEP 1:	Seminar	1. Introduction to KM concepts used by airlines (L.R)
		2. Raise the awareness of KM
		3. Introduce OBKM Framework
STEP 2:	Workshop	1. Introduce workshop objectives
		2. Divide people into groups of 6
		3. Each Group is required to answer 2 questions Q1: What are the **CSFs** of a KM System Q2-What could be the **Challenges** to KM System implantation
		4. Each group present their results and clarification of each item
		5. Summarize it into Post-it notes (2-3 words)
		6. Post it into the wall (Grouping and Collection)
STEP 3:	Summary	1. Results presentation
		2. Questions and Discussions

A2.3 Workshop Brochure

[redacted]

Knowledge Management Workshop

25 September 2011
(repeated on 26 Sept. 2011)

8:00am – 4:00pm

University of Technology, Sydney

Knowledge Management

Knowledge Management (KM) emerged as a scientific discipline since early 1990's however, it been said that KM is thousands of years old, dating back when -as a matter of survival- first human drew information on a cave wall. While nowadays organizations use deferent KM methods, Knowledge sharing is no less of a matter of survival. KM is the process of retaining employees' knowledge and experience within the organization's boundary.

This workshop aims to introduce to the participants the concepts of KM, while establishing a view of the current KM practice within the participants' industry.

Among many other benefits, some of the typical advantages of implementing KM practices may include:

- Reduce the skill gap between employees
- Reduce cost of engineering training
- Improve decision making time
- Increase safety by reducing the error probability

Who Should Attend

This workshop is suitable for all levels of aircraft engineering and related professions

Venue

Saudia Aerospace Engineering Industries

Workshop Objectives

Workshop objectives include:

- Introducing KM concepts to the aircraft engineering industry.
- Raising the awareness of the importance of engineering knowledge to the organizations and the potential risk of loosing it.
- Reaching a common perception about meaning of knowledge and KM.
- Determining the (formal or informal) KM current practices.
- Identifying the challenges and critical success factors of implantation of KM systems.
- Initiating the establishment of the Saudi Arabian Aircraft Engineering Community (SAAEC)

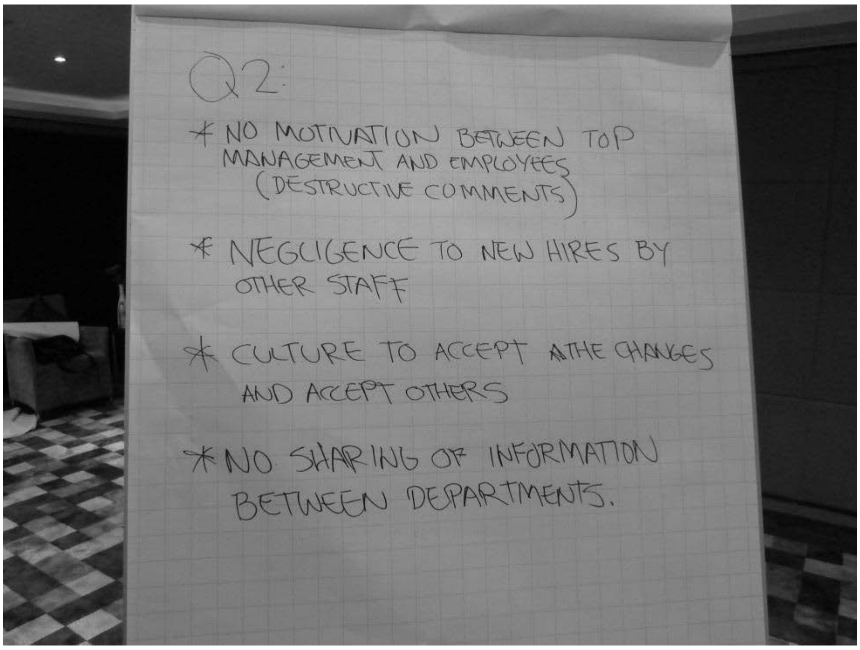
Facilitators

This workshop is part of a collaboration between University of Technology Sydney, Australia and [redacted] and will be facilitated by:

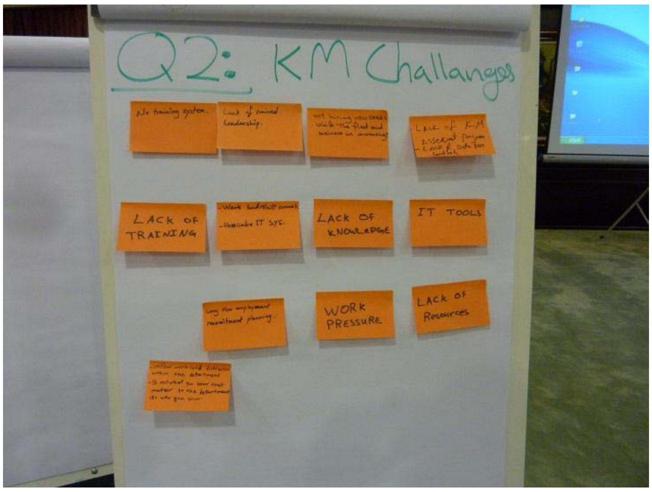
Dr. Hasan Akpolat – Senior Lecturer
Mr. Ravindra Bagia – Senior Lecturer
Mr. Rafed Zawawi – PhD Candidate

Faculty Engineering and IT
University of Technology Sydney
Australia

A2.4. Presented Group Results (Sample)



A2.5 Summarized Groups Results



Appendix 3: Questionnaire

<u>Translation Certificate</u>

NATIONAL ACCREDITATION AUTHORITY FOR TRANSLATORS AND INTERPRETERS
NAATI No. 35239
MOHAMMAD BAWAZEER
TRANSLATOR
ARABIC <-> ENGLISH

[ARABIC TRANSLATION OF THE ATTACHED DOCUMENT]

NAME OF TRANSLATOR: Mohammad Bawazeer
NAATI ACCREDITATION NO.: 35239
NAATI ACCREDITATION STATUS: Professional
DATE: 27 November 2012

NATIONAL ACCREDITATION AUTHORITY FOR TRANSLATORS AND INTERPRETERS
NAATI No. 35239
MOHAMMAD BAWAZEER
TRANSLATOR
ARABIC <-> ENGLISH

<u>Screen shots of the web-based survey</u>.

Managing Aircraft Engineering Knowledge

هذا الاستبيان هو حول إدارة وإستبقاء الخبرات والمعرفة في هندسة الطائرات. وهو جزء من مشروع بحثي لنيل شهادة الدكتوراه. جميع المعلومات التي تم جمعها سيتم استخدامها لغرض هذا البحث فقط. وعلاوة على ذلك، فإن البيانات التي سيتم جمعها عن طريق هذه الدراسة ستيم التعامل معها بسريه مطلقة

المشاركة في هذا المسح هو تطوعي ويمكنك الانسحاب في اي وقت

الرجاء الإجابة على الأسئلة بقدر الاستطاعة. لا توجد إجابة صحيحة أو خاطئة. أنا مهتم برأيك حول هذا الموضوع

This questionnaire is about managing and retaining aircraft engineering knowledge. It is part of my PhD research project and all the information gathered through the questionnaire will be used for the purpose of this research ONLY. Moreover, the data collected via this survey will be treated in an absolute confidental manner.

The survey participation is voluntary and you may withdraw any time.

Please answer the questions to the best of your knowledge. There is no right or wrong answer. I am interested in your opinion on the subject surveyed.

Rafed Zawawi

School of Systems, Management& Leadership
Faculty of Engineering& Information Technology
University of Technology, Sydney

Phone: +61 (02) 9514 7585
Mobile: +61 [redacted]
Email: rafed.a.zawawi@student.uts.edu.au
Office: CB01.20.2702
Postal: University of Technology, Sydney
P.O.Box 123, Broadway NSW 2007, Australia

* Required

SECTION A: GENERAL (ORGANIZATIONAL AND PERSONAL INFORMATION)

What is your position in the organization? *
ما هو موقعك الوظيفي في هذه المنظمة (الشركة)؟

- Higher Management (Division Head)
- Middle Management (Section Head, Chief Engineer)
- Technical Lead (Principle Engineer)
- Senior Engineer
- Engineer
- Administration
- Other:

Years working in this Organization *
كم سنة قضيتها في عملك في هذه المنظمة؟

- Less than 5 years
- 5-10 Years
- 11-15 Years
- 16-20 Years
- More than 20 years

What is your organization's field of work? *
ما هو مجال عمل هذه المنظمة؟

- Government Authority (GACA)
- Manufacturer- (Aircraft, Engine, Parts…ets)
- Aircraft Operator (Airline, private…etc)
- Maintenance Repair and Overhaul (MRO)
- Defence
- Other:

In which country is your organization located? *
اين تقع هذه المنظمة؟

- Kingdom of Saudi Arabia
- UAE
- Other GCC countries (Gulf Corporation Council)
- Other:

How familiar do you consider yourself with respect to Knowledge Management (KM) concepts and tools? *
كيف تقيم نفسك في ما يتعلق بمفاهيم ادارة المعرفة وادواتها؟

- Very Familiar
- Familiar
- Somehow Familiar
- Unfamiliar
- Very Unfamiliar

In your point of view, when engineers leave the organisation, how much of their Knowledge is been retained in the organisation (or replacement engineer)? *
في وجهة نظركم، عند مغادرة المهندسين المنظمة، كم يتبقى من معرفتهم في حدود المنظمة (أو لدى المهندس البديل)؟

- None of their knowledge
- Some of their knowledge
- Most of their knowledge
- All of their knowledge

Continue »

Powered by Google Docs

Report Abuse - Terms of Service - Additional Terms

Managing Aircraft Engineering Knowledge

* Required

SECTION B: KNOWLEDGE MANAGEMENT CURRENT PRACTICES AND IMPORTANCE

TOP MANAGEMENT ASPECT

This section presents a number of statements and for each statement you are asked to provide two (2) ratings.

The first rating gives an extent to which you agree that the statement APPLIES IN YOUR OWN ORGANISATION. You will give these ratings in the row labelled "IN MY ORGANIZATION"

Strongly Disagree 1 2 3 4 5 Strongly Agree

The second rating gives an extent to which you agree that the statement reflects what is IMPORTANT FOR THE SUCCESSFUL OF MANAGING KNOWLEDGE ACTIVITIES. You will give these ratings in the row labelled "IMPORTANCE"

Not important at all 1 2 3 4 5 Vital

يعرض هذا القسم عددا من الجُمل. المطلوب تقديم تقييمين (2) لكل جملة

التقييم الاول يبين مدي موافقتك على ان الجملة تنطبق على المنظمة اللتي تنتمي اليها. سوف تعطي هذا التقييم في السطر المسمى
IN MY ORGANIZATION

التقييم الثاني يبين مدى موافقتك على أهمية هذه الجملة في نجاح إدارة المعرفة. سوف تعطي هذا التقييم في السطر المسمى
IMPORTANCE

Managing knowledge is viewed as a critical tool in managing organization's business processes *

ادارة المعرفة تعتبر اداة هامة في ادارة العمليات التجارية للمنظمة

	1	2	3	4	5
IN MY ORGANIZATION	○	○	○	○	○
IMPORTANCE	○	○	○	○	○

The organization has a defined and documented policy for managing knowledge *

المنظمة لديها سياسة محددة وموثقة لإدارة المعرفة

	1	2	3	4	5
IN MY ORGANIZATION	○	○	○	○	○
IMPORTANCE	○	○	○	○	○

Policy for managing knowledge is understood, implemented and maintained at all levels of the organization *

سياسة ادارة المعرفة مفهومة و مطبقة و محافظ عليها على جميع مستويات المنظمة

	1	2	3	4	5
IN MY ORGANIZATION	○	○	○	○	○
IMPORTANCE	○	○	○	○	○

Top Management has a well-defined plan for implementation of managing knowledge activities *

الإدارة العليا لديها خطة واضحة المعالم لتنفيذ الأنشطة الخاصة بإدارة المعرفة

	1	2	3	4	5
IN MY ORGANIZATION	○	○	○	○	○
IMPORTANCE	○	○	○	○	○

Top management provides adequate resources for managing knowledge activities *

الإدارة العليا توفر موارد كافية لأنشطة إدارة المعرفة

	1	2	3	4	5
IN MY ORGANIZATION	○	○	○	○	○
IMPORTANCE	○	○	○	○	○

Objectives for managing organizational knowledge are tied to the business objectives *

أهداف إدارة المعرفة للمنظمة مرتبطة بالأهداف التجارية للمنظمة

	1	2	3	4	5
IN MY ORGANIZATION	○	○	○	○	○
IMPORTANCE	○	○	○	○	○

Managing knowledge activities are included in the overall business strategy *

أنشطة ادارة المعرفة مشمولة في الإستراتيجية التجارية العامة للمنظمة

	1	2	3	4	5
IN MY ORGANIZATION	○	○	○	○	○
IMPORTANCE	○	○	○	○	○

Top management is committed to the success of managing knowledge initiatives *

الادارة العليا ملتزمة بنجاح مبادرات ادراة المعرفة في المنظمة

	1	2	3	4	5
IN MY ORGANIZATION	○	○	○	○	○
IMPORTANCE	○	○	○	○	○

Management strives to use the latest management theory and principles *

مدراء المنظمة يسعون لاستخدام أحدث نظريات ومبادئ الإدارة

	1	2	3	4	5
IN MY ORGANIZATION	○	○	○	○	○
IMPORTANCE	○	○	○	○	○

Top management drives and champions management of knowledge across the organization *

الإدراة العليا تقود وتتبنى إدارة المعرفة على جميع الأصعدة في النظمة

	1	2	3	4	5
IN MY ORGANIZATION	○	○	○	○	○
IMPORTANCE	○	○	○	○	○

Sharing Knowledge between the employees is encouraged and facilitated by top management *

الإدارة العليا تشجع وتيسر تبادل المعرفة بين الموظفين

	1	2	3	4	5
IN MY ORGANIZATION	○	○	○	○	○
IMPORTANCE	○	○	○	○	○

« Back | Continue »

Managing Aircraft Engineering Knowledge

* Required

SECTION B: KNOWLEDGE MANAGEMENT CURRENT PRACTICES AND IMPORTANCE

PROCESS MANAGEMENT

This section presents a number of statements and for each statement you are asked to provide two (2) ratings.

The first rating gives an extent to which you agree that the statement APPLIES IN YOUR OWN ORGANISATION. You will give these ratings in the row labelled "IN MY ORGANIZATION"

Strongly Disagree 1 2 3 4 5 Strongly Agree

The second rating gives an extent to which you agree that the statement reflects what is IMPORTANT FOR THE SUCCESSFUL OF MANAGING KNOWLEDGE ACTIVITIES. You will give these ratings in the row labelled "IMPORTANCE"

Not important at all 1 2 3 4 5 Vital

يعرض هذا القسم عددا من الجُمل. المطلوب تقديم تقييمين (2) لكل جملة

التقييم الاول يبين مدي موافقتك على ان الجملة تنطبق على المنظمة اللتي تنتمي اليها. سوف تعطي هذا التقييم في السطر المسمى IN MY ORGANIZATION

التقييم الثاني يبين مدى موافقتك على أهمية هذه الجملة في نجاح إدارة المعرفة. سوف تعطي هذا التقييم في السطر المسمى IMPORTANCE

Key performance metrics for management of knowledge are identified and used *
قياسات الأداء الرئيسية لادارة المعرفة مُعرفه ومُستخدمه

	1	2	3	4	5
IN MY ORGANIZATION	○	○	○	○	○
IMPORTANCE	○	○	○	○	○

Achievement of management of knowledge objectives is assessed regularly *
يتم تقييم إنجاز أهداف إدارة المعرفة بشكل منتظم

	1	2	3	4	5
IN MY ORGANIZATION	○	○	○	○	○
IMPORTANCE	○	○	○	○	○

Managing knowledge standards are identified and used *
معايير إدارة المعرفة مُحددة ومستخدمة

	1	2	3	4	5
IN MY ORGANIZATION	○	○	○	○	○
IMPORTANCE	○	○	○	○	○

Gaps between organization's management of knowledge practices and organization's management of knowledge standards are addressed *
تقوم المنظمة بتحديد الفجوات بين المعايير والممارسات في إدارة المعرفة لديها

	1	2	3	4	5
IN MY ORGANIZATION	○	○	○	○	○
IMPORTANCE	○	○	○	○	○

Organization's management of knowledge standards are regularly reviewed against global best practices *
تتم بشكل منتظم مراجعة معايير إدارة المعرفة لمقارنتها بأفضل الممارسات العالمية

	1	2	3	4	5
IN MY ORGANIZATION	○	○	○	○	○
IMPORTANCE	○	○	○	○	○

Management of knowledge performance results are used to plan improvements in managing knowledge *
يتم استخدام نتائج الأداء في التخطيط لتحسين إدارة المعرفة

	1	2	3	4	5
IN MY ORGANIZATION	○	○	○	○	○
IMPORTANCE	○	○	○	○	○

IT-tools for managing knowledge are adequate and effective *
أدوات تكنولوجيا المعلومات المستخدمة لإدارة المعرفة كافية وفعالة

	1	2	3	4	5
IN MY ORGANIZATION	○	○	○	○	○
IMPORTANCE	○	○	○	○	○

Input from staff is sought for the proposed changes to management of knowledge practices *
تؤخذ آراء الموظفين في التغييرات المقترحة على ممارسات إدارة المعرفة

	1	2	3	4	5
IN MY ORGANIZATION	○	○	○	○	○
IMPORTANCE	○	○	○	○	○

Organizational structure and facilities (physical and non-physical) are adequate and effective for managing knowledge in the organization *
الهيكل التنظيمي والمرافق (المادية وغير المادية) كافية وفعالة لادارة المعرفة في النظمة

	1	2	3	4	5
IN MY ORGANIZATION	○	○	○	○	○
IMPORTANCE	○	○	○	○	○

Employees knowledge and experiences from one area is useful in other areas in the workplace *

معارف وخبرات الموظفين في مجال ما مفيدة في مجال آخر من مجالات العمل

	1	2	3	4	5
IN MY ORGANIZATION	○	○	○	○	○
IMPORTANCE	○	○	○	○	○

There are well established procedures to for identifying and managing useful knowledge *

يوجد هنالك إجراءات واضحة لتعريف المعرفة المفيدة وإدارتها

	1	2	3	4	5
IN MY ORGANIZATION	○	○	○	○	○
IMPORTANCE	○	○	○	○	○

Managing knowledge procedures are integrated and embedded into the organizational management systems *

إجراءات إدارة المعرفة متكاملة و مدمجة ببرامج إدارة المنظمة

	1	2	3	4	5
IN MY ORGANIZATION	○	○	○	○	○
IMPORTANCE	○	○	○	○	○

« Back | Continue »

Powered by Google Docs

Managing Aircraft Engineering Knowledge

* Required

SECTION B: KNOWLEDGE MANAGEMENT CURRENT PRACTICES

PEOPLE MANAGEMENT

This section presents a number of statements and for each statement you are asked to provide two (2) ratings.

The first rating gives an extent to which you agree that the statement APPLIES IN YOUR OWN ORGANISATION. You will give these ratings in the row labelled “IN MY ORGANIZATION”

Strongly Disagree 1 2 3 4 5 Strongly Agree

The second rating gives an extent to which you agree that the statement reflects what is IMPORTANT FOR THE SUCCESSFUL OF MANAGING KNOWLEDGE ACTIVITIES. You will give these ratings in the row labelled “IMPORTANCE”

Not important at all 1 2 3 4 5 Vital

يعرض هذا القسم عددا من الجُمل. المطلوب تقديم تقييمين (2) لكل جملة

التقييم الاول يبين مدي موافقتك على ان الجملة تنطبق على المنظمة التي تنتمي اليها. سوف تعطي هذا التقييم في السطر المسمى
IN MY ORGANIZATION

التقييم الثاني يبين مدى موافقتك على أهمية هذه الجملة في نجاح إدارة المعرفة. سوف تعطي هذا التقييم في السطر المسمى
IMPORTANCE

Organizational culture is key to sharing knowledge between employees *
ثقافة بيئة العمل هي المفتاح لتبادل المعارف بين الموظفين

	1	2	3	4	5
IN MY ORGANIZATION	○	○	○	○	○
IMPORTANCE	○	○	○	○	○

Unfair workload distribution prevents knowledge sharing between employees *
التوزيع غير العادل لعبء العمل يمنع تبادل المعرفة بين الموظفين

	1	2	3	4	5
IN MY ORGANIZATION	○	○	○	○	○
IMPORTANCE	○	○	○	○	○

Employees are supportive of managing knowledge practices *
الموظفون يدعمون ممارسات إدارة المعرفة

	1	2	3	4	5
IN MY ORGANIZATION	○	○	○	○	○
IMPORTANCE	○	○	○	○	○

Trust and Transparency in teams is essential to knowledge sharing *
الثقة والشفافية في فرق العمل أمر ضروري لتبادل المعرفة

	1	2	3	4	5
IN MY ORGANIZATION	○	○	○	○	○
IMPORTANCE	○	○	○	○	○

Good communication within teams is key for knowledge sharing *
التواصل الجيد بين فرق العمل هو مفتاح تبادل المعرفة

	1	2	3	4	5
IN MY ORGANIZATION	○	○	○	○	○
IMPORTANCE	○	○	○	○	○

Sharing knowledge between team members is helping organizational learning and retains knowledge *
تبادل المعرفة بين أعضاء فريق العمل الواحد يساعد على حفظ خبرات ومعارف المنظمة

	1	2	3	4	5
IN MY ORGANIZATION	○	○	○	○	○
IMPORTANCE	○	○	○	○	○

Knowledge sharing training and education is part of staff development program *
التدريب والتعليم على إدارة المعرفة جزء من برنامج تطوير الموظفين

	1	2	3	4	5
IN MY ORGANIZATION	○	○	○	○	○
IMPORTANCE	○	○	○	○	○

Mentoring system (i.e. On The Job Training) is an effective tool for retaining knowledge in organization *
نظام لإرشاد (أي التدريب على رأس العمل) هو أداة فعالة للحفاظ على المعرفة في المنظمة

	1	2	3	4	5
IN MY ORGANIZATION	○	○	○	○	○
IMPORTANCE	○	○	○	○	○

Rewards and sanctions for knowledge sharing practices are well established *
لوائح المكافآت و العقوبات في ما يخص ممارسات تبادل المعرفة مؤسسة بشكل جيد

	1	2	3	4	5
IN MY ORGANIZATION	○	○	○	○	○
IMPORTANCE	○	○	○	○	○

Knowledge sharing related performance is part of staff appraisal and performance management system *
أداء تبادل المعرفة هو جزء من تقييم الموظفين ونظام إدارة الأداء في المنظمة

	1	2	3	4	5
IN MY ORGANIZATION	○	○	○	○	○
IMPORTANCE	○	○	○	○	○

« Back   Submit

Appendix 4: Letter of Approval from UTS Human Research Ethics Committee (HREC)

UNIVERSITY OF TECHNOLOGY SYDNEY

Research & Innovation
Building 1, Level 14
PO Box 123 Broadway
NSW 2007 Australia
T: +61 2 9514 9681
F: +61 2 9514 1244
www.uts.edu.au

UTS CRICOS PROVIDER CODE 00099F

25 October 2011

Dr Hasan Akpolat
School of Systems, Management and Leadership
FEIT
CB02.07.71
UNIVERSITY OF TECHNOLOGY, SYDNEY

Dear Hasan,

UTS HREC 2011000373 – Dr Hasan AKPOLAT, Mr Ravindra BAGIA (for Mr Rafed ZAWAWI, PhD student) – "Building competitive advantage in the Civil Aviation Industry by maintaining reliability and sustainability of the Aircraft engineering, using knowledge management and processes Re-Engineering"

At its meeting held on Tuesday 18 October 2011, the UTS Human Research Ethics Committee considered the above proposal and agreed that the application meets the requirements of the NHMRC National Statement on Ethical Conduct in Human Research (2007). I am pleased to inform you that ethics approval is now granted. Any conditions of approval as stipulated in the Committee's comments will be noted on our files.

Your clearance number is UTS HREC REF NO. 2011000373

Please note that the ethical conduct of research is an on-going process. The *National Statement on Ethical Conduct in Research Involving Humans* requires us to obtain a report about the progress of the research, and in particular about any changes to the research which may have ethical implications. This report form must be completed at least annually, and at the end of the project (if it takes more than a year). The Ethics Secretariat will contact you when it is time to complete your first report.

I also refer you to the AVCC guidelines relating to the storage of data, which require that data be kept for a minimum of 5 years after publication of research. However, in NSW, longer retention requirements are required for research on human subjects with potential long-term effects, research with long-term environmental effects, or research considered of national or international significance, importance, or controversy. If the data from this research project falls into one of these categories, contact University Records for advice on long-term retention.

If you have any queries about your ethics clearance, or require any amendments to your research in the future, please do not hesitate to contact the Ethics Secretariat at the Research and Innovation Office, on 02 9514 9772.

Yours sincerely,

Production Note:
Signature removed prior to publication.

Professor Marion Haas
Chairperson
UTS Human Research Ethics Committee

Appendix 5: Example of Survey e-mail

هذا الاستبيان هو حول إدارة وإستبقاء الخبرات والمعرفة في هندسة الطائرات. وهو جزء من مشروع بحثي لنيل شهادة الدكتوراه. جميع المعلومات التي تم جمعها سيتم استخدامها لغرض هذا البحث فقط. وعلاوة على ذلك، فإن البيانات التي سيتم جمعها عن طريق هذه الدراسة ستيم التعامل معها بسريه مطلقة المشاركة في هذا المسح هو تطوعي ويمكنك الانسحاب في اي وقت الرجاء الإجابة على الأسئلة بقدر الاستطاعة. لا توجد إجابة صحيحة أو خاطئة. أنا مهتم برأيك حول هذا الموضوع

Dear Madam/Sir,

This questionnaire is about managing and retaining aircraft engineering knowledge. It is part of my PhD research project and all the information gathered through the questionnaire will be used for the purpose of this research ONLY. Moreover, the data collected via this survey will be treated in an absolute confidental manner.

The survey participation is voluntary and you may withdraw any time.

Please answer the questions to the best of your knowledge. There is no right or wrong answer. I am interested in your opinion on the subject surveyed.

The link to the web-servey

https://docs.google.com/spreadsheet/viewform?fromEmail=true&formkey=dHktdFZ4OTBHRTUwZmtsYmhzRFI5dXc6MQ

Rafed Zawawi

School of Systems, Management& Leadership
Faculty of Engineering& Information Technology
University of Technology, Sydney
Phone: +61 (02) 9514 7585
Mobile: +61 [redacted]
Email: rafed.a.zawawi@student.uts.edu.au
Office: CB01.20.2702
Postal: University of Technology, Sydney P.O.Box 123,
Broadway NSW 2007, Australia

Appendix 6: Literature Analysis (Theoretical Framework)

Litrature Feedback (Importance)

Elements	1- Planning and Strategy Development			2- Leadership		3- Monitoring and Continual Improvement			4-Implementation			5- Guidelines & Procedure		6-Culture		7- Teamwork			8- Development	
Codes / References	Knowledge Policy & Strategy	Resources Allocation & Planning	Strategic Alignment	Commitment	Support	Measuring	Control	Audit	IT-Tools	Change Management	Organization Infrastructure	Knowledge Identification & Architecture	Procedure	Organizational Culture	Knowledge Friendly Culture	Trust & Transparency	Communication	Sharing Knowledge	Training, Education and Mentoring	Rewards & Recognition
Wiig (1996)	•					•	•	•	•		•	•	•							
Davenport et al. (1998)	•		•		•				•			•	•		•		•			•
Davenport & Prusak (1998)				•					•		•	•		•		•		•	•	
Morey (1998)						•	•	•	•			•								
Trussler (1998)			•	•					•		•	•		•			•		•	•
Finneran (1999)												•		•	•			•		
Liebowitz (1999)	•	•		•	•				•			•			•					•
Manasco (1999)	•						•	•	•		•	•	•				•			
Bassi (1999)	•											•	•					•	•	
Choi (2000)				•		•		•	•	•	•	•		•		•	•	•		•
Skyrme (1997)	•	•	•	•	•	•	•		•		•	•	•	•	•		•			
Skyrme & Amidon (1997)	•	•	•	•	•				•				•		•				•	
Heisig (2001)	•		•		•							•		•			•			
Alazmi & Zairi (2003)	•			•					•		•	•	•	•	•					
Alkhavan et al.(2006)	•			•	•			•			•	•	•		•	•	•	•	•	
Alkhavan et al.(2009)	•	•				•	•	•	•			•		•	•	•	•	•	•	•
Wong (2005)	•	•		•	•	•			•		•		•	•	•	•	•	•	•	•
Al-Mabrouk (2006)	•	•	•	•	•	•			•		•	•		•	•	•	•	•	•	•
Holsapple & Joshi (2000)	•	•		•	•	•	•													
Hasanali (2002)		•		•	•	•			•				•	•	•					
Mathi (2004)		•	•	•	•	•	•	•	•				•	•	•					
Moffett et al. (2003)	•								•			•		•	•	•	•	•	•	•
Tobin (2003)	•		•							•				•					•	
No. of References to Each Code	16	9	8	13	11	10	7	7	17	2	10	17	11	14	13	7	11	9	10	8
No. of References to Each Element	**19**			15		12			**19**			**21**		**18**		14			13	

Finding and Discussion:

- In KM literature, although the range of the times the elements been referenced is from 12-21, all of the elements seems to be important. However, the *"2-Leadership", "3- Monitoring and Continual Improvement", 7-Teamwork"* and *"8-Development"* elements are considered the least important elements for the successful implantation of KM system

Appendix 7: Focus Groups Analysis (Practice-based Framework)

Experts Feedback (Importance)

Elements	Codes / Experts Groups	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7	Group 8	Group 9	Group 10	No. of Groups Responded of **Each Code**	No. of Groups Responded to **Each Element**
1- Planning and Strategy Development	Knowledge Policy & Strategy	•		•	•		•	•	•	•	•	8	9
	Resources Allocation & Planning	•	•		•		•	•	•		•	7	
	Strategic Alignment				•			•				2	
2- Leadership	Commitment	•		•	•	•	•	•	•		•	8	8
	Support				•	•	•		•		•	5	
3- Monitoring and Continual Improvement	Measuring			•	•		•		•		•	5	5
	Control			•	•				•		•	4	
	Audit			•	•				•		•	4	
4-Implementation	IT-Tools	•	•	•	•		•	•	•	•	•	9	10
	Change Management					•		•		•		3	
	Organization Infrastructure		•									1	
5- Guidelines & Procedure	Knowledge Identification & Architecture	•			•	•	•	•	•	•	•	8	9
	Procedure	•		•	•		•	•	•	•	•	8	
6-Culture	Organizational Culture	•	•			•	•	•	•	•	•	7	10
	Knowledge Friendly Culture			•	•	•				•		4	
7- Teamwork	Trust & Transparency			•		•	•	•	•	•		6	9
	Communication	•	•	•		•	•	•	•	•	•	9	
	Sharing Knowledge			•		•	•	•	•	•	•	7	
8- Development	Training, Education and Mentoring	•		•	•	•			•	•	•	7	9
	Rewards & Recognition		•	•	•		•		•	•	•	7	
	Career Path						•				•	2	

Experts Feedback (Current Practice)

Elements	Codes \ Experts Groups	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7	Group 8	Group 9	Group 10	No. of Groups Responded of **Each Code**	No. of Groups Responded to **Each Element**
1- Planning and Strategy Development	Knowledge Policy & Strategy			•	•	•		•	•	•	•	7	8
	Resources Allocation & Planning		•		•			•	•		•	5	
	Strategic Alignment							•				1	
2- Leadership	Commitment	•		•	•	•		•			•	6	7
	Support						•	•			•	3	
3- Monitoring and Continual Improvement	Measuring								•			1	1
	Control								•			1	
	Audit								•			1	
4-Implementation	IT-Tools		•	•	•		•				•	5	8
	Change Management							•		•	•	3	
	Organization Infrastructure		•				•		•			3	
5- Guidelines & Procedure	Knowledge Identification & Architecture	•			•					•	•	4	6
	Procedure							•	•	•	•	4	
6-Culture	Organizational Culture	•	•		•	•		•	•	•		7	9
	Knowledge Friendly Culture			•							•	2	
7- Teamwork	Trust & Transparency					•		•		•		3	6
	Communication						•			•	•	3	
	Sharing Knowledge		•							•		2	
8- Development	Training, Education and Mentoring	•			•	•			•		•	5	8
	Rewards & Recognition				•				•	•		3	
	Career Path		•				•					2	

Finding and Discussion:

- The experts believe that the top elements that make the implementation of the KM system difficult in their organization are *"1- Planning and Strategy Development", "2- Leadership", "4-Implementation", "6-Culture"* and *"8- Development"*. Also, from the previous table-2 , these four elements were part of the most important elements for the success of a KM system. As a result, gap in these four elements is highlighted.

- The experts believe the problem is less severe with regards to *"5-Guidance"* and *"7-teamwork"* elements. Although, in the previous table these elements were part of the top important elements for the success of a KM system.

- Also, *"3- Monitoring and Continual Improvement "*seems to score the least important elements and only one group mentioned it in the difficulties for KM systems. This might be due to the fact they are coming from an aviation background, were every action is monitored and registered. As a result, they could have a false believe that they don't have a problem with regards to monitoring and continual improvement. This needs to be re-evaluated and examined with a broader audience (survey).

Appendix 8: Questionnaire Coding Sheet

Question No.	Variable No.	Code Description	Variable Name
-	1	Identification Number	ID
1	2	Position in the organization 1= Higher Management (Division Head) 2= Middle Management (Section Head, Chief Engineer) 3= Technical Lead (Principle Engineer) 4= Senior Engineer 5= Engineer 6= Administration 7= Other	Position
2	3	Years of experience 1= Less than 5 years 2= 5-10 Years 3= 11-15 Years 4= 16-20 Years 5= More than 20 years	Experience
3	4	Organization's Field of work 1= Government Authority (GACA) 2= Manufacturer- (Aircraft, Engine, Parts…etc.) 3= Aircraft Operator (Airline, private…etc.) 4= Maintenance Repair and Overhaul(MRO) 5= Defence 6= Other	OrgType
4	5	Organization Location 1= Kingdom of Saudi Arabia 2= UAE 3= Other GCC countries (Gulf Corporation Council) 4= Other	Location
5	6	Familiarity with KM concepts 1= Very familiar 2= Familiar 3= Somewhat familiar 4= Unfamiliar 5= Very unfamiliar	Familiarity
6	7	Current knowledge retention 1= None of their knowledge 2= Some of their knowledge 3= Most of their knowledge 4= All of their knowledge	CurrentKM
7	8	In my organization (Practice) 1= Strongly Disagree 2= Disagree 3= Neutral 4= Agree 5= Strongly Agree	Planning1p
7	9	Importance 1= Not important at all 2= Not important 3= Neutral Important 4= Important 5= Vital	Planning1i

Question No.	Variable No.	Code Description	Variable Name
8	10	In my organization (Practice) 1= Strongly Disagree 2= Disagree 3= Neutral 4= Agree 5= Strongly Agree	Planning2p
8	11	Importance 1= Not important at all 2= Not important 3= Neutral Important 4= Important 5= Vital	Planning2i
9	12	In my organization (Practice) 1= Strongly Disagree 2= Disagree 3= Neutral 4= Agree 5= Strongly Agree	Planning3p
9	13	Importance 1= Not important at all 2= Not important 3= Neutral Important 4= Important 5= Vital	Planning3i
10	14	In my organization (Practice) 1= Strongly Disagree 2= Disagree 3= Neutral 4= Agree 5= Strongly Agree	Planning4p
10	15	Importance 1= Not important at all 2= Not important 3= Neutral Important 4= Important 5= Vital	Planning4i
11	16	In my organization (Practice) 1= Strongly Disagree 2= Disagree 3= Neutral 4= Agree 5= Strongly Agree	Planning5p
11	17	Importance 1= Not important at all 2= Not important 3= Neutral Important 4= Important 5= Vital	Planning5i
12	18	In my organization (Practice) 1= Strongly Disagree 2= Disagree 3= Neutral 4= Agree 5= Strongly Agree	Planning6p

Question No.	Variable No.	Code Description	Variable Name
12	19	Importance 1= Not important at all 2= Not important 3= Neutral Important 4= Important 5= Vital	Planning6i
13	20	In my organization (Practice) 1= Strongly Disagree 2= Disagree 3= Neutral 4= Agree 5= Strongly Agree	Planning7p
13	21	Importance 1= Not important at all 2= Not important 3= Neutral Important 4= Important 5= Vital	Planning7i
14	22	In my organization (Practice) 1= Strongly Disagree 2= Disagree 3= Neutral 4= Agree 5= Strongly Agree	Leadership1p
14	23	Importance 1= Not important at all 2= Not important 3= Neutral Important 4= Important 5= Vital	Leadership1i
15	24	In my organization (Practice) 1= Strongly Disagree 2= Disagree 3= Neutral 4= Agree 5= Strongly Agree	Leadership2p
15	25	Importance 1= Not important at all 2= Not important 3= Neutral Important 4= Important 5= Vital	Leadership2i
16	26	In my organization (Practice) 1= Strongly Disagree 2= Disagree 3= Neutral 4= Agree 5= Strongly Agree	Leadership3p
16	27	Importance 1= Not important at all 2= Not important 3= Neutral Important 4= Important 5= Vital	Leadership3i

Question No.	Variable No.	Code Description	Variable Name
17	28	In my organization (Practice) 1= Strongly Disagree 2= Disagree 3= Neutral 4= Agree 5= Strongly Agree	Leadership4p
17	29	Importance 1= Not important at all 2= Not important 3= Neutral Important 4= Important 5= Vital	Leadership4i
18	30	In my organization (Practice) 1= Strongly Disagree 2= Disagree 3= Neutral 4= Agree 5= Strongly Agree	Monitoring1p
18	31	Importance 1= Not important at all 2= Not important 3= Neutral Important 4= Important 5= Vital	Monitoring1i
19	32	In my organization (Practice) 1= Strongly Disagree 2= Disagree 3= Neutral 4= Agree 5= Strongly Agree	Monitoring2p
19	33	Importance 1= Not important at all 2= Not important 3= Neutral Important 4= Important 5= Vital	Monitoring2i
20	34	In my organization (Practice) 1= Strongly Disagree 2= Disagree 3= Neutral 4= Agree 5= Strongly Agree	Monitoring3p
20	35	Importance 1= Not important at all 2= Not important 3= Neutral Important 4= Important 5= Vital	Monitoring3i
21	36	In my organization (Practice) 1= Strongly Disagree 2= Disagree 3= Neutral 4= Agree 5= Strongly Agree	Monitoring4p

Question No.	Variable No.	Code Description	Variable Name
21	37	Importance 1= Not important at all 2= Not important 3= Neutral Important 4= Important 5= Vital	Monitoring4i
22	38	In my organization (Practice) 1= Strongly Disagree 2= Disagree 3= Neutral 4= Agree 5= Strongly Agree	Monitoring5p
22	39	Importance 1= Not important at all 2= Not important 3= Neutral Important 4= Important 5= Vital	Monitoring5i
23	40	In my organization (Practice) 1= Strongly Disagree 2= Disagree 3= Neutral 4= Agree 5= Strongly Agree	Monitoring6p
23	41	Importance 1= Not important at all 2= Not important 3= Neutral Important 4= Important 5= Vital	Monitoring6i
24	42	In my organization (Practice) 1= Strongly Disagree 2= Disagree 3= Neutral 4= Agree 5= Strongly Agree	Implementation1p
24	43	Importance 1= Not important at all 2= Not important 3= Neutral Important 4= Important 5= Vital	Implementation1i
25	44	In my organization (Practice) 1= Strongly Disagree 2= Disagree 3= Neutral 4= Agree 5= Strongly Agree	Implementation2p
25	45	Importance 1= Not important at all 2= Not important 3= Neutral Important 4= Important 5= Vital	Implementation2i

Question No.	Variable No.	Code Description	Variable Name
26	46	In my organization (Practice) 1= Strongly Disagree 2= Disagree 3= Neutral 4= Agree 5= Strongly Agree	Implementation3p
26	47	Importance 1= Not important at all 2= Not important 3= Neutral Important 4= Important 5= Vital	Implementation3i
27	48	In my organization (Practice) 1= Strongly Disagree 2= Disagree 3= Neutral 4= Agree 5= Strongly Agree	Guidelines1p
27	49	Importance 1= Not important at all 2= Not important 3= Neutral Important 4= Important 5= Vital	Guidelines1i
28	50	In my organization (Practice) 1= Strongly Disagree 2= Disagree 3= Neutral 4= Agree 5= Strongly Agree	Guidelines2p
28	51	Importance 1= Not important at all 2= Not important 3= Neutral Important 4= Important 5= Vital	Guidelines2i
29	52	In my organization (Practice) 1= Strongly Disagree 2= Disagree 3= Neutral 4= Agree 5= Strongly Agree	Guidelines3p
29	53	Importance 1= Not important at all 2= Not important 3= Neutral Important 4= Important 5= Vital	Guidelines3i
30	54	In my organization (Practice) 1= Strongly Disagree 2= Disagree 3= Neutral 4= Agree 5= Strongly Agree	Culture1p

Question No.	Variable No.	Code Description	Variable Name
30	55	Importance 1= Not important at all 2= Not important 3= Neutral Important 4= Important 5= Vital	Culture1i
31	56	In my organization (Practice) 1= Strongly Disagree 2= Disagree 3= Neutral 4= Agree 5= Strongly Agree	Culture2p
31	57	Importance 1= Not important at all 2= Not important 3= Neutral Important 4= Important 5= Vital	Culture2i
32	58	In my organization (Practice) 1= Strongly Disagree 2= Disagree 3= Neutral 4= Agree 5= Strongly Agree	Culture3p
32	59	Importance 1= Not important at all 2= Not important 3= Neutral Important 4= Important 5= Vital	Culture3i
33	60	In my organization (Practice) 1= Strongly Disagree 2= Disagree 3= Neutral 4= Agree 5= Strongly Agree	Teamwork1p
33	61	Importance 1= Not important at all 2= Not important 3= Neutral Important 4= Important 5= Vital	Teamwork1i
34	62	In my organization (Practice) 1= Strongly Disagree 2= Disagree 3= Neutral 4= Agree 5= Strongly Agree	Teamwork2p
34	63	Importance 1= Not important at all 2= Not important 3= Neutral Important 4= Important 5= Vital	Teamwork2i

Question No.	Variable No.	Code Description	Variable Name
35	64	In my organization (Practice) 1= Strongly Disagree 2= Disagree 3= Neutral 4= Agree 5= Strongly Agree	Teamwork3p
35	65	Importance 1= Not important at all 2= Not important 3= Neutral Important 4= Important 5= Vital	Teamwork3i
36	66	In my organization (Practice) 1= Strongly Disagree 2= Disagree 3= Neutral 4= Agree 5= Strongly Agree	Development1p
36	67	Importance 1= Not important at all 2= Not important 3= Neutral Important 4= Important 5= Vital	Development1i
37	68	In my organization (Practice) 1= Strongly Disagree 2= Disagree 3= Neutral 4= Agree 5= Strongly Agree	Development2p
37	69	Importance 1= Not important at all 2= Not important 3= Neutral Important 4= Important 5= Vital	Development2i
38	70	In my organization (Practice) 1= Strongly Disagree 2= Disagree 3= Neutral 4= Agree 5= Strongly Agree	Development3p
38	71	Importance 1= Not important at all 2= Not important 3= Neutral Important 4= Important 5= Vital	Development3i
39	72	In my organization (Practice) 1= Strongly Disagree 2= Disagree 3= Neutral 4= Agree 5= Strongly Agree	Development4p

Question No.	Variable No.	Code Description	Variable Name
39	73	Importance 1= Not important at all 2= Not important 3= Neutral Important 4= Important 5= Vital	Development4i

Appendix 9: Construct Validity Testing (Factor Analysis)

Factor 1: Planning and Strategy Development

Communalities

	Initial	Extraction
Planning.1p	1.000	.874
Planning.2p	1.000	.784
Planning.3p	1.000	.867
Planning.4p	1.000	.898
Planning.5p	1.000	.821
Planning.6p	1.000	.934
Planning.7p	1.000	.725

Extraction Method: Principal Component Analysis.

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	5.903	84.331	84.331	5.903	84.331	84.331
2	.367	5.244	89.575			
3	.264	3.771	93.346			
4	.217	3.099	96.445			
5	.112	1.595	98.040			
6	.085	1.212	99.251			
7	.052	.749	100.000			

Extraction Method: Principal Component Analysis.

Component Matrix[a]

	Component
	1
Planning.1p	.935
Planning.2p	.886
Planning.3p	.931
Planning.4p	.947
Planning.5p	.906
Planning.6p	.967
Planning.7p	.852

Extraction Method: Principal Component Analysis.
a. 1 components extracted.

Factor 2: Leadership

Communalities

	Initial	Extraction
Leadership.1p	1.000	.818
Leadership.2p	1.000	.622
Leadership.3p	1.000	.717
Leadership.4p	1.000	.691

Extraction Method: Principal Component Analysis.

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.849	71.217	71.217	2.849	71.217	71.217
2	.560	13.990	85.206			
3	.429	10.723	95.930			
4	.163	4.070	100.000			

Extraction Method: Principal Component Analysis.

Component Matrix[a]

	Component
	1
Leadership.1p	.905
Leadership.2p	.789
Leadership.3p	.847
Leadership.4p	.831

Extraction Method: Principal Component Analysis.
a. 1 components extracted.

Factor 3: Monitoring and Continual Improvement

Communalities

	Initial	Extraction
Monitoring.1p	1.000	.667
Monitoring.2p	1.000	.859
Monitoring.3p	1.000	.908
Monitoring.4p	1.000	.888
Monitoring.5p	1.000	.884
Monitoring.6p	1.000	.911

Extraction Method: Principal Component Analysis.

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	5.116	85.273	85.273	5.116	85.273	85.273
2	.430	7.165	92.437			
3	.183	3.058	95.495			
4	.107	1.777	97.272			
5	.083	1.376	98.648			
6	.081	1.352	100.000			

Extraction Method: Principal Component Analysis.

Component Matrix[a]

	Component
	1
Monitoring.1p	.817
Monitoring.2p	.927
Monitoring.3p	.953
Monitoring.4p	.942
Monitoring.5p	.940
Monitoring.6p	.954

Extraction Method: Principal Component Analysis.
a. 1 components extracted.

Factor 4: Implementation

Communalities

	Initial	Extraction
Implementation.1p	1.000	.705
Implementation.2p	1.000	.526
Implementation.3p	1.000	.871

Extraction Method: Principal Component Analysis.

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.102	70.065	70.065	2.102	70.065	70.065
2	.689	22.972	93.037			
3	.209	6.963	100.000			

Extraction Method: Principal Component Analysis.

Component Matrix[a]

	Component
	1
Implementation.1p	.840
Implementation.2p	.725
Implementation.3p	.933

Extraction Method: Principal Component Analysis.

a. 1 components extracted.

Factor 5: Guidelines and Procedure

Communalities

	Initial	Extraction
Guidelines.1p	1.000	.354
Guidelines.2p	1.000	.873
Guidelines.3p	1.000	.862

Extraction Method: Principal Component Analysis.

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.088	69.613	69.613	2.088	69.613	69.613
2	.778	25.945	95.558			
3	.133	4.442	100.000			

Extraction Method: Principal Component Analysis.

Component Matrix[a]

	Component
	1
Guidelines.1p	.595
Guidelines.2p	.934
Guidelines.3p	.929

Extraction Method: Principal Component Analysis.

a. 1 components extracted.

Factor 6: Culture

Communalities

	Initial	Extraction
Culture.1p	1.000	.833
Culture.2p	1.000	.501
Culture.3p	1.000	.575

Extraction Method: Principal Component Analysis.

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	1.909	63.626	63.626	1.909	63.626	63.626
2	.796	26.518	90.145			
3	.296	9.855	100.000			

Extraction Method: Principal Component Analysis.

Component Matrix[a]

	Component
	1
Culture.1p	.913
Culture.2p	.708
Culture.3p	.758

Extraction Method: Principal Component Analysis.

a. 1 components extracted.

Factor 7: Teamwork

Communalities

	Initial	Extraction
Teamwork.1p	1.000	.836
Teamwork.2p	1.000	.935
Teamwork.3p	1.000	.792

Extraction Method: Principal Component Analysis.

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.563	85.428	85.428	2.563	85.428	85.428
2	.338	11.266	96.694			
3	.099	3.306	100.000			

Extraction Method: Principal Component Analysis.

Component Matrix[a]

	Component
	1
Teamwork.1p	.914
Teamwork.2p	.967
Teamwork.3p	.890

Extraction Method: Principal Component Analysis.

a. 1 components extracted.

Factor 8: Development

Communalities

	Initial	Extraction
Development.1p	1.000	.564
Development.2p	1.000	.624
Development.3p	1.000	.685
Development.4p	1.000	.809

Extraction Method: Principal Component Analysis.

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.682	67.052	67.052	2.682	67.052	67.052
2	.689	17.214	84.266			
3	.527	13.166	97.433			
4	.103	2.567	100.000			

Extraction Method: Principal Component Analysis.

Component Matrix

	Component
	1
Development.1p	.751
Development.2p	.790
Development.3p	.828
Development.4p	.900

Extraction Method: Principal Component Analysis.

a. 1 components extracted.

Appendix 10: Criterion-Related Validity Testing (Multiple Regression Analysis)

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	Planning.1p Planning.2p Planning.3p Planning.4p Planning.5p Planning.6p Planning.7p Leadership.1p Leadership.2p Leadership.3p Leadership.4p Monitoring.1p Monitoring.2p Monitoring.3p Monitoring.4p Monitoring.5p Monitoring.6p Implementation.1p Implementation.2p Implementation.3p Guidelines.1p Guidelines.2p Guidelines.3p Culture.1p Culture.2p Culture.3p Teamwork.1p Teamwork.2p Teamwork.3p Development.1p Development.2p Development.3p Development.4p	.	Enter

a. Dependent Variable: Importance

b. Tolerance = .000 limits reached.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.999[a]	.999	.996	.02702

a. Predictors: (Constant), Development.4p, Teamwork.3p, Guidelines.1p, Culture.2p, Leadership.2p, Planning.7p, Culture.1p, Implementation.1p, Teamwork.1p, Implementation.2p, Monitoring.4p, Development.3p, Planning.3p, Development.2p, Leadership.3p, Planning.2p, Monitoring.1p, Leadership.4p, Planning.1p, Culture.3p, Guidelines.3p, Implementation.3p, Planning.5p, Monitoring.6p, Development.1p, Guidelines.2p, Teamwork.2p, Monitoring.3p, Monitoring.5p, Monitoring.2p, Planning.4p, Leadership.1p

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	8.163	32	.255	349.470	.000[b]
	Residual	.011	15	.001		
	Total	8.174	47			

a. Dependent Variable: Importance
b. Predictors: (Constant), Development.4p, Teamwork.3p, Guidelines.1p, Culture.2p, Leadership.2p, Planning.7p, Culture.1p, Implementation.1p, Teamwork.1p, Implementation.2p, Monitoring.4p, Development.3p, Planning.3p, Development.2p, Leadership.3p, Planning.2p, Monitoring.1p, Leadership.4p, Planning.1p, Culture.3p, Guidelines.3p, Implementation.3p, Planning.5p, Monitoring.6p, Development.1p, Guidelines.2p, Teamwork.2p, Monitoring.3p, Monitoring.5p, Monitoring.2p, Planning.4p, Leadership.1p

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	5.019	.048		104.914	.000
	Planning.1p	-.244	.034	-.753	-7.145	.000
	Planning.2p	.129	.026	.397	4.951	.000
	Planning.3p	-1.051	.038	-3.031	-27.439	.000
	Planning.4p	-.251	.073	-.763	-3.457	.004
	Planning.5p	.852	.040	2.433	21.039	.000
	Planning.5p	.245	.041	.485	2.055	.063
	Planning.7p	.044	.037	.126	1.198	.249
	Leadership.1p	.218	.109	.564	1.996	.064
	Leadership.2p	-.230	.025	-.788	-9.365	.000
	Leadership.3p	.908	.049	2.151	18.375	.000
	Leadership.4p	.091	.033	.289	2.798	.014
	Monitoring.1p	-.064	.038	-.164	-1.657	.118
	Monitoring.2p	-1.190	.092	-2.599	-12.886	.000
	Monitoring.3p	-.642	.042	-1.555	-15.164	.000
	Monitoring.4p	1.279	.107	3.088	11.917	.000
	Monitoring.5p	-.609	.096	-1.690	-6.348	.000
	Monitoring.6p	-.041	.045	-.092	-.897	.384
	Implementation.1p	.077	.017	.270	4.425	.000
	Implementation.2p	-.194	.025	-.497	-7.903	.000
	Implementation.3p	-.604	.041	-1.515	-14.842	.000
	Guidelines.1p	-.027	.010	-.077	-2.786	.014
	Guidelines.2p	.876	.111	2.203	7.878	.000
	Guidelines.3p	.064	.057	.188	1.122	.279
	Culture.1p	.366	.045	.923	8.111	.000
	Culture.2p	-.190	.021	-.605	-8.937	.000
	Culture.3p	-.078	.038	-.166	-2.084	.055
	Teamwork.1p	.052	.025	.148	2.053	.058
	Teamwork.2p	.019	.025	.060	.748	.466
	Teamwork.3p	.007	.016	.020	.406	.691
	Development.1p	.125	.042	.325	2.991	.009
	Development.2p	-.135	.053	-.448	-2.565	.022
	Development.3p	.255	.040	.732	6.346	.000
	Development.4p	.096	.026	.256	3.624	.003

a. Dependent Variable: Importance

Appendix 11: Questionnaire Reliability Testing

Factor 1: Planning and Strategy Development

Scale: ALL VARIABLES

Case Processing Summary

		N	%
Cases	Valid	48	100.0
	Excluded[a]	0	.0
	Total	48	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.870	7

Factor 2: Leadership

Scale: ALL VARIABLES

Case Processing Summary

		N	%
Cases	Valid	48	100.0
	Excluded[a]	0	.0
	Total	48	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.844	4

Factor 3: Monitoring

Scale: ALL VARIABLES

Case Processing Summary

		N	%
Cases	Valid	48	100.0
	Excluded[a]	0	.0
	Total	48	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.940	6

Factor 4: Implementation

Scale: ALL VARIABLES

Case Processing Summary

		N	%
Cases	Valid	48	100.0
	Excluded[a]	0	.0
	Total	48	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.794	3

Factor 5: Guidance and Procedure

Scale: ALL VARIABLES

Case Processing Summary

		N	%
Cases	Valid	48	100.0
	Excluded[a]	0	.0
	Total	48	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.821	3

Factor 6: Culture

Scale: ALL VARIABLES

Case Processing Summary

		N	%
Cases	Valid	48	100.0
	Excluded[a]	0	.0
	Total	48	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.725	3

Factor 7: Teamwork

Scale: ALL VARIABLES

Case Processing Summary

		N	%
Cases	Valid	48	100.0
	Excluded[a]	0	.0
	Total	48	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.879	3

Factor 8: Development

Scale: ALL VARIABLES

Case Processing Summary

		N	%
Cases	Valid	48	100.0
	Excluded[a]	0	.0
	Total	48	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.824	4

Appendix 12: Hypotheses Testing

Hypothesis 1: There is a significant difference between the importance and practice of a knowledge management system.

T-Test

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Planning	2.4643	48	1.13733	.16416
	Planning	4.7143	48	.44983	.06493
Pair 2	Leadership	2.4688	48	1.01272	.14617
	Leadership	4.7031	48	.42419	.06123
Pair 3	Monitoring	2.0451	48	.93699	.13524
	Monitoring	4.5694	48	.56685	.08182
Pair 4	Implementation	2.4792	48	.99623	.14379
	Implementation	4.6875	48	.48819	.07046
Pair 5	Guidelines	2.4861	48	.94270	.13607
	Guidelines	4.6736	48	.49341	.07122
Pair 6	Culture	3.0000	48	.86432	.12475
	Culture	4.7431	48	.39043	.05635
Pair 7	Teamwork	3.0694	48	1.16278	.16783
	Teamwork	4.7986	48	.40528	.05850
Pair 8	Development	2.4740	48	.97746	.14108
	Development	4.7865	48	.39943	.05765

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	Planning & Planning	48	-.068	.647
Pair 2	Leadership & Leadership	48	-.025	.865
Pair 3	Monitoring & Monitoring	48	-.211	.150
Pair 4	Implementation & Implementation	48	-.249	.087
Pair 5	Guidelines & Guidelines	48	.054	.718
Pair 6	Culture & Culture	48	-.021	.887
Pair 7	Teamwork & Teamwork	48	.226	.123
Pair 8	Development & Development	48	-.137	.353

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Planning - Planning	-2.25000	1.25114	.18059	-2.61329	-1.88671	-12.459	47	.000
Pair 2	Leadership - Leadership	-2.23438	1.10777	.15989	-2.55604	-1.91271	-13.974	47	.000
Pair 3	Monitoring - Monitoring	-2.52431	1.19296	.17219	-2.87071	-2.17791	-14.660	47	.000
Pair 4	Implementation - Implementation	-2.20833	1.21384	.17520	-2.56080	-1.85587	-12.604	47	.000
Pair 5	Guidelines - Guidelines	-2.18750	1.04034	.15016	-2.48958	-1.88542	-14.568	47	.000
Pair 6	Culture - Culture	-1.74306	.95586	.13797	-2.02061	-1.46550	-12.634	47	.000
Pair 7	Teamwork - Teamwork	-1.72917	1.14164	.16478	-2.06066	-1.39767	-10.494	47	.000
Pair 8	Development - Development	-2.31250	1.10547	.15956	-2.63350	-1.99150	-14.493	47	.000

Hypothesis 2: Planning and strategy development have a positive impact on an effective OBKM system.

T-Test

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Planning 1	4.85	48	.357	.051
	Planning 2	4.81	48	.491	.071
Pair 2	Planning 1	4.85	48	.357	.051
	Planning 3	4.79	48	.410	.059
Pair 3	Planning 1	4.85	48	.357	.051
	Planning 4	4.75	48	.668	.096
Pair 4	Planning 1	4.85	48	.357	.051
	Planning 5	4.67	48	.694	.100
Pair 5	Planning 1	4.85	48	.357	.051
	Planning 6	4.56	48	.741	.107
Pair 6	Planning 1	4.85	48	.357	.051
	Planning 7	4.56	48	.712	.103
Pair 7	Planning 2	4.81	48	.491	.071
	Planning 3	4.79	48	.410	.059
Pair 8	Planning 2	4.81	48	.491	.071
	Planning 4	4.75	48	.668	.096
Pair 9	Planning 2	4.81	48	.491	.071
	Planning 5	4.67	48	.694	.100
Pair 10	Planning 2	4.81	48	.491	.071
	Planning 6	4.56	48	.741	.107
Pair 11	Planning 2	4.81	48	.491	.071
	Planning 7	4.56	48	.712	.103
Pair 12	Planning 3	4.79	48	.410	.059
	Planning 4	4.75	48	.668	.096
Pair 13	Planning 3	4.79	48	.410	.059
	Planning 5	4.67	48	.694	.100
Pair 14	Planning 3	4.79	48	.410	.059
	Planning 6	4.56	48	.741	.107
Pair 15	Planning 3	4.79	48	.410	.059
	Planning 7	4.56	48	.712	.103
Pair 16	Planning 4	4.75	48	.668	.096
	Planning 5	4.67	48	.694	.100
Pair 17	Planning 4	4.75	48	.668	.096
	Planning 6	4.56	48	.741	.107
Pair 18	Planning 4	4.75	48	.668	.096
	Planning 7	4.56	48	.712	.103
Pair 19	Planning 5	4.67	48	.694	.100
	Planning 6	4.56	48	.741	.107
Pair 20	Planning 5	4.67	48	.694	.100
	Planning 7	4.56	48	.712	.103
Pair 21	Planning 6	4.56	48	.741	.107
	Planning 7	4.56	48	.712	.103

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	Planning 1 & Planning 2	48	.205	.162
Pair 2	Planning 1 & Planning 3	48	.660	.000
Pair 3	Planning 1 & Planning 4	48	.379	.008
Pair 4	Planning 1 & Planning 5	48	.315	.029
Pair 5	Planning 1 & Planning 6	48	.478	.001
Pair 6	Planning 1 & Planning 7	48	.749	.000
Pair 7	Planning 2 & Planning 3	48	.753	.000
Pair 8	Planning 2 & Planning 4	48	.243	.096
Pair 9	Planning 2 & Planning 5	48	.562	.000
Pair 10	Planning 2 & Planning 6	48	.589	.000
Pair 11	Planning 2 & Planning 7	48	.369	.010
Pair 12	Planning 3 & Planning 4	48	.271	.062
Pair 13	Planning 3 & Planning 5	48	.498	.000
Pair 14	Planning 3 & Planning 6	48	.603	.000
Pair 15	Planning 3 & Planning 7	48	.701	.000
Pair 16	Planning 4 & Planning 5	48	.917	.000
Pair 17	Planning 4 & Planning 6	48	.290	.046
Pair 18	Planning 4 & Planning 7	48	.570	.000
Pair 19	Planning 5 & Planning 6	48	.372	.009
Pair 20	Planning 5 & Planning 7	48	.560	.000
Pair 21	Planning 6 & Planning 7	48	.759	.000

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Planning 1 - Planning 2	.042	.544	.079	-.116	.200	.531	47	.598
Pair 2	Planning 1 - Planning 3	.063	.320	.046	-.030	.155	1.353	47	.182
Pair 3	Planning 1 - Planning 4	.104	.627	.091	-.078	.286	1.151	47	.256
Pair 4	Planning 1 - Planning 5	.188	.673	.097	-.008	.383	1.929	47	.060
Pair 5	Planning 1 - Planning 6	.292	.651	.094	.103	.481	3.104	47	.003
Pair 6	Planning 1 - Planning 7	.292	.504	.073	.145	.438	4.013	47	.000
Pair 7	Planning 2 - Planning 3	.021	.325	.047	-.074	.115	.443	47	.659
Pair 8	Planning 2 - Planning 4	.063	.727	.105	-.148	.273	.596	47	.554
Pair 9	Planning 2 - Planning 5	.146	.583	.084	-.023	.315	1.733	47	.090
Pair 10	Planning 2 - Planning 6	.250	.601	.087	.075	.425	2.880	47	.006
Pair 11	Planning 2 - Planning 7	.250	.700	.101	.047	.453	2.476	47	.017
Pair 12	Planning 3 - Planning 4	.042	.683	.099	-.157	.240	.423	47	.674
Pair 13	Planning 3 - Planning 5	.125	.606	.087	-.051	.301	1.430	47	.159
Pair 14	Planning 3 - Planning 6	.229	.592	.085	.057	.401	2.681	47	.010
Pair 15	Planning 3 - Planning 7	.229	.515	.074	.080	.379	3.081	47	.003
Pair 16	Planning 4 - Planning 5	.083	.279	.040	.002	.164	2.067	47	.044
Pair 17	Planning 4 - Planning 6	.188	.842	.122	-.057	.432	1.543	47	.130
Pair 18	Planning 4 - Planning 7	.188	.641	.093	.001	.374	2.027	47	.048
Pair 19	Planning 5 - Planning 6	.104	.805	.116	-.130	.338	.896	47	.375
Pair 20	Planning 5 - Planning 7	.104	.660	.095	-.088	.296	1.093	47	.280
Pair 21	Planning 6 - Planning 7	.000	.505	.073	-.147	.147	.000	47	1.000

Hypothesis 3: Leadership has a positive impact on an effective OBKM system.

T-Test

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Leadership 1	4.67	48	.476	.069
	Leadership 2	4.75	48	.438	.063
Pair 2	Leadership 1	4.67	48	.476	.069
	Leadership 3	4.65	48	.601	.087
Pair 3	Leadership 1	4.67	48	.476	.069
	Leadership 4	4.75	48	.526	.076
Pair 4	Leadership 2	4.75	48	.438	.063
	Leadership 3	4.65	48	.601	.087
Pair 5	Leadership 2	4.75	48	.438	.063
	Leadership 4	4.75	48	.526	.076
Pair 6	Leadership 3	4.65	48	.601	.087
	Leadership 4	4.75	48	.526	.076

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	Leadership 1 & Leadership 2	48	.510	.000
Pair 2	Leadership 1 & Leadership 3	48	.842	.000
Pair 3	Leadership 1 & Leadership 4	48	.594	.000
Pair 4	Leadership 2 & Leadership 3	48	.384	.007
Pair 5	Leadership 2 & Leadership 4	48	.277	.056
Pair 6	Leadership 3 & Leadership 4	48	.791	.000

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Leadership 1 - Leadership 2	-.083	.454	.065	-.215	.048	-1.273	47	.209
Pair 2	Leadership 1 - Leadership 3	.021	.325	.047	-.074	.115	.443	47	.659
Pair 3	Leadership 1 - Leadership 4	-.083	.454	.065	-.215	.048	-1.273	47	.209
Pair 4	Leadership 2 - Leadership 3	.104	.592	.085	-.068	.276	1.219	47	.229
Pair 5	Leadership 2 - Leadership 4	.000	.583	.084	-.169	.169	.000	47	1.000
Pair 6	Leadership 3 - Leadership 4	-.104	.371	.054	-.212	.004	-1.944	47	.058

Hypothesis 4: Monitoring and Continual Improvement have a positive impact on an effective OBKM system.

T-Test

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Monitoring 1	4.60	48	.610	.088
	Monitoring 2	4.67	48	.476	.069
Pair 2	Monitoring 1	4.60	48	.610	.088
	Monitoring 3	4.56	48	.616	.089
Pair 3	Monitoring 1	4.60	48	.610	.088
	Monitoring 4	4.52	48	.618	.089
Pair 4	Monitoring 1	4.60	48	.610	.088
	Monitoring 5	4.56	48	.712	.103
Pair 5	Monitoring 1	4.60	48	.610	.088
	Monitoring 6	4.50	48	.799	.115
Pair 6	Monitoring 2	4.67	48	.476	.069
	Monitoring 3	4.56	48	.616	.089
Pair 7	Monitoring 2	4.67	48	.476	.069
	Monitoring 4	4.52	48	.618	.089
Pair 8	Monitoring 2	4.67	48	.476	.069
	Monitoring 5	4.56	48	.712	.103
Pair 9	Monitoring 2	4.67	48	.476	.069
	Monitoring 6	4.50	48	.799	.115
Pair 10	Monitoring 3	4.56	48	.616	.089
	Monitoring 4	4.52	48	.618	.089
Pair 11	Monitoring 3	4.56	48	.616	.089
	Monitoring 5	4.56	48	.712	.103
Pair 12	Monitoring 3	4.56	48	.616	.089
	Monitoring 6	4.50	48	.799	.115
Pair 13	Monitoring 4	4.52	48	.618	.089
	Monitoring 5	4.56	48	.712	.103
Pair 14	Monitoring 4	4.52	48	.618	.089
	Monitoring 6	4.50	48	.799	.115
Pair 15	Monitoring 5	4.56	48	.712	.103
	Monitoring 6	4.50	48	.799	.115

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	Monitoring 1 & Monitoring 2	48	.928	.000
Pair 2	Monitoring 1 & Monitoring 3	48	.662	.000
Pair 3	Monitoring 1 & Monitoring 4	48	.727	.000
Pair 4	Monitoring 1 & Monitoring 5	48	.867	.000
Pair 5	Monitoring 1 & Monitoring 6	48	.502	.000
Pair 6	Monitoring 2 & Monitoring 3	48	.798	.000
Pair 7	Monitoring 2 & Monitoring 4	48	.818	.000
Pair 8	Monitoring 2 & Monitoring 5	48	.816	.000
Pair 9	Monitoring 2 & Monitoring 6	48	.559	.000
Pair 10	Monitoring 3 & Monitoring 4	48	.946	.000
Pair 11	Monitoring 3 & Monitoring 5	48	.719	.000
Pair 12	Monitoring 3 & Monitoring 6	48	.800	.000
Pair 13	Monitoring 4 & Monitoring 5	48	.770	.000
Pair 14	Monitoring 4 & Monitoring 6	48	.797	.000
Pair 15	Monitoring 5 & Monitoring 6	48	.617	.000

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Monitoring 1 - Monitoring 2	-.063	.245	.035	-.134	.009	-1.770	47	.083
Pair 2	Monitoring 1 - Monitoring 3	.042	.504	.073	-.105	.188	.573	47	.569
Pair 3	Monitoring 1 - Monitoring 4	.083	.454	.065	-.048	.215	1.273	47	.209
Pair 4	Monitoring 1 - Monitoring 5	.042	.355	.051	-.061	.145	.814	47	.420
Pair 5	Monitoring 1 - Monitoring 6	.104	.722	.104	-.105	.314	1.000	47	.322
Pair 6	Monitoring 2 - Monitoring 3	.104	.371	.054	-.004	.212	1.944	47	.058
Pair 7	Monitoring 2 - Monitoring 4	.146	.357	.051	.042	.249	2.833	47	.007
Pair 8	Monitoring 2 - Monitoring 5	.104	.425	.061	-.019	.227	1.699	47	.096
Pair 9	Monitoring 2 - Monitoring 6	.167	.663	.096	-.026	.359	1.741	47	.088
Pair 10	Monitoring 3 - Monitoring 4	.042	.202	.029	-.017	.100	1.430	47	.159
Pair 11	Monitoring 3 - Monitoring 5	.000	.505	.073	-.147	.147	.000	47	1.000
Pair 12	Monitoring 3 - Monitoring 6	.063	.480	.069	-.077	.202	.903	47	.371
Pair 13	Monitoring 4 - Monitoring 5	-.042	.459	.066	-.175	.092	-.628	47	.533
Pair 14	Monitoring 4 - Monitoring 6	.021	.483	.070	-.120	.161	.299	47	.767
Pair 15	Monitoring 5 - Monitoring 6	.063	.665	.096	-.131	.256	.651	47	.518

Hypothesis 5: Implementation has a positive impact on an effective OBKM system.

T-Test

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Implementation 1	4.81	48	.394	.057
	Implementation 2	4.69	48	.589	.085
Pair 2	Implementation 1	4.81	48	.394	.057
	Implementation 3	4.56	48	.712	.103
Pair 3	Implementation 2	4.69	48	.589	.085
	Implementation 3	4.56	48	.712	.103

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	Implementation 1 & Implementation 2	48	.567	.000
Pair 2	Implementation 1 & Implementation 3	48	.308	.033
Pair 3	Implementation 2 & Implementation 3	48	.834	.000

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Implementation 1 - Implementation 2	.125	.489	.071	-.017	.267	1.770	47	.083
Pair 2	Implementation 1 - Implementation 3	.250	.700	.101	.047	.453	2.476	47	.017
Pair 3	Implementation 2 - Implementation 3	.125	.393	.057	.011	.239	2.205	47	.032

Hypothesis 6: Guidance and Procedure have a positive impact on an effective OBKM system.

T-Test

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Guidelines 1	4.63	48	.606	.087
	Guidelines 2	4.79	48	.410	.059
Pair 2	Guidelines 1	4.63	48	.606	.087
	Guidelines 3	4.60	48	.676	.098
Pair 3	Guidelines 2	4.79	48	.410	.059
	Guidelines 3	4.60	48	.676	.098

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	Guidelines 1 & Guidelines 2	48	.792	.000
Pair 2	Guidelines 1 & Guidelines 3	48	.617	.000
Pair 3	Guidelines 2 & Guidelines 3	48	.540	.000

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Guidelines 1 - Guidelines 2	-.167	.377	.054	-.276	-.057	-3.066	47	.004
Pair 2	Guidelines 1 - Guidelines 3	.021	.565	.081	-.143	.185	.256	47	.799
Pair 3	Guidelines 2 - Guidelines 3	.188	.571	.082	.022	.353	2.276	47	.027

Hypothesis 7: Culture has a positive impact on an effective OBKM system.

T-Test

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Culture 1	4.73	48	.449	.065
	Culture 2	4.79	48	.410	.059
Pair 2	Culture 1	4.73	48	.449	.065
	Culture 3	4.71	48	.582	.084
Pair 3	Culture 2	4.79	48	.410	.059
	Culture 3	4.71	48	.582	.084

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	Culture 1 & Culture 2	48	.380	.008
Pair 2	Culture 1 & Culture 3	48	.343	.017
Pair 3	Culture 2 & Culture 3	48	.720	.000

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Culture 1 - Culture 2	-.063	.480	.069	-.202	.077	-.903	47	.371
Pair 2	Culture 1 - Culture 3	.021	.601	.087	-.154	.195	.240	47	.811
Pair 3	Culture 2 - Culture 3	.083	.404	.058	-.034	.201	1.430	47	.159

Hypothesis 8: Teamwork has a positive impact on an effective OBKM system.

T-Test

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Teamwork 1	4.85	48	.357	.051
	Teamwork 2	4.81	48	.394	.057
Pair 2	Teamwork 1	4.85	48	.357	.051
	Teamwork 3	4.73	48	.574	.083
Pair 3	Teamwork 2	4.81	48	.394	.057
	Teamwork 3	4.73	48	.574	.083

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	Teamwork 1 & Teamwork 2	48	.709	.000
Pair 2	Teamwork 1 & Teamwork 3	48	.842	.000
Pair 3	Teamwork 2 & Teamwork 3	48	.711	.000

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Teamwork 1 - Teamwork 2	.042	.289	.042	-.042	.125	1.000	47	.322
Pair 2	Teamwork 1 - Teamwork 3	.125	.334	.048	.028	.222	2.591	47	.013
Pair 3	Teamwork 2 - Teamwork 3	.083	.404	.058	-.034	.201	1.430	47	.159

Hypothesis 9: Development has a positive impact on an effective OBKM system.

T-Test

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Development 1	4.73	48	.536	.077
	Development 2	4.83	48	.377	.054
Pair 2	Development 1	4.73	48	.536	.077
	Development 3	4.83	48	.519	.075
Pair 3	Development 1	4.73	48	.536	.077
	Development 4	4.75	48	.526	.076
Pair 4	Development 2	4.83	48	.377	.054
	Development 3	4.83	48	.519	.075
Pair 5	Development 2	4.83	48	.377	.054
	Development 4	4.75	48	.526	.076
Pair 6	Development 3	4.83	48	.519	.075
	Development 4	4.75	48	.526	.076

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	Development 1 & Development 2	48	.299	.039
Pair 2	Development 1 & Development 3	48	.446	.001
Pair 3	Development 1 & Development 4	48	.737	.000
Pair 4	Development 2 & Development 3	48	.725	.000
Pair 5	Development 2 & Development 4	48	.645	.000
Pair 6	Development 3 & Development 4	48	.468	.001

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Development 1 - Development 2	-.104	.555	.080	-.265	.057	-1.300	47	.200
Pair 2	Development 1 - Development 3	-.104	.555	.080	-.265	.057	-1.300	47	.200
Pair 3	Development 1 - Development 4	-.021	.385	.056	-.133	.091	-.375	47	.710
Pair 4	Development 2 - Development 3	.000	.357	.052	-.104	.104	.000	47	1.000
Pair 5	Development 2 - Development 4	.083	.404	.058	-.034	.201	1.430	47	.159
Pair 6	Development 3 - Development 4	.083	.539	.078	-.073	.240	1.071	47	.290

Hypothesis 10: There is a significant interrelationship between the eight critical success factors of the OBKM system.

Correlations

Correlations

		Planning	Leadership	Monitoring	Implementation	Guidelines	Culture	Teamwork	Development
Planning	Pearson Correlation	1	.761**	.819**	.927**	.881**	.860**	.772**	.901**
	Sig. (2-tailed)		.000	.000	.000	.000	.000	.000	.000
	N	48	48	48	48	48	48	48	48
Leadership	Pearson Correlation	.761**	1	.869**	.750**	.713**	.654**	.717**	.740**
	Sig. (2-tailed)	.000		.000	.000	.000	.000	.000	.000
	N	48	48	48	48	48	48	48	48
Monitoring	Pearson Correlation	.819**	.869**	1	.781**	.814**	.803**	.736**	.701**
	Sig. (2-tailed)	.000	.000		.000	.000	.000	.000	.000
	N	48	48	48	48	48	48	48	48
Implementation	Pearson Correlation	.927**	.750**	.781**	1	.765**	.773**	.571**	.933**
	Sig. (2-tailed)	.000	.000	.000		.000	.000	.000	.000
	N	48	48	48	48	48	48	48	48
Guidelines	Pearson Correlation	.881**	.713**	.814**	.765**	1	.832**	.811**	.736**
	Sig. (2-tailed)	.000	.000	.000	.000		.000	.000	.000
	N	48	48	48	48	48	48	48	48
Culture	Pearson Correlation	.860**	.654**	.803**	.773**	.832**	1	.742**	.687**
	Sig. (2-tailed)	.000	.000	.000	.000	.000		.000	.000
	N	48	48	48	48	48	48	48	48
Teamwork	Pearson Correlation	.772**	.717**	.736**	.571**	.811**	.742**	1	.572**
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000		.000
	N	48	48	48	48	48	48	48	48
Development	Pearson Correlation	.901**	.740**	.701**	.933**	.736**	.687**	.572**	1
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000	
	N	48	48	48	48	48	48	48	48

**. Correlation is significant at the 0.01 level (2-tailed).