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## Investigating knowledge flows at Saudi engineering research organisations

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# **Investigating Knowledge Flows at Saudi Engineering Research Organisations**

A thesis submitted in fulfilment of the requirement for the award of the degree

**DOCTOR OF PHILOSOPHY**

From

**The University of Wollongong**  
School of Management and Marketing

By

**Moshary A. Al-Holaibi**  
BSc. EE, M. EngMgt

**CERTIFICATION**

I, Moshary Al-Holaibi, declare that this thesis, submitted in partial fulfilment of the requirements for the award of PhD, in the school of Marketing and Management, University of Wollongong, is wholly my own work unless otherwise referenced or acknowledged. The document has not been submitted for qualifications in any other academic institution.

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**Moshary A. Al-Holaibi**



**ABSTRACT**

The ultimate objective for this thesis is to assist Saudi engineering research organisations in achieving positive change in their learning organisation capacity (LOC) to become globally competitive. The thesis examines the knowledge transfer process between three Saudi engineering research organisations and external knowledge suppliers (e.g. overseas experts). It also examines the knowledge transfer process between staff within each organisation and between staff and the local Saudi industry. It investigates knowledge transfer as three flows: (1) external to internal, (2) internal to internal, and (3) internal to external. The thesis has three main parts. Part 1 establishes a baseline of 23 indicators using LOC as a proxy for measuring the performance of the research organisations in broad knowledge management terms. This was part of the first research cycle. The findings showed weaknesses in the majority of the indicators. Part 2 identifies and maps 60 business processes at the research organisations and the knowledge flow blockages within each process. This was part of the second research cycle. The findings showed inefficiencies and knowledge blockages in the majority of core processes. Part 3 identifies the nature of 269 underlying knowledge transfer barriers from five dimensions: (a) the knowledge itself, (b) the individuals, (c) the organisation, (d) the national environment and (e) the international environment. This was part of the third research cycle. The findings showed varying impacts of these barriers on knowledge flows. Validation of identified issues and preliminary solutions were also discussed. This was part of the fourth research cycle. The findings showed that the top management at the three organisations denied or defended the majority of the negative outcomes of the 23 LOC measurement indicators, the inefficiencies in the 60 business processes and the reasons underlying the 269 knowledge transfer barriers. The knowledge transfer strategy blueprint provided a high-level guide to address the above issues. The thesis adopts an Action Research (AR) methodology, and while there is survey data and numbers presented, it is primarily a qualitative case study.

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# LIST OF ABBREVIATIONS

The following table describes the various abbreviations and acronyms used throughout the thesis.

<b>Abbreviation</b>	<b>Meaning</b>
<b>AC</b>	Absorptive Capacity
<b>ARC</b>	Australian Research Council
<b>AR</b>	Action Research
<b>BPR</b>	Business Process Re-engineering
<b>CoP</b>	Community of Practice
<b>CoI</b>	Communities of Interest
<b>DKTC</b>	Dynamic Knowledge Transfer Capacity
<b>ITS</b>	Information Technology System
<b>KT</b>	Knowledge Transfer
<b>KM</b>	Knowledge Management
<b>LO</b>	Learning Organisation
<b>LOC</b>	Learning Organisation Capacity
<b>MFG</b>	Management Focus Group
<b>NVIVO</b>	A qualitative research software owned by QSR international
<b>OL</b>	Organisational Learning
<b>OKB</b>	Organisational Knowledge Base
<b>PM</b>	Performance Measurement
<b>PMM</b>	Performance Measurement Model
<b>PMMI</b>	Performance Measurement Model Indicators
<b>ROI</b>	Return on Investment
<b>RBV</b>	Resource Based View
<b>RTC</b>	Recipient Transfer Capacity
<b>STC</b>	Source Transfer Capacity
<b>SNA</b>	Social Network Analysis
<b>TQM</b>	Total Quality Management

# CHAPTER 1: INTRODUCTION

*“If only we knew what we know”*

*(O’Dell and Grayson, 1998)*

## **1.1 BACKGROUND: THE JOURNEY OF CHANGE FOR SHARING KNOWLEDGE**

This thesis examines the flow of knowledge at three leading engineering research organisations in Saudi Arabia. Historically, Saudi Arabia has been a purchaser of engineering knowledge. As a wealthy nation for the last 50 years, it acquired engineering knowledge from external experts around the world. However, the Government recognises that this is only a short-term solution. Saudi Arabia invests considerable funds to develop world-class engineering research organisations. These organisations have world-class buildings and equipment. They regularly bring world leading researchers for both short and longer term visits to work with local staff. However, engineering research organisations in Saudi Arabia are not yet producing the level of world-class research the Government expects from this investment.

This thesis proposes that the gap between existing and desired capability at the three research organisations is caused by the way knowledge flows at three distinctive and fundamental levels:

- (1) From external experts to internal experts (staff)
- (2) From internal experts to other internal experts (staff to staff)
- (3) From internal experts (staff) to external local industry.

To achieve the goal of having truly world-class engineering research conducted by Saudi research organisations, the Government needs to decrease dependence on external experts and build capability within the three research organisations. This thesis tackles this goal in four ways. First, the learning capacity status of the organisations will be measured to provide a performance baseline as perceived by organisational members. Second, the phenomenon of knowledge flows will be investigated to identify what needs to be fixed. Third, the barriers to knowledge sharing will be identified to explain why problems exist. Fourth, preliminary solutions will be proposed to illustrate how knowledge flows can be improved. Conclusions will be drawn to show how the findings help build capability.

The research is framed as a change program. By adopting action research (AR) as the principle methodology, the thesis investigates the nature and challenges of knowledge flows at three engineering research organisations.

### **1.1.1 A PHILOSOPHICAL STANCE TO THIS THESIS**

Integral to our performance as social creatures, knowledge sharing tests the experiential ability of people to realize the praxis of being creative and innovative. Changing the status quo of our understanding to produce tangible innovations is a challenging mission to many. Researchers in Saudi Arabia are confronted with high technological expertise as if it was the inevitable mystery. By some, this mystery has placed the hidden knowledge as ineffable. Consequently, this forced many minds to simply surrender. Many developing countries fall in this trap especially in the Arab World. This stance assumes high expertise as a mysterious capability.

After decades of struggles in many Arab countries in seeking engineering knowledge, many argue that achieving technological subject matter expertise is questionable. This sceptic view is supported by the growing knowledge gap between the Arab World and developed nations. Such view considers the reasons underlying this gap as invisible to human experience, thereby, not possible to address. As a result of this view, the unattended knowledge gap between Arab countries and the developed nations cannot but continue to grow. This thesis seeks to demonstrate the flaw in this view.

Using the framework and theory of the Knowledge Management (KM) discipline, I aim to address what was thought to be unseen in the above view. Given the attributes of location and context, this thesis will provide a new perspective to model the understanding of the knowledge flow problem in Saudi engineering research organisations. Using an action learning approach, I examined how the existence of obstructive knowledge flow barriers and system process capability gaps resulted in the human and natural resources of Saudi Arabia to fail in assimilating engineering expertise. In the continuum of the action learning process, the cycles of acting and reflecting on the problem, and then acting again and reflecting again till a solution emerges makes this story worth telling. I will assert throughout this thesis that this project aims to start a journey that goes beyond the length of this study. In other words, this study is only a few AR cycles that start a life time journey for engineering research organisations in Saudi Arabia.



## 1.2. AN ACTION RESEARCH APPROACH FOR CHANGE

This thesis examines empirical data sourced from existing system barriers of knowledge flow. Modelling complex systems involves considering a number of interrelated variables while at the same time considering different units of analysis. I attempt to model these barriers on the levels of the individual, organisation and knowledge itself to create a coherent understanding of the problem. While this thesis explicates underlying hidden causes of the problem in detail, it also suggests some possible solutions that are grounded in the action learning approach.

Examining each barrier level involves a form of qualitative testing that relates to the literature and the case of this field study. Special care was taken to ensure that the disaggregation of the problem was in line with the context of different variables according to the hierarchal level of each research participant<sup>1</sup>. Following the action learning approach, I engage stakeholders in the study to learn how knowledge flows and where it is blocked. The action learning approach identifies the thematic barriers that stakeholders experienced in their work environments.

The research literature is congruent with the notion that knowledge flow is a highly tacit process. This view resembles the critique to logical positivism in addressing knowledge flow issues. Knowing in itself is a *process* and not an object to be possessed (Polanyi, 1966). We can only facilitate the flow of knowledge rather than contain it. This proves the difference between knowledge content and knowledge processes. The impetus to disaggregating the two originates from theorizing that knowing is dynamically constructed with some degree of tacitness that needs to be unpacked in order to achieve faster flow in the future.

The research approach of this thesis, thus, resembles the concept of embracing the spiral movement and fluidity of knowledge. Unless all involved stakeholders assimilate

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<sup>1</sup> Usually referred to as 'subjects' in other research methods. In AR, the term 'subject' does not apply as stakeholders are engaged - not separated from the research activity. The notion of Participative Action Research (PAR), therefore, emerges. Consequently, all involved in the research study are considered 'AR participants'.

the efficacy of a dynamic knowledge flow *process*, the flow is unlikely to prevail on environmental resistance, thereby, causing knowledge barriers. This can be realized through human interaction and social behaviour. I therefore adopt a change framework to provide self-evidence as a pragmatic approach to explain related phenomena.

### 1.2.1 METHODOLOGY FOR ACTION LEARNING

Action learning research has a direct relationship with work practices that have meaning in real-life situations (Winter and Badley, 2007). Action learning thus moves from the realm of abstract thinking to making real-life interventions. In this thesis, I shift from describing relevant experiences in terms of their factual descriptions, to describing an actual insider's experience in terms of what trying to transfer knowledge feels like. Through a systematic cyclic unfolding (i.e. action learning), I identified the tensions and resistance encountered and provided an initial knowledge transfer strategy for action to address them. Thus moving from the problem to the initial solution strategy using such a holistic inside out perspective requires a research approach that goes far beyond the analytical. By synthetically examining the phenomena, better outcomes are expected.

The change journey in this study follows a qualitative sequential track. It starts with setting a diagnostic health audit as a starting point using an online survey (LOC model in chapter 5). Understanding the situation from a process perspective using improvement methods is then presented (knowledge transfer Processes in chapter 6). KT barriers using different qualitative units of analysis are then discovered via longitudinal semi-structured interviews (knowledge transfer barriers in chapter 7).

The validation stage consolidates the findings qualitatively to be tested using controlled focus group discussions (Management feedback in chapter 8). Once validation was completed, the study proposes possible KT strategies as solutions to the problems identified over three AR cycles. The KT strategy suggests an initial solution action plan (KT strategy in chapter 9). Each corpus in this thesis is considered a building block in the action-learning journey.

### **1.3. A REVIEW OF SAUDI RESEARCH ORGANISATIONS**

This study is concerned with the engineering research industry in one of the twelve largest economies in the world as measured by gross domestic product (GDP), in which 73% of the world's GDP is concentrated (International Monetary Fund, 2009). Exploring the barriers to knowledge transfer (KT) in Saudi Arabia in general is a new area of research. Just as Bohn (1994, p. 56) places huge emphasis on knowledge as *“the central force behind the competitive success of firms and even nations”*, I contend that the exploration of KT is a cornerstone for Saudi research organisations and even for the Saudi economy in general to become a knowledge economy.

In Saudi Arabia, KT is of great public interest recently. Social-science research may play an integral role to provide context to the phenomena. In conducting research on KT for the case of Saudi research organisations, many stakeholders would be involved. It involves policymakers in the public and private arenas, decision-makers at the organisational, community, regional and national levels and multinational economic communities that have high business relationships with the Saudi economy. Attempting to resolve KT problems in Saudi Arabia is thus multi-level and linked with disjointed concepts from different disciplines. There is no general theory to embrace.

Reviewing the relevant literature on KT to Saudi RandD organisations provides publicly available fact sheets that show enough evidence that Saudi research organisations are indeed not highly competitive on the global scale, nor had they attracted global recognition. Despite the fact that Saudi Arabia enters the twenty first century with a wealth of natural resources and a strong economy, it could have achieved much higher economic potential if it had taken advantage of converting its primary natural resources into manufactured products by investing in research and technology. There is little evidence of commercially substantive research-based innovations with industrial value coming out of Saudi research institutions. Original research innovations claimed by Saudi research organisations in the fields of

engineering are limited. It is therefore important to explore possible underlying reasons and potential solutions.

Saudi research engineers at the three leading research organisations in Saudi Arabia have been very interested in the subject of this study and showed willingness from the start of the study to criticise the status quo. Besides fragmented ideas, most participants said there was little evidence to demonstrate that any current solutions or road maps were being implemented to enhance KT to their organisations. Most participants saw their organisation's problem to be primarily explained by lack of expertise, a high learning curve (i.e. long time to competence), and relatively slow knowledge flows within and across the borders of their own and other organisations in the region, thus confirming my argument that there is a need to explore the root cause of these issues and that few initiatives exists.

In order to build a globally competitive engineering workforce, it is essential to closely link local industries to the innovation talent made available by local academic and research organisations (Kumaraswamy and Chitale, 2012). This means that in order for incoming KT from overseas to have effect, KT must consider two systems; firstly, knowledge must be transferred from international experts to local research organisations, then secondly, from local research organisations to local industries. Only local academic and research institutions can contextualise, re-design and properly implement incoming KT from overseas. The raw transmission of international knowledge to local industries would be of few benefits if not properly calibrated to local factors and environmentally specific variables, which research organisations should do for the local industry. This justifies focusing on research organisations as a proxy to strengthen local industries.

### **1.3.1 DEFINITIONS, CONCEPTS, AND PROPOSITIONS**

The interest in the subject of knowledge has exponentially increased since Drucker (1993) coined a new societal concept. With the inauguration of the new knowledge economy, knowledge was claimed as the exclusive source for organisational and national competitiveness (Zack, 1999). However, knowledge is not necessarily only explicit, formal and systematic. Sources for knowledge are similarly not only through

education, training and written reports or manuals. Rather, explicit knowledge might actually be only the visible part of an iceberg where a tacit component underlies the competitiveness that knowledge represents. This type of knowledge is seen as subjective, personal and hard to formalize and communicate. Whether it is the ‘know-how’ of technical knowledge or ingrained beliefs and mental models of individuals, tacit knowledge proves to be the strategic component of any competitive advantage.

It is for this reason that Nonaka and Takeuchi (1995) adopted Plato’s ‘justified true belief’ as a definition to knowledge. They contended that as much as knowledge is about ideas it is also about ideals, beliefs, commitment and values. The latter is what drives the first in this definition. In this sense, knowledge as the basic component of this thesis may be defined as “a dynamic human process of justifying personal belief toward the truth” (Nonaka and Takeuchi, 1995, p. 43). However, it is far from reality that scholars have agreed on a universal definition to knowledge. In other words, knowledge remains an ambiguous phenomenon (Dalker, 2005).

Building on the above definition, this thesis adopts a social platform to managing knowledge. In quest of sharing knowledge between social beings, scholars examined how knowledge can be mobilised, transferred, disseminated or shared. In this thesis, these terms may interchangeably be used on the basis that they have the same meaning. Also, this study adopts a meaning to KT that implies a *process* within a dynamic *action* perspective as opposed to a perspective that views knowledge as a movable *product*. KT may therefore be defined as “[d]yadic exchanges of organisational knowledge between a source and a recipient” (Szulanski, 1996, p. 31). In this thesis, KT is seen as a process that requires a reliable overseas knowledge source that is willing to share knowledge and allow it to be transferred to engineering research organisations in Saudi Arabia. Saudi research organisations then need to replicate this process onto the local industry.

### 1.3.2 SITUATING THE STUDY

Early adopters of KM followed different approaches with varying emphasis on technological, cultural and managerial issues. Nevertheless, two main strategies for KM have been employed (Hansen *et al.*, 1999; Koehn and Abecker, 1997):

(1) The product-centred approach, which focuses on knowledge documents, their creation, storage and reuse in computer-based corporate memories. This approach is also referred to as ‘content-centred’ or the ‘codification’ approach.

(2) The process-centred approach, which understands KM as a social process. In this approach, knowledge is closely tied to the person and is shared mainly through person-to-person contact. The purpose of IT is only to help people communicate knowledge, not to store it. This approach is also referred to as the *personalisation* approach.

In the first strategy, much of the energy has been spent on treating knowledge as an *it* (product-centred), an entity separate from the people who create it and use it. The typical goal is to take documents with knowledge embedded in them - memos, reports, presentations, articles, etc. - and store them in a repository where they can be easily retrieved. The second KM strategy provides access to knowledge transfer among individuals (process-centred). It recognises that finding the person with the knowledge one needs, and then transferring it from one to another, are difficult processes. The underlying strategy is to connect people who possess and those who need knowledge.

In the global consulting firms’ approach to implementing KM initiatives, the bias toward the process or the product approach is evident (Hansen *et al.*, 1999; Apostolou and Mentzas, 1999). KPMG for instance takes technology implementations as the basis for building knowledge repositories, such as document management systems for storing captured knowledge assets and data warehousing for knowledge discovery and decision support (Woods and Sheina, 1998). On the other hand, Ernst and Young consider community enabling as a key solution that runs across most of their KM initiatives (Woods and Sheina, 1998). This thesis advocates the latter (the process-centred approach). As the study unfolds, it will show how knowledge flow can never be contained but rather directed. This makes the conceptual process more appropriate.

For guiding knowledge sharing, two key components are required: (1) collaboration enablers between knowledge workers to synergise their knowledge flows, and (2) discovery enablers for searching and retrieving information. The collaboration enabler corresponds to what Nonaka (1994) calls the *ontological dimension* as knowledge creating mechanisms. This ontological dimension refers to social interactions where

there are three levels of knowledge interactions: (1) individual; (2) organisation; and (3) inter-organisation. The individual level refers to capabilities, experience, competencies and personal development. The organisational level includes internal networks related to systems, policies, processes and culture. Inter-organisational level networks refer to inter-enterprise relationships, alliances and value networks. The discovery enablers correspond to epistemological dimensions transforming knowledge from tacit to explicit, which can be stored and retrieved through technology.

This thesis is situated at the confluence of three research domains: action learning, KM, and Business Process Re-engineering (BPR). Within these domains, specific sub-domains overlap as shown in figure (1-1). Knowledge flow and its related barriers; knowledge sharing behaviour; KM approaches and strategies; and the AR methodology were adopted to understand the KT problem. Linking the modelling of the problem with possible solutions was an important contribution in this thesis.

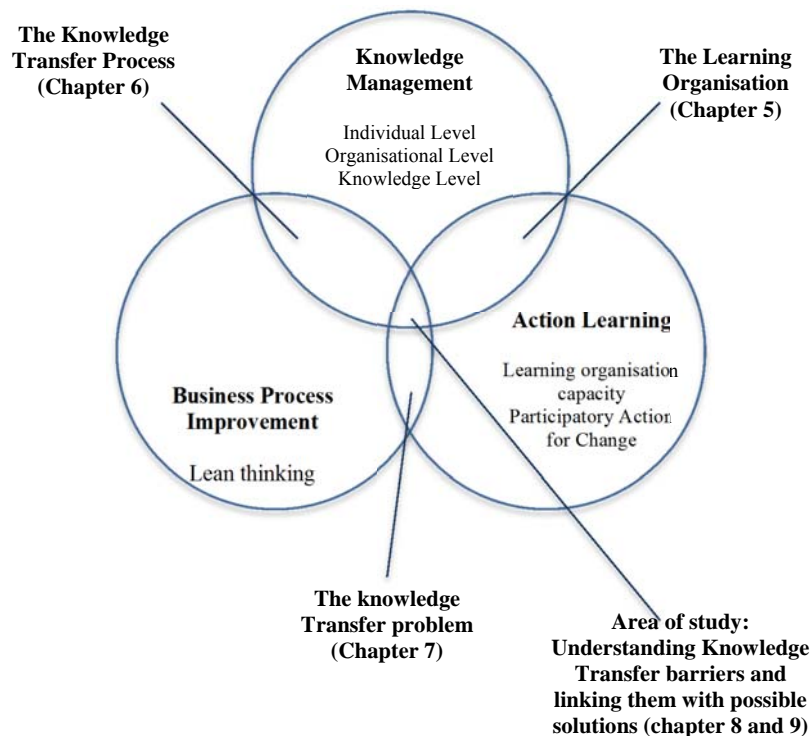


Figure 2-1: Situating the study of this thesis

## 1.4. RESEARCH OBJECTIVES AND CONTRIBUTION OF THIS THESIS

The aim of this thesis was to examine the knowledge flow and its underlying barriers that were preventing the building of engineering research capabilities in Saudi Arabia. In so doing, the novel contributions of this thesis are:

- (1) Adapting a learning organisation (LO) capacity assessment<sup>2</sup> for Saudi engineering research organisations using the learning organisation capacity (LOC) performance model (practical contribution).
- (2) Creating a knowledge flow process model for Saudi engineering research organisations using BPR and other performance and quality improvement models (theoretical and practical contribution).
- (3) Creating a systems barriers assessment framework for Saudi engineering research organisations using an AR learning methodology (theoretical and methodological contribution).
- (4) Demonstrating how the above models and the AR method can be applied in research institutions of developing nations to uncover knowledge flow blockages (methodological contribution).
- (5) Demonstrate that the explication of knowledge flow blockages and system process barriers is useful for improving the practice of engineering research, and finding contextual KT strategies to attain higher levels of internal expertise (theoretical contribution).

The thesis demonstrates that the knowledge flow assessment is an essential first building block to solve the knowledge transfer problem in the research organisations studied in this thesis. Each model was supported by a framework in the relevant chapter.

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<sup>2</sup> Developed and tested by Dr Peter Massingham from the Centre for Knowledge Management at the University of Wollongong.



### 1.4.1 MAIN RESULTS AND CONCLUSIONS

In the three Saudi engineering research organisations, I have identified 23 LOC indicators and 60-core internal business process. Within those processes, I found 269 KT barriers. These barriers were placed in different levels of analysis: knowledge characteristics, individual, organisational, national and international. The LOC indicators that were highly weak were:

- (1) Organisational direction
- (2) Mission and vision
- (3) Finding purpose/awareness

The core processes that were inefficient and required most attention were:

- (1) Process for evaluating the suitability of internal experts for external collaborations.
- (2) Process for researchers to learn overseas
- (3) Process to facilitate internal knowledge exchange
- (4) Process for evaluating the suitability of internal experts for external collaborations.
- (5) Process for measuring research activity with the local industry

The KT barriers that were severely blocking knowledge flow were:

- (1) Lack of peer trust and respect
- (2) Tendency of superiors towards increased unjustified control over subordinates
- (3) Lack of discipline and accountability of organisational members at all levels.

If the study was to single out one main issue to KT at the hosting organisations then it would be organisational culture. Storey and Barnett (2000) found that overturning deeply ingrained cultural practice was critical to avoid KM failure. Damodaran (2000) and McDermott and O'Dell (2001) had similar views. The culture at the hosting organisations was that of *silent individuals, not team players*, a participant commented. This promoted ingenuity at the expense of creativity. These findings emerged from in-depth analysis and coding work as detailed in chapters 6 and 7.

## **1.5. THE STRUCTURE OF THIS THESIS**

This thesis is divided into four parts. Part A considers definitional and theoretical inquiry of knowledge and knowledge flow management. Part B deals with how the three engineering research organisations are examined and how the results are theorised using new frameworks and models. Part C details the functional model of how the research outcomes were validated using an AR management feedback approach. Part D demonstrates the first building block for creating an initial KT strategy for Saudi engineering research organisations.

### **Part A: What is the theory behind knowledge transfer?**

**Chapter 2** critically reviews the theory of knowledge, knowledge management strategy and knowledge transfer with a contemporary focus on recent findings in knowledge flow attributes on inter and intra-organisational levels. The chapter begins with literature definitions of knowledge, knowledge management and innovation. It then introduces the theory of knowledge management strategy and presents theoretical background on knowledge transfer and conventional human resource management. The ‘make versus buy’ decision model is explained via transaction cost economics, human capital theory and the resource-based view (RBV) of the firm. My objective was to analyse the stages in which an organisation can successfully convert from exploration of knowledge (KT) to exploitation of knowledge (creation) (Tsai, 2001).

The knowledge-based view (KBV) is then presented and followed by the knowledge economy construct. Barriers to knowledge transfer are explored and followed by theoretical frameworks to knowledge acquisition. Implementation specifications of knowledge management frameworks are then presented with specification techniques for closing knowledge and capability gaps, using externalized employment modes and alliance with external knowledge sources. Knowledge flow, connections and worker roles are also discussed. The chapter is aggregated to enable grouping relevant constructs on knowledge, the individual and then on the Organisational level to easily link the literature with the fieldwork chapters.

**Chapter 3** develops a conceptual framework for knowledge transfer to research organisations in Saudi Arabia based on careful study of literature on KM, strategy and HRM. The selected research organisations were asked to answer questions such as what knowledge is actually needed for their competitiveness; what knowledge existed; what knowledge is lacking; who needs this knowledge within the organisation; how it can be made available; and how will they use this knowledge when provided; what are the barriers that may arise; what cultural challenges exist and what is the current costs in acquiring such knowledge from overseas sources (Liebowitz et al 2000).

### **Part B: How the study was designed and empirically implemented?**

**Chapter 4** is a methodology review of AR and how this method was applied to this study. AR is now a well-documented and well-accepted research methodology (Hearn *et al.* 2008). AR is particularly useful for this study because it enables positive organisational change (Neuman, 2006). Action occurs by engaging people in the change project and giving them a sense of empowerment via the principles of AR; i.e. participation and democracy (Neuman, 2006). AR aims to democratise the knowledge sharing process, reveal injustices, highlight the centrality of social conflict, and emphasise the importance of engaging in collective action to alter social structures (Stoecker, 1999). AR is especially appropriate for testing KM research theories, where innovation and change are continual, and where processes and outcomes are usually dynamic, complex and often involve fuzzy and subjective human input. The key element in applying AR in this study is the focus on being systematic (Emery and Purser, 1996). Rich description, deduction and idiographic qualitative approaches were applied to support each cycle in this research (Gibbs, 2007).

Four cascaded AR cycles were designed and conducted. Three cycles focused on examination while the fourth was to validate the problems identified and to produce an initial KT strategy. Each cycle was identically divided into 6 phases: (1) situation engagement, (2) emerging definition, (3) planning for action, (4) taking action, (5) analysis and reflection and (6) reporting. These recurring phases helped systemise the research process, while engaging AR participants in each phase. Each cycle illustrates how the research process evolved from start to end, then engaging in the next AR cycle. In my view, this allows for a more pragmatic unfolding of the change process.

This study addresses a single industry for a specific country, that is, engineering research in Saudi Arabia. A small sample for a single industry satisfies the detection of reasonably substantial effects (Slater and Atuahene-Gima, 2004). The use of multiple industries demands a larger sample size and generates weaker relationship links, which was avoided (Slater and Atuahene-Gima, 2004). Therefore, caution must be considered in the application of the study results to other industries or contexts.

The study in this thesis is distinctive in two ways in relation to previous empirical research on KM: first, it is an *action research* study (i.e. the research is motivated at a practical level towards field-based design, evaluation and change); second, it makes use of a widely accepted *set of KM constructs* to provide a rigorous basis for the validity of theory that exists in the KM literature via a practical approach. As theory should be generalisable, the AR approach should count as a rigorous test for generalisations that exist in the literature that were based on other research methods (traditional methods).

**Chapter 5** introduces the first fieldwork framework, the LOC model, its analysis and findings. As organisations learn to improve process performance including knowledge flow, the measurement of LOC in chapter 5 identifies organisational-level factors that measure the learning capability gap in the knowledge strategy using set benchmarks.

**Chapter 6** presents the knowledge transfer processes analysis. The BPR element in this chapter aims to explain how knowledge transfer happens at the three research organisations. By mapping this into discrete processes, it was possible to isolate areas where knowledge was *blocked* and, therefore, did not flow as it should. Blockages in the flow of knowledge can have serious consequences. Most obviously, blockages affect productivity as they mean the organisation cannot get knowledge to those who need it when they need it. Often the result is that researchers waste considerable time repeating their search for knowledge or giving up and trying to do something they do not know, by themselves, with poor results (Massingham, 2013). Therefore, the BPR method used in this chapter identifies wastage in the flow of knowledge and how work is done at the three research organisations.

**Chapter 7** examines the knowledge transfer problem. The purpose of this chapter was to present results from the qualitative follow-up interviews phase cycle 3, which began with the LOC measurement of cycle 1 in chapter 5 then KT processes of cycle 2 in chapter 6. Therefore rather than just trying to address the processes broadly, I attempted to link the barriers to the specific processes of chapter 6, thereby understanding exactly where the blockages are and the impact that solving them using a KT strategy (chapter 9). This chapter is therefore a continuation to the findings of chapter 6. When the initial KT processes (60-processes) were identified in chapter 6, it was realised that identifying KT barriers was necessary to better understand the temporal and social issues involved in KT. Where chapter 6 identified *where* the KT blockages were occurring; chapter 7 examined *why* these problems were occurring.

### **Part C: How the study was validated?**

**Chapter 8** presents the responses from management executives at the three research organisations on the findings of part B. A grounded theory approach (see Glaser and Strauss, 1967; Collins and Porras, 1994; Collins, 2001; Olson and Raffanti, 2004) was used to examine the responses using a validation framework in chapter 8. This chapter offers a useful proxy for linking the findings of the fieldwork analysis in chapters 5, 6 and 7 to possible KT strategy solutions presented in chapter 9.

### **Part D: How can the results generate solutions?**

**Chapter 9** attempts to provide a possible functional model for solution mapping from validated findings in the form of a KT strategy. It explains how to design a KT strategy grounded from assessment frameworks discussed in previous chapters. Chapter 9 sets the mark to begin a second wave of AR cycles. The second wave of cycles represent future research that test, reflect and improve outcomes from the first wave, that is, this thesis. Participants must ensure continuity of thinking on the subject matter.

**Chapter 10** summarises the journey of this thesis. It presents the theoretical, methodological and substantive contributions. It also summarises the research outcomes. Data appendices follow this chapter at the end of the thesis. Figure (1-2) provides a sequential guide to the main events of the thesis process.

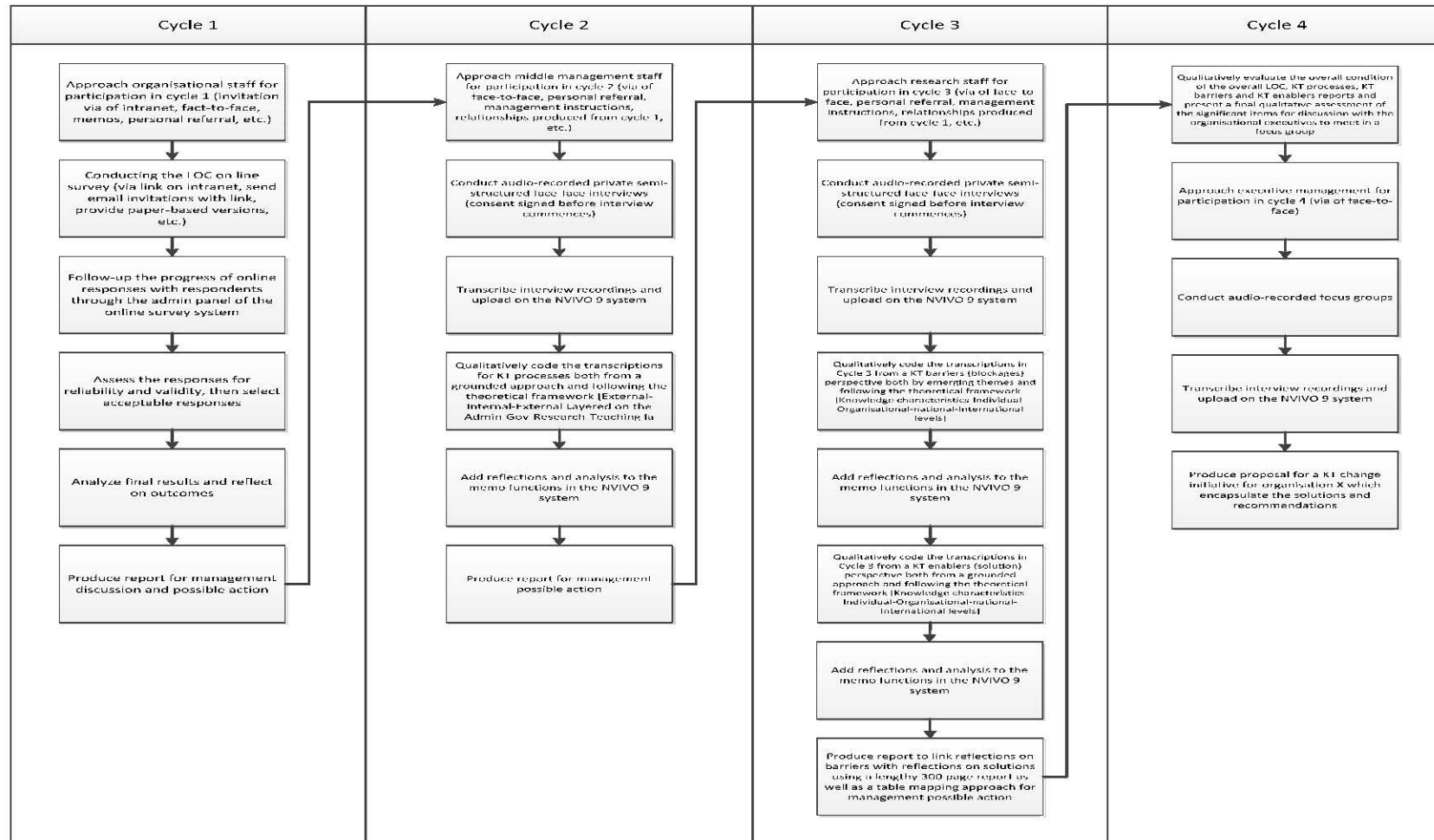


Figure 1-2: Sequential guide to the main events of the research process

### 1.5.1 CHAPTER SUMMARY

In this introductory chapter, I have explained the real-life legitimacy of this study for a country that possesses a potential to improve its engineering research competitiveness. An overall view was presented on the concepts and definitions behind the main elements of the KM domain and the approaches to delivering a scientific study to examine knowledge flows at three engineering research organisations. AR as the methodology was introduced and linked to the design of the study through systematic cycles. This chapter also provided an overview of each subsequent chapter and presented the main phases in each AR cycle, which assemble the outcomes of the research study as a whole. It also indicated that this study establishes a concept of AR that perceives change as a continuous never-ending process. Thus suggesting only an initial KT strategy at the end of the thesis, rather than a final comprehensive solution.

### 1.5.2 SUPPORTING PUBLICATIONS

Given the longitudinal nature of exposure to stakeholders' classified data in this research and the penetration of internal business matters, hosting research organisations to this study have restricted the publication of any findings or work related to data generated from their participation beyond this thesis. This matter is being discussed at this present time with the executive management at each organisation to result in mutually agreed upon publications and possible research that meet the requirements of all stakeholders involved.

# CHAPTER 2: THEORISING THE STUDY OF KNOWLEDGE TRANSFER

*“All men by nature desire knowledge.”*

*(Aristotle 384-322 BC)*

## 2.1 INTRODUCTION: THE STARTING PROBLEM

As a field of science, KM has significantly grown over the last two decades and is now a recognised academic discipline with its own theoretical base (Serenko and Bontis, 2004; Serenko *et al.*, 2010). KM theory has made connections between action and theory to explain and model the methods, aims and concepts essential to establish itself as a field in management science (Sutton and Staw, 1995; DiMaggio, 1995; Weick, 1995; Baskerv and Dulipovici, 2006).

The Knowledge-Based View (KBV) of the firm proposes that competitive advantage is best achieved with effective management of knowledge (Grant, 1996). KM elements have been dissected into specialised subfields such as knowledge creation, usage, transfer and retention (Wah, 1999; Bou-Llusar and Segarra-Cipres, 2006; Halawi *et al.*, 2007). A researcher must eventually decide on a focus area to enable concise theoretical and empirical contributions. However, it is difficult to make clear-cut divisions between KM subfields, which I shall call *the starting problem*.

While KM had little activity before 1990, the legitimacy to KM increased in the 1990s. It evolved from Nonaka's *Driving Force in the Corporate World*, which built on IT and process re-engineering thinking (Easterby-Smith and Lyle, 2003; Hammer and Champy, 1993; Grint and Case, 1998). The evolution of KM subfields began after 1995 in a fragmented, rapid and chaotic way (Easterby-Smith and Lyle, 2011). The



irony of seeing researchers working on the same thing at the same time in different places in the world without knowing about each other's progress surfaced in KM studies and aggravated this fragmentation (Easterby-Smith and Lyle, 2011).

This chapter will aim to cover the emergence of KM, its legitimacy as a field in its own right and its relatedness with strategy, learning and innovation. After a discussion of theory on knowledge and KM principles, barriers, and enablers, I then present examples of KT implementations. Techniques for closing knowledge capability gaps and worker roles are also discussed. The knowledge-based view (KBV) and knowledge economy perspectives are presented in the context of this discussion. Figure (2-1) in the following page presents a sequential map for the topics presented in this chapter.

### 2.2 PART A: SITUATING THE THEORY OF KM AS A FIELD OF STUDY

A historical narrative on the quest for 'what knowledge is?' reveals that scholars of philosophical knowing –and later on, scholars of KM – have attempted to create a precise definition of knowledge, but have failed to do so. The literature suggests more than 100 definitions (Dalkir, 2005). Hosapple and Joshi (2004) developed an 'ontology' in an attempt to unify KM concepts. Their attempt did not end the debate. Part A will explore and analyse scholarly concepts relating to the following questions:

1. What is the nature of knowledge and knowing?
2. How do we know what we know?
3. What is organisational knowledge?
4. What is knowledge management?

#### 2.2.1 PHILOSOPHICAL PERSPECTIVES ON KNOWING

A Greek term for knowledge is *epistemology* (Collins English Dictionary, 1994). It relates the one who knows to the object known by deductive reasoning (rationalism) or inductive perception. Deduction is a process of reasoning in which a rationale is presented to support a claim. However, knowledge from inductive experience was defined by Aristotle as *practical wisdom*. Rationalism, on the other hand, argues that true knowledge comes only from a cognitive deductive process (Ryle, 1949).

## CHAPTER 2: THEORISING THE STUDY OF KNOWLEDGE TRANSFER

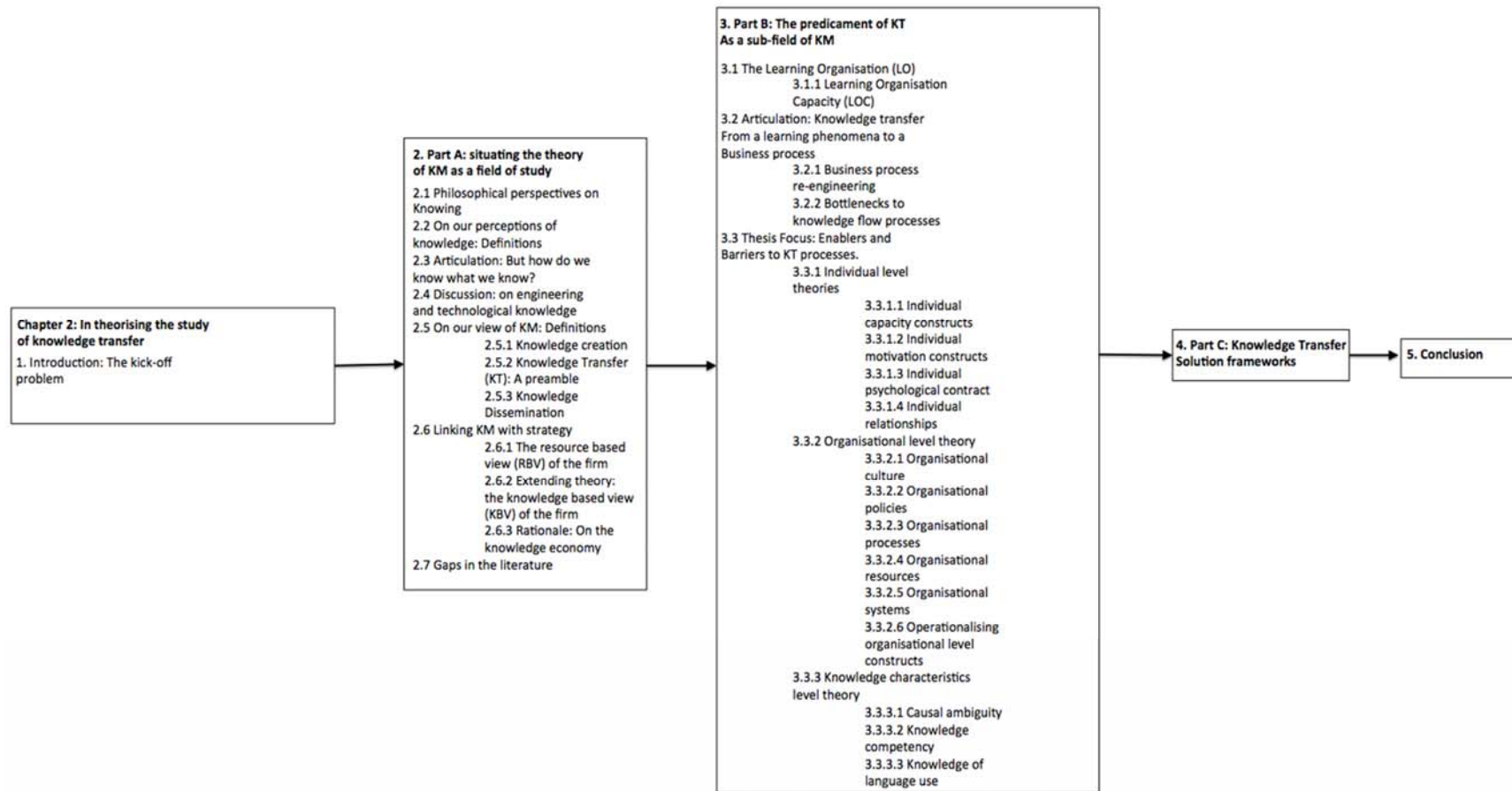


Figure (2-1): The topics covered in the literature chapter (author's interpretation compiled from the literature)

In verifying this meaning, 'Knowledge' is the nominalisation of the *mental process* of 'knowing' (Ortony, 1993). This conceptual position situates knowledge as a meaningful process, which opposes the constituency-based view of knowledge as a product (Polanyi, 1967). The orientation of this thesis places knowledge (or better said, knowing) as a dynamic process. This orientation is important to be clear from the start because it influences the process of modelling knowledge flow and consequently differ from models that are based on the product view (Bargh, 1999; Suchman, 1987; Wenger, 1998). The process view of KM argues that it is difficult to separate the knowledge from the knower. It advocates that knowledge is highly subjective and asserts that socialisation rather than knowledge capture and IT is the correct way to manage knowledge. It tends to privilege tacit knowledge over codified knowledge.

On this basis, managing the *knowing* element of knowledge becomes important for two reasons: first, the account of knowing comes from embodying knowledge as a fluid and dynamic phenomenon that tallies with the nature of a humanistic process. Second, the exclusion of such process lens would preclude the objectivity of movement in knowledge transfer, which I refute. This thesis thus argues against the notion of knowledge storage and retrieval that many KM systems claim to master. This chapter and the thesis as a whole will focus instead on the human side of KM.

### 2.3 ON MY PERCEPTIONS OF KNOWLEDGE: DEFINITIONS

No agreement has been made to uncover the mystery of knowledge (Dalker, 2005). Philosophers agree that knowledge is 'difficult to define' (Earl, 2001; Keen and Tan, 2007). The reason for this ambiguity is that it is impossible for scholars to reveal the essence of knowledge without anchoring a valid reference to it. For example, Plato defined knowledge as 'justified true belief' (Nonaka and Takeuchi, 1995). If a piece of knowledge 'p' is to be claimed as truth by a knower 'a' then this cannot be validated without a rationally accepted *knowledge evaluator* 's' who can confirm that 'a' knows 'p' to be true. When 's' is accepted as a valid evaluator to 'a' in knowing 'p', only then 'a' can prove 'p' to be true. Otherwise, without 's', it is impossible for 'a' to prove that 'p' is true. From here, knowledge seems difficult to grasp. In a world of knowledge pieces, a chain of pieces of knowledge 'p's and evaluators 's's who

validate that each 'a' knows each 'p' becomes a complex mesh of realities or illusive claims. If the ultimate truth was represented by an infinite value of 'p', then it will require an ultimate evaluator 's' with powerful knowledge to confirm that the value of 'p' is true.

However, no human being, due to bounded rationality, can claim to be the ultimate evaluator 's', thus, knowledge remains sceptic to people as long as the existence issue of the 'ultimate evaluator' is not resolved. Costa (2010, p. 155) examined Plato's definition of knowledge by demonstrating that in order for knowledge to be valid as justified true belief, it requires an ultimate truth to sustain its definitional validity:

[t]here is no way of attributing truth value to (p) independently of judging subjects and the ways in which they arrive at this attribution. As the one who decides that (p) is true is the person evaluating whether or not (a) knows (p), the condition of truth assumes that (p) must be true for the knowledge evaluator (s)... one could still ask if what is meant by the condition of truth isn't the ultimate truth value of (p), even if it is impossible to ascribe truth value to (p) independently of a knowledge evaluator and the ways in which he comes to know it. The answer is that here this demand would lead us to epistemic scepticism, since our empirical truth attributions are almost always dependent on fallible evidential support. Only God, the infallible evaluator, by knowing the ultimate truth value of any empirical proposition, would be able to apply the tripartite definition in order to decide with absolute certainty whether or not (p) is true and, consequently, whether or not (a) really knows (p).

Discussions on knowledge in ancient times among early philosophers such as Plato continue today by theorists who are still aiming to rest by an understanding of knowledge (Baskerville and Dulipovici, 2006). Today, contributing scholars come from artificial intelligence (AI), systems engineering, psychology, linguistics, religions, economics, strategic management and organisational learning among others. Table (2-1) below provides a literature definition summary list on knowledge.

Despite their fundamental differences, many authors use the terms knowledge and information interchangeably. While information makes meaning to data, knowledge is cognitively created from experimentation and usage of information, which produces experience. Ackoff (1989) is credited with the development of the data, information, knowledge and wisdom (DIKW) typology. Social construction of reality, a phrase that derives from Berger and Luckmann (1966), emphasises the role of perspective in knowing what we know. Based on this view, knowledge follows an iterative or circular rather than linear function (Parent *et al.*, 2007). The social connotation thus

## CHAPTER 2: THEORISING THE STUDY OF KNOWLEDGE TRANSFER

impacts our understanding during the conversion process. Other constructions of reality anchor knowledge to religious perspectives that focuses on truth as the divine source of knowing (Parent *et al.*, 2007). It seems that the only way to have a stable definition to understand knowledge is to first have a lens in which knowledge can be seen through.

<i>Author</i>	<i>Definition of Knowledge</i>
Davenport and Prusak (1998)	A flux mix of framed experiences, values, contextual information, and expert insight that provides a framework for evaluating and incorporating new experiences and information that originates and is applied in the minds of the knower.
Bell (1999)	The capacity to exercise judgement of the significance of events and items, which comes from a particular context or theory.
Allee (1997)	The experience that can be communicated and shared.
Dalker (2005)	The insights, understanding and practical know-how that we all possess in social reality.
Berger and Luckmann (1966)	The social construction of reality.
Sowa (1984)	The encompassment of implicit and explicit restrictions placed upon objects (entities), operations, and relationships along with general and specific heuristics and inference procedures involved in the situation being modelled.
Tsoukas and Vladimirov (2001)	A dynamic human process of justifying personal belief toward the truth and capability to draw distinctions, within a domain of action, based on an appreciation of context or theory, or both.
Stewart (1997)	The intellectual capital that has been formalised, captured, and leveraged to create wealth by producing a higher valued asset.
Nonaka and Takeuchi (1995)	Wisdom that is acquired from perspective of the entire personality.

**Table (2-1): Definitions of knowledge**

Ontology is “a method or activity of enquiry into philosophical problems about the concept or facts of existence” (Dale, 2002, p. 57). The philosophical fundamental science of analyzing existence and being was applied in the KM domain to the entity of knowledge (Nonaka and Takeuchi, 1995). Therefore, while ontology is considered the anchor to pure phenomenological philosophy (Dale, 2002), the existence of knowledge with a person, a group of individuals, an organisation or an industry falls under the scrutiny of ontology from a KM perspective.

In the context of business, the ontology of knowledge may be individual or organisational (Nonaka and Takeuchi, 1995). The ontology of knowledge on the individual level falls in two categories: explicit and tacit (Polanyi, 1967). Tacit knowledge can be segmented into two dimensions: technical, which represents a kind of informal and hard-to-pin-down skills, and cognitive, consisting of schemata, mental models, beliefs, and perceptions. The cognitive dimension reflects an image of

reality -what it is- and vision for the future -what ought to be (Nonaka and Takeuchi, 1995). Explicit knowledge may be individual or organisational; however, tacit knowledge can only be individual. Thus, only explicit knowledge is contained within tangible or concrete media such as words, audio recordings, or images (Dalkir, 2005).

Drucker (1993) argues that tacit skills cannot be explained in words, but only stand as a demonstration through apprenticeship and experience. Polanyi (1966) had earlier views that are congruent with Drucker, by which he defined tacit skills as knowledge that resides only within individuals because it is difficult to articulate. Simon (1973), however, had an opposing view to the point that he went as far as seeing tacitness as noise and in the best cases, he called it *implicit knowledge*, which implied explicit knowledge to be superior to tacit knowledge.

### 2.3.1 ARTICULATION: BUT HOW DO WE KNOW WHAT WE KNOW?

People may argue that they know what they know because it has entered their package of 'knowledge'. But can knowledge be captured, stored and shared? The answer is controversial, especially with the debate between *content* and *process* of knowledge and knowing respectively. Currie and Kerrin (2004) considered the epistemology of possession and epistemology of practice (Cook and Brown, 1999) as a way of thinking about knowledge and knowing. This thesis contends the epistemology of practice because it is congruent with the process perspective of knowledge. Tsoukas and Vladimirou (2001) supported this view and described knowledge flow processes by giving a lens on how we know. Other theorists from fields such as education and psychology have also supported this view by describing numerous instances of knowing processes. They described knowledge flow processes as mainly coming from experience and perception of reality. This form of knowledge is usually tacit in nature.

The process of knowing may therefore be argued as a tacit process. Brown and Duguid (2001) and Wenger (1998) presented an example of *a knowing form* by investigating how workers know what they know in a particular area they master. In practicing their skills, they were found to repeat a set of guidelines over a given time period and cognitively instrumentalise a skill in their minds in the form of tacit

knowing. A link between how we tacitly know and the act of repetition was thus established. Tacit knowledge, even when acquired as part of a group or community, remains personal; hence, “*all* knowing is personal” (Polanyi, 1958, p. 133).

How one tacitly knows could lead the way to how KT could be implemented, i.e., how to help others know (Argyris, 1987). I advocate the position that knowing is multifaceted and can be innovative and highly idiosyncratic. The ways we can help someone know are autonomous and perhaps unlimited but what works at the end may end up a specific set. Since a one for all strategy is an unlikely acceptable approach to knowing, people are selective in how they know and their selections are based primarily on their social context. I argue that similar contexts may allow for similar approaches to knowing. This view of the act of knowing adopts an empiricist view, i.e. that knowledge is gained through sensory experience (Nonaka and Takeuchi, 1995). As the future chapters will demonstrate, the social context of Saudi Arabia has many idiosyncrasies that suggest the need for a unique process for knowing.

### 2.4 DISCUSSION: ENGINEERING KNOWLEDGE

Engineering sciences produce hard knowledge to improve human lives such as faster means of transport, better health care, easier methods of communication of information and so on. These improvement build on equipment and hard systems. Bohn (1994, p. 55) defines such knowledge as having the means “to produce goods and services, through making predictions, causal associations and prescriptive decisions about what to do using the understanding of the effects of the input variables on the output”. Technological and engineering knowledge are used interchangeably, which suggests similar meaning. It is yet not clear how the nature of knowledge may impact its flow.

Table (2-2) presents an eight-level scale to assess technological knowledge, starting from complete ignorance (Stage 1) to complete knowledge (Stage 8). The higher the knowledge level, the better the chances to improve processes that use this knowledge. Bohn (1994) considers non-mathematical models of knowledge as low knowledge, implying that tacit knowledge indicates knowing less, which I consider untrue.

## CHAPTER 2: THEORISING THE STUDY OF KNOWLEDGE TRANSFER

Stage	Name	Comment	Typical Form of Knowledge
1	Complete ignorance	Absent	Nowhere
2	Awareness	Pure art	Tacit
3	Measure	Pre-technological	Written
4	Control of the mean	Scientific method feasible	Written and embodied in hardware
5	Process capability	Local recipe	Hardware and operating manual
6	Process characterization	Trade-offs to reduce costs	Empirical equations (numerical)
7	Know why	Science	Scientific formulas and algorithms
8	Complete knowledge	Nirvana	-

**Table (2-2): Stages of engineering and technological knowledge (Bohn 1994)**

Epistemological traditions see engineering as a *hard* scientific discipline attributed with stability, equilibrium, controlled change, cyclicity, and robustness; generating predictable behaviour; and hence, following the deductive rationalism view epistemology (Mingers and While, 2010). On the contrary, chaos, complexity, instability, far-from-equilibrium, sudden change, sensitivity to initial conditions and complex behaviour was then profoundly proven in the 1970s and 1980s through the complexity theory, which fits with a *new* view to engineering knowledge that acknowledges dependency on activities of *soft* contextual and subjective components (Lewin, 1992; Mainzer, 1997). *Soft* activities thus help make value from *hard* knowledge produced from rationalism knowledge work (Nonaka and Takeuchi, 1995).

The ontological universality aspect of engineering knowledge (Mark, 1997) may confuse the epistemological context-specific and subjective elements discussed above (Hayek, 1945). Given the human nature of people, who generate, possess and use engineering knowledge, the universality of engineering does not necessarily mean that it is learned, tested or applied in a universal way. Rather, these epistemologies are contextual and subjective. Although engineering knowledge does not possess circumstances of time and space, people are time and space dependent to interact with it. Engineering knowledge is distinct from social knowledge ontologically by its positivist view. However, epistemologically, all people-knowing processes are subjective in nature and arguably include science and engineering (Gotschl, 1992).

Mathematics, pillar to engineering, strictly follow the process of deductive reasoning. Physics and chemistry, however, conducts experiments by deduction and induction approaches (Nonaka, 1991). Both forms produce the truthfulness of engineering



knowledge, implying thus that engineering depends on rationalism and phenomena. Electrical engineering, for example, empirically explored the phenomena of electron flows, and was successful to theoretically articulate it into a mathematical model using both deductive and inductive epistemologies. Philosophers in the 18th and 19th century such as Kant, Hegel, and Marx attempted to synthesize the two forms of epistemology to conclude that even the positivist path does not deny induction and deduction to collectively generate engineering knowledge (Nonaka and Takeuchi, 1995).

Engineering knowledge, as a phenomenon, undergoes processes that involve human interaction and therefore, it requires the understanding of the soft components in social science. This establishes the relatedness between engineering knowledge as a phenomenon and people who seek to use it (Colton and Covert, 2007). Attributes that are not observable such as psychological and behavioural constructs may underlie the way engineering knowledge is formed in the minds of people, how it interacts between people, and how it behaves as a fluid process in which human beings are elements.

The impact of the type of knowledge on how it flows leads to enquire whether all types of knowledge follow the same process of knowing. In managing the process of knowing, a differentiation between hard and soft knowledge may thus emerge. While hard knowledge can be seen through engineering work, soft knowledge is likely to be seen through people (Easterby-Smith *et al.*, 2000; Lindkvist, 2005). The process of managing the balance between hard knowledge and soft knowledge within the context of knowledge flows becomes legitimate. This requires reviewing the literature on how knowledge is managed and the contribution of the KM discipline to this enquiry. The literature, however, contains contradicting views on managing knowledge. This requires the researcher to take a specific stance towards the different views and approaches to be able to conduct a field study.

### **2.5 ON MY VIEW TO KNOWLEDGE MANAGEMENT: DEFINITIONS**

If knowledge is to be managed, it must first be known (i.e. identified). Unless this identification process is successful (i.e., I know what I am about to manage), KM may

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seem to be an elusive concept. The epistemological divergence in defining knowledge impedes consensus on what KM is about. In order to set boundaries to this dilemma, a focal point is needed. By starting from the perspective that KM is about *managing what people know*, it may be argued that organisations use KM, within a *systematic process*, to seek competitive advantage by capitalising and leveraging what their employees know (Grant, 1996; O'Dell, 2000). The key mechanisms for KM here is 'capitalising and leveraging'. I construe from this that there is a *participant* and a *process*, which are represented by *someone who knows something* and *someone managing something that is known by someone* for an organisational purpose. This implies that KM is not about an owner of knowledge (Participant) but how knowledge is meaningfully transmitted and used (Process). Definitions from the literature on KM are presented in Table (2-3) to provide further insights on how KM is perceived.

<i>Author</i>	<i>Definition</i>
<b>Wiig (1997)</b>	The systematic, explicit, and deliberate building, renewal, and application of knowledge assets
<b>Hibbard (1997)</b>	The process of capturing a company's collective expertise wherever it resides – in databases, on paper, or in people's heads – and distributing it to wherever it can help produce the biggest payoff
<b>Petrash (1996)</b>	Getting the right knowledge to the right people at the right time so they can make the best decision
<b>O'Dell (1996)</b>	The systematic approaches to find, understand, and use knowledge to create value
<b>van der Spek (1997)</b>	The explicit control and management of knowledge within an organisation aimed at achieving the company's objectives
<b>Beckman (1997)</b>	The formalization of and access to experience, knowledge, and expertise that create new capabilities, enable superior performance, encourage innovation, and enhance customer value
<b>Grant (2005)</b>	The efficient utilization of resources and capabilities to produce a sustained competitive advantage
<b>Zaied (2012)</b>	Strategies and processes designed to identify, capture, structure, value, leverage, and share an organisation's intellectual assets to enhance its performance and competitiveness

**Table (2-3): Definitions of KM**

The above definitions show that there is a multifaceted view to KM (i.e. knowledge creation, knowledge transfer, knowledge use, etc.) and how these KM views can bring value to organisations. It can also be seen that the understanding of what knowledge itself is may influence our understanding of the essence of KM.

### 2.5.1 KNOWLEDGE CREATION

The notion of Aristotle that 'all men by nature desire knowledge' may be aggregated to teams and organisations to provide a sufficient insight into the importance of new

knowledge to businesses as a way of surviving and growing. The desire to know may be driven by curiosity to know the unknown (Freire, 1985). Therefore, such desire may end up not only discovering new knowledge on one's own but building on existing knowledge sourced from others. This is where knowledge creation and knowledge transfer intersect. Von Krogh *et al.* (2000) defined knowledge creation as a process of combining and amplifying knowledge and connecting it to an organisations' knowledge system. This implies that it involves a transformation process from dispersed individual knowledge to a connected structure (Tsoukas, 1996).

KM research on knowledge creation has two dimensions; hard or soft (Tiwana, 2002). The process is hard when members of the discipline share the same view of how research should be conducted, and soft when there is little consensus in managing this shared view. Knowledge creation is considered a subfield of KM and Nonaka and Takeuchi (1995) are credited with the formation of its theory. Although a degree of correlation between knowledge creation and other KM subfields exists, this thesis is mainly concerned with KT.

### 2.5.2 KNOWLEDGE TRANSFER: A PREAMBLE

Knowledge Transfer is the main focus of this thesis. It is defined as the event in which an individual, group or organisation learns from the experience of individuals, groups or organisations by *connecting* those individuals, groups or organisations who need to know with those who know at the time they need it (Easterby-Smith *et al.*, 2008; Tsai, 2001; Faraj and Sproull, 2000). KT occurs at multiple levels, i.e. between individuals, individual and groups, groups and groups, groups to organisations, and organisations to organisations. Therefore KT can be on an intra-organisational (internal) or inter-organisational (external) levels. The terms *connecting* refers to the explication of knowledge to a seeker where knowledge is made useful and meaningful. The need to allow seekers of knowledge to construe the experience of the knower through properly contextualising knowledge into the seeker's own experience becomes essential for a successful KT. KT is therefore more of a tacit contextualisation process.

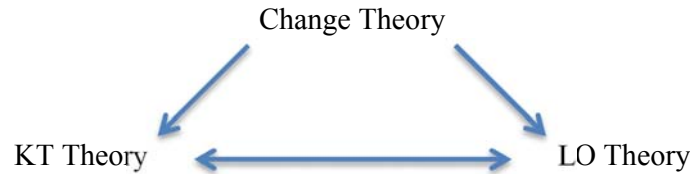
Polanyi (1966) asserts that the epistemological significance of being unaware of knowing (subsidiary knowledge) stands as a barrier to KT. This means that contextualising transferred knowledge is complex, especially with difficult (sticky) codification (Szulanski, 1996). Even if knowers attempt to codify what they know, they still risk that seekers will not find *meaning* from codified content. This suggests that it is not accurate for KT to rely on codifying the 'knowledge for transfer' as if finding *meaning* from it was taken for granted. On other hand, KT may perhaps not require codification nor need present consciousness in what we *tell*, according to Polanyi. For knowledge to be *articulated* while risks associated with *codification* exists, the form of face, body patterns, features in language, silent gestural explication of concepts and non-formal experimentation may offer the seeker to tacitly 'elicit', and therefore 'bring-in', and make 'meaning', of targeted knowledge without the need to codify. This approach to bypass codification in the process of KT may require an individual *capability* on the seeker's side to master elicitation without codification.

Locating expertise and who needs it at a given time is a problem accentuated by geographical barriers (Grinter *et al.*, 1999). Distanced expertise may lead to not being able to locate it, hence, exposing staff who need it to suffer (Cross and Cummings, 2004). Even if expertise was located, challenges such as locating the ones who would *accept* to release knowledge, to tolerate methods to overcome distance barriers, and to patiently contextualise knowledge would still stand.

Transfer of knowledge to a seeker involves a risk of release of ownership, control and power. The willingness of the knower to transfer and contextualise knowledge to the seeker may consequently be affected by this risk, especially in the context of organisations. On an organisational level, such release of power could risk competitive advantage. An exchange of benefit may *balance* the equation but socio-political factors may reveal inherent inequities in power relationships of KT (Marshall *et al.*, 1996; Neuman, 2006). By supporting 'collective action' to alter social structures where the seeker ensures that the knower recognises a benefit from release of knowledge, dysfunctional KT processes may avoided (Stoecker, 1999).

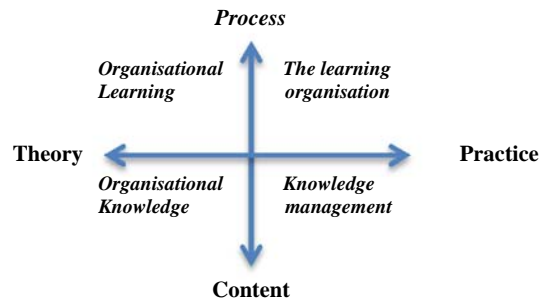
In terms of planning KT activities, methods of informative experiments, seeking systemic patterns and trying to understand how knowledge transformation occurs on

the seeker's side are congruent with the theory of transformational change and the LO (Alle, 1997). They all seek to re-order, re-balance and re-design reality to achieve a favourable knowledge goal whether for one or both sides of the transfer process. As supported by Easterby-Smith and Lyle (2008), figure (2-2) conceptually integrates those theories.



**Figure (2-2): Integration of Change, LO and KT (Easterby-Smith and Lyles, 2008)**

Easterby-Smith and Lyles (2008) mapped Organisational knowledge, KM, LO and OL against the dimensional dichotomies of *process*, *content*, *theory* and *practice*, as illustrated in figure (2-3). They however, did not clarify the change theory element as I did.



**Figure (2-3): Integrating KM with the LO (Easterby-Smith and Lyles, 2008)**

In many ways, the above two figures summarise the lens of this thesis, which starts with a goal (the knowledge strategy). This strategy is the change objective that is inspired by the LO target. The change objective guides the practical process to manage knowledge resources and build KT capabilities (required substance or content). To increase the organisational knowledge base (OKB), which contains knowledge resources and KT capabilities, learning processes are needed to operationalise the change initiative. In my view, change theory provides the basis for KT capability, which can be framed as the change KT initiative to improve the knowledge resources.

Once knowledge is transferred and contextualised, it needs to be spread (i.e. disseminated) in a given *space*. Knowledge dissemination describes the internal transfer of knowledge within an organisation. The disseminative capacity builds on social capital networks (Apostolou *et al.*, 2007), which is the dissemination *space*. This capacity is influenced by tacitness, stickiness, causal ambiguity and issues like trust (Szulanski *et al.*, 2004). Schultz and Jobe (2001) recognised the human component to ‘knowledge flow’ and suggested the rotation between the knower and seeker to enable dissemination. In this way, useful knowledge *spreads* and remains embedded within multiple social structures (Orlikowski 2000; Swan and Scarbrough 2005; Ormrod *et al.*, 2007). In this way, dissemination becomes more effective than using IT systems.

### 2.6 LINKING KNOWLEDGE MANAGEMENT WITH STRATEGY

Both KM and strategy have a reciprocal impact on one another. While the implication of strategy on KM means guidance and definition to fill a KM capability gap (Zack, 2002), the implications of KM on strategy means positioning knowledge as the most important source for competitive advantage (Zack, 2002; McEvily and Chakravarthy, 2002; Newbert, 2007; Spender, 1996). Tiwana (2002, p. 76) phrases this bi-directional impact neatly in the following quote: “Knowledge drives strategy and strategy drives KM ... Without a clearly articulated link between KM and business strategy, even the world’s best KM system will deliver nothing”.

KM, as a strategic solution, should not only focus on operational mechanisms to improve efficiency, but to encompass a strategic perspective to trigger innovation (Nonaka and Takeuchi, 1995; Wiig, 1997). Pablos (2001), however, recognised *operational* and *strategic KM* as essentially integrated. The main concern of *operational KM* is to connect people to the process of distribution and transfer of knowledge (Tissen *et al.*, 1998). *Strategic KM*, on the other hand, connects Organisational knowledge with business strategy (Eisenhardt and Santos, 2002; Grant, 2005). Organisations thus need *strategic* and *operational KM* alignments to remain competitive (Grant, 1996; Zack, 2002). From this perspective, the methodological approach of this thesis will consider tapping on both the strategic and operational staff to examine the knowledge flows in Saudi research organisations.

The KM ‘building blocks’ of Probst *et al.* (2000) disaggregate into cascaded constructs of knowledge goals, identification, acquisition, development, distribution, utilization, retention, and measuring. Jones (2001) advocates building the knowledge strategy after understanding the business strategy. However, Davenport (1997) argue that the KM strategy should not be separate from the business strategy. Armbrrecht *et al.* (2001) narrowed the KM strategy to focus on speeding knowledge flow and removing barriers from its processes (see chapter 6). Chapter 9 will present this view as a focal point to developing knowledge flows solutions.

Intellectual capabilities may be assessed using knowledge maps of tacit, explicit, general, situated, context-specific, individual, collective, declarative, procedural, causal, conditional and rational knowledge types (Demsetz, 1988; Polanyi 1966; Spender, 1996; Zack, 2002). On the organisational level, knowledge types have three elements: core, advanced, and innovative (Zack, 2002). The role of KM strategy, therefore, is to position (align) the organisation to its processes and then to ensure sustainability by knowing that what is assessed as innovative today will be core tomorrow (Zack, 2002). More knowledgeable organisations have the opportunity to synergise with existing knowledge stocks that less knowledgeable firms would not be able to perform (Zack, 2002). This ties to the KT problem to be examined in thesis.

Systematically benchmarking and mapping organisational knowledge can be used to focus the strategic critical learning mass (Zack, 2002). Building upon the KM strategy goal of value adding for competitive advantage, critical learning should result in customer (user) knowledge, knowledge in products, knowledge in markets and knowledge in processes, thus transforming the organisation into a valuable, rare, inimitable and irreplaceable organisation (Mertin *et al.*, 2003).

While a strategic gap occurs between what an organisation must do to compete and what it is actually doing, a knowledge gap occurs between what an organisation must know to execute its strategy and what it does know (Zack, 1999). The knowledge gap should be derived from and aligned with the strategic gap (Earl, 2001). An organisation should know how far existing knowledge is in alignment with strategic requirements and hence, a business vision can be framed (Zack, 2002). Empirical

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research may face difficulties in operationalizing such concepts. Chapter 5 aims to address this challenge.

Within a knowledge strategy alignment process, business units must either devise their new strategies to acquire (buy) external capabilities or align their business strategy to better exploit (make) internal resources and capabilities (Zack, 2002). This will depend on the innovative capabilities of the organisation (Drucker, 2002). Numerous studies have investigated alignment of knowledge strategy (Zack, 1999, 2002; Davenport, 1999; Sabherwal and Sabherwal, 2007; Sunassee and Sewry, 2002). These studies, however, presented models that were difficult to measure or analyze (Franken and Braganza, 2006). Table (2-4) summarises relevant definitions of KM strategy alignment.

	Author	Definition	Concept
1	Smaczny, (2001)	A process of fusion or act of joining, uniting or integrating the changes in internal and external environment conditions	<i>Fusion</i>
2	Broadbent and Weill (1993,1997)	The extent to which business strategies were enabled, supported, and stimulated by information strategies	<i>Alignment</i>
3	Luftman <i>et al.</i> (1998)	The strategic fit between strategy and infrastructure, and fundamental integration between business and IT.	<i>Fit</i>
4	Luftman <i>et al.</i> , (1993)	The extent to which the KM strategy supports, and is supported by, the business strategy	<i>Alignment</i>
5	Reich and Benbasat, (1998, 1996)	The degree to which the information technology mission, objectives and plans support and are supported by those of the business.	<i>Linkage</i>
6	Zviran (1990)	The specific KM objectives need customization according to the organisation objectives	<i>Relationship</i>
7	Henderson, (1990)	A working relationship that reflect long-term commitment, sense of co-operation, shared risk and benefits, and qualities consistent with theories of participatory decision making	<i>Partnership</i>
8	Henderson and Venkatraman, (1993)	The internal fit and integration between business and KM strategy to gain a competitive advantage	<i>Fit</i>

**Table (2-4): Alignment of KM and business strategy (Franken and Braganza, 2006)**

Strategic alignment thus implies that the organisation calibrates a match between its strategy and implementation at the operational level (Chapman, 2005; Kaplan and Norton, 2006). In doing so, organisations can realise synergy, which goes beyond the minimum objective to alignment in reducing waste and redundancy to produce leveraging powers between work practices (i.e. 1+1= more than 2). This process improves the learning curve (i.e. people learn quicker with less mistakes) (Massingham, 2012). Such accelerated learning economies would support KT processes to meet the knowledge strategy goal more effectively.



The dimensions in Table (2-5) were considered by many authors as knowledge strategic choices (Zack, 1999; Asoh, 2004; Choi and Lee, 2003; Bierly and Daly, 2002; Bierly and Chakrabarti, 1996). This suggests that knowledge strategic choice require trade-offs (i.e. a decision being made with full awareness of the advantage and disadvantage of each choice). One cannot pursue several choices simultaneously without detrimental effects because organisations have limited resources (Porter, 1985), hence, the process of choosing a specific approach for knowledge strategy is critical to business strategy. Strategic success or failure to filling capability gaps is therefore dependent on the decision to pursue one knowledge activity or the other (Asoh, 2004).

Reference	K-strategy	Definitions
<b>Zack (1999)</b>	Aggressive	Firm exploring the external (unbound) knowledge
	Conservative	Firm exploits internal knowledge
<b>Choi and Lee (2003)</b>	Dynamic	Takes an aggressive role on both codifications and the personalization strategies with un-boundaries source
	System-oriented	Increase Organisational effectiveness by codifying and reusing knowledge through advanced information technology
<b>Swan <i>et al.</i> (2000)</b>	Cognitive	Linear information flow, codify via IT (use existing knowledge)
	Community	Dialogue and KT through social network
<b>Bierly and Chakrabarti (1996)</b>	Explores	Acquisition from external sources then disseminate
	Exploiter	Emphasis on utilization of knowledge from internal sources.
<b>Bierly and Daly (2002)</b>	Explores	Develops new radical knowledge but not strong at exploiting.
	Exploiter	Exploits existing knowledge but not strong generators
<b>Jordan and Jones (1997)</b>	Tacit-oriented	Acquire external focused knowledge and share it informally
	Explicit-oriented	Acquire internal and focused knowledge and share it formally

Table (2-5): KM strategic choices (Asoh, 2004)

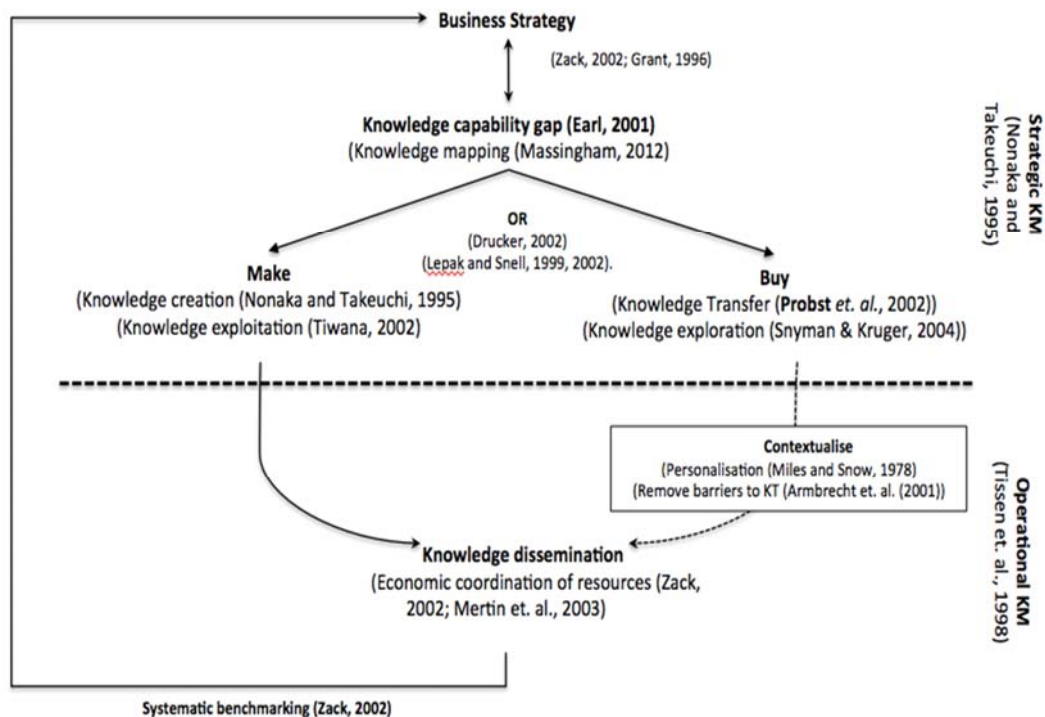
Tiwana (2002), adapting the ideas of Weill and Broadbent (1997) and Porter (1985), illustrated a relationship in table (2-6) between business strategy, competitive environment, KM strategy, and KM technology. He demonstrated the alignment of KM with business strategy using internal mapping through *personalization* or *codification* (Miles and Snow, 1978) and external mapping through strategic and Knowledge-based SWOT. *Exploitation (make)* and *exploration (buy)* supported the interdependency between KM strategy and business strategies (Snyman and Kruger, 2004).

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	Type	Definitions
1	Internal knowledge source	Knowledge activities within the organisation's boundaries. Internal knowledge may reside within peoples' heads; embedded in behaviours, procedures, software and equipment
2	External knowledge sources	Knowledge sources outside the organisation's boundaries
3	System (codification)	Codifying, storing, sharing and using explicit knowledge
4	Human (personalization)	Acquiring and sharing tacit knowledge and experience
5	Exploitation (leveraging knowledge)	Focuses on creating new knowledge
6	Exploration (creating knowledge)	Focuses on incrementally enhancing and utilizing the existing knowledge base
7	Centralized knowledge profile	High degree of integration in knowledge flows across different functions in an Organisation
8	Decentralized knowledge profile	Each sub unit has independent knowledge requirements
9	Deep knowledge base	Focus on specific domain of knowledge or core competencies
10	Broad knowledge base	Generic knowledge and product integrate knowledge streams

**Table (2-6): Strategic relationships with KM (Tiwana, 2002)**

To operationalise the above concepts, figure (2-4) below presents the strategic needs of the organisation, the knowledge capabilities needed to fulfil those needs and also those needed to find the best approach. The choices of approach may be by using transaction cost economics (Williamson; 1975), human capital theory (Becker and Gerhart, 1996) or the RBV theory (Barney, 1991). In this way, it becomes possible to operationalise the strategic and operational KM strategy (Massingham, 2013).



**Figure (2-4): Conceptualising the links between KM and business strategy (author's interpretation compiled from the literature)**

Rather than make or buy whole functions, sensitivity can be applied to disaggregate the work involved with each choice (Burton-Jones, 1999). Mapping the organisation's knowledge resources against strategic direction helps decision makers understand the strengths and weaknesses of the resource base of the organisation (Zack, 1999), allowing a more intelligent make versus buy decision to fill knowledge gaps. Lepak and Snell (2002) suggest a technique that encourages organisations to explore the value and uniqueness of human capital and its potential to contribute to competitive advantage (Lepak and Snell, 2002).

The practical sequential process of such strategy-making may be planned or emergent (Pidd, 2004). The planned mode is rational (Dyson, 2004) and has often been attributed to systems thinkers (Ackoff, 1970, 1981; Ansoff, 1965, 1979). Emergent strategy arises when planned strategies contain inadequacies, a difficult to avoid event (Mintzberg, 1991). Strategy is thus never static, rather a continual cyclical debate (Ansoff, 1991; Mintzberg, 1991), where one process mode cannot be sustainably optimal (Ormerod, 2006). Learning from experience is considered the best approach to emergent strategy making (Nonaka and Takeuchi, 1995).

### 2.6.1 THE RESOURCE BASED VIEW (RBV) OF THE FIRM

The RBV of the firm is defined as the perspective that sustained competitive advantage derives from the tangible and intangible resources and capabilities a firm controls that are valuable, rare, imperfectly imitable and not substitutable (Barney, 2001). From this perspective, resources are classified and defined by Wernerfelt (1984) as:

[T]angible and intangible assets which are tied semi-permanently to the firm. Examples of resources are: brand names, in-house knowledge of technology, employment of skilled personnel, trade contracts, machinery, efficient procedures, capital, etc. (p. 174)

Linking back to the aim of this thesis, research organisations need to improve strategic competitiveness by better using their internal resources (i.e by building capability). The RBV makes this link through its focus on linking the internal characteristics with competitiveness (Barney, 1991). Easterby-Smith and Prieto (2008, p. 236) makes the connection in the following quote between existing resources and expected competitiveness:

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[E]ach organisation possesses a different profile of tangible and intangible resources and capabilities, and these differences account for variations in Organisations' competitive positions and their performance

The resource capability gap is therefore profoundly important for the RBV theory. Grant (2008) categorises resources in three domains: (1) tangible resources (financial and physical assets), (2) intangible resources (intellectual property, patents and trade secrets), and (3) human resources (experts holding organisational expertise). The focus in this thesis rests on the second and third categories by understanding how knowledge flow (transfer) can satisfy needed capabilities to produce a competitive advantage to Saudi engineering research organisations that currently may lack competitiveness.

The RBV accounts for the contribution of human resources to value creation because human resources are firm specific (Wright *et al.*, 1995). Congruent with the RBV, Grant (2005) found that firm-specific resources were more important than environment factors in supporting competitiveness. Grant (2005) quoted the following statement from Quinn (1992) who illustrated how value creation as a main resource for organisations can guide its human resources to success in creating a competitive advantage for their organisations:

IBM is defined not as a computer company, but as business-processes company; Microsoft defines itself not as a software company, but as a company that helps people and businesses develop their potential; and Wal-Mart is defined not as a large low-cost retailer, but as a large company with competencies in cost-leadership, distribution, and supply-chain management. (p. 41)

From the above, it is clear that value creation, strategically, starts from a specific vision that can clearly explain the value the organisation is creating to its clients. Research organisations in Saudi Arabia need to define their firm-specific value to their staff before considering strategic changes. On their own, resources do not create value; rather, it is the capacity to understand the potential of possessed resources in creating value.

Human resource skills create 'dynamic capabilities' as a special kind of capabilities to create value (Grant, 2008). Such capabilities require time to develop into competitive advantage, however. Winter (1995) suggested that the dynamic aspects of capability

are more involved with bringing-in knowledge for long-term future positions, instead of short-run profits (Stalk *et al.*, 1992; Nonaka, 1994; Teece *et al.*, 1997). Grant (2008) argued that internal capabilities provide greater security to long-term strategy in changing environments. Long-term value is therefore suggested to be reliant on its dynamics (Wernerfelt, 1984; Winter, 1995). This suggests that this study should consider that the changes that may emerge may require a long time to create value.

To identify the dynamic capabilities that create such value, it is necessary to classify functional activities underlying the overall organisation hierarchical capabilities (Grant, 2008). For example, capabilities that are important in an engineering functional area may be research originality, innovation of new products and fast-cycling product development (Grant, 2008). This study will link these important concepts to field findings where the business processes are mapped against KT processes in chapter 6 and then the barriers that are identified as capability inhibitors are examined. In this way, the missing capabilities that are needed for competitiveness are clarified.

Pursuing new research due to changing external factors may be risky and failure rates are higher compared to exploiting internal capabilities. Distinctive resources may lead to uniqueness which extrapolates scarce resources like patents, skills, research and development, and knowledge about customers (Shin 2004). However, what do organisations do when their existing exploiting capability is low? New capabilities need to be brought (acquired) into the organisation (Grant, 1996). Exploiting the combinations of internal resources with brought-in resources may then rationalize the RBV and KT processes to realise better performance and a higher competitive advantage (Lippman and Rumelt, 2003). This study asserts the importance of socialisation and network relationships to the RBV in combining external and internal expertise (Penrose, 1959; Wernerfelt, 1984) and contradicts the positivist concept of knowledge as an asset.

The RBV assumes that heterogeneity should be invested in to exploit differences, which suggests a need to limit importing capability when internal resources can be exploited (Prahalad and Hamel, 1990). The RBV encourages acquiring professional (market) knowledge from external sources but discourages it once firm-specific knowledge is developed (Tordoir, 1995). This criterion may rationalise the ‘make

versus buy' decision (Ciabuschi and Martin, 2011).

Figure (2-4) from the previous section informs this section by illustrating the importance of the 'make versus buy' decision. Quinn (1992) argued that firms should focus on core capabilities while noncore capabilities should be brought-in (through KT) (Lepak and Snell, 1999). Core competencies are rare, valuable, inimitable, and non-transferable (Barney, 1991; Prahalad and Hamel, 1990; Wernerfelt, 1984). Core and non-core resources are idiosyncratically classified through the long-term strategic lens of each organisation. Chapter 5 will examine this activity.

### 2.6.2 EXTENDING THEORY: THE KNOWLEDGE BASED VIEW (KBV)

The knowledge-based view (KBV) of the firm is complementary to the RBV. While the RBV implicitly refers to knowledge, the KBV explicitly asserts its importance (Nonaka and Takeuchi, 1995). KBV is a theory that changes the way we think about managing organisations. Grant (1996) argues that knowledge expands when it is used, while it decays if less used (Massingham, 2012). Knowledge expands through learning and integration (Stata, 1989; Kogut and Zander, 1992; Grant, 1996; Prahalad and Hamel, 1990). This is explained by Kogut and Zander (1992) who discuss *combinative capabilities* through generative integration.

KT characteristics such as transferability (i.e. explicit versus tacit), capacity for aggregation (i.e. absorption and additivity of knowledge), appropriability (i.e. return on knowledge value), and specialisation in acquisition (i.e. bounded rationality) are pertinent constructs to knowledge utilization and decisive in creating value (Kogut and Zander, 1992; Cohen and Levinthal, 1990; Teece, 1987; Simon, 1991). Better use of these constructs than that in rival firms creates a competitive advantage (Liebeskind, 1996; Galunic and Rodan, 1998; Phene *et al.*, 2006). Engineering research need to continually improve its KT practices to grow the value of its knowledge (Itami, 1987).

Coordination of knowledge resources should be integrated economically to reduce the costs of KT (Grant, 2005). This understanding is vital for this study because it advises that not all knowledge must be learnt by everyone to realise a finished product; rather,

better coordination of knowledge may result in the same effect. In the case of this study for example, the expected significant knowledge gaps cannot be filled at all levels and with all researchers. It would be virtually too expensive and economically draining. By guiding both the learning and ignorance of researchers, KT may create tangible value while being economical.

Knowledge coordination and integration, however, require rules and directives that can (1) regulate the interactions of individuals (Galbraith, 1973), (2) sequence the input of knowledge workers (Nonaka, 1990; Clark and Fujimoto 1991), (3) establish automated routines (Pentland and Rueter, 1994) and (4) allow group problem solving and decision making (Grant, 2005). Agency theory applies in any relationship where one person depends upon another. The use of economic coordination in building KT capability will be addressed as a strategic KT choice in this thesis (see chapter 5).

Based on the KBV construct, knowledge may therefore be: (1) cognitive (know-what) (Grant, 2008), (2) operational (know-how), (3) problem-solving (know-why) or (4) creative (care-why) (Tiwana, 2002). Most organisations, even the well established, are at the know-how knowledge stage. This implies that it is problematic when a firm is at the know-what stage. As a starting point example, this thesis suggests that the capability gap in engineering research in Saudi Arabia has not surpassed the know-what stage.

### 2.6.3 RATIONALE: ON THE KNOWLEDGE ECONOMY

The knowledge economy is defined as the constitutive mechanism and identity of modern societies that are driven by replacing property and labour with knowledge (Drucker, 1995; Stehr, 1994). The theoretical foundation for the Knowledge Economy construct emerged from intellectual capital (IC) and intellectual property (IP) theories of information economics (Tordoit, 1995; Inkpen and Tsang, 2005). KM theories are thus theoretical extensions to IC. As Tsoukas and Mylonopoulos, (2003) explain, IC and Knowledge Economy theories emerged due to:

[i]ncreasing digitization of social and economic life, the widespread use of information and communication technologies, a more literate workforce, the increasing dependence of advanced economies on services, the expansion of a professional class, and several

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other factors, all of which have made economic activities and transactions depend on specialized, or 'theoretical' knowledge. (p. 975)

Knowledge limitations will always exist, no matter how knowledgeable the firm capability becomes (Grant, 1996). The knowledge domain and the product domain suggested by Grant and Baden-Fuller (1995) are good examples of such limitations. These two domains may fall inside or outside the firm, which results in forming a matrix of knowledge inputs and product outputs to understand multiple inter-firm collaboration. The means that knowledge flow into the organisation is important to decrease those limitations and expand the capability boundaries.

Inter-organisational collaborations are thus the result of knowledge limitations. Otherwise, firms would produce products without inter-firm interventions or crossing its borders to explore alliance options. Such overlap of inter-firm contribution towards a product requires governance of rights such as sufficiently using patents, preserving knowledge specific employee skills and proper governance of resources. Organisations must also configure their decision model to determine which intellectual assets to develop internally and which to acquire externally (Probst *et al.*, 2000; Teece, 1998). From this theoretical base, KT strategies are created to provide governance to KT.

Probst *et al.* (2000) identified three trends of the knowledge economy: exponential knowledge growth, knowledge fragmentation, and overwhelming globalization. They claim that knowledge increase is doubling every five years. This increase in knowledge has led to specialization. Not only do researchers need to develop new knowledge but they also need to be able to replace obsolete knowledge with new knowledge. This is called organisational forgetting (Wiig, 1993), which means knowing what knowledge to let go of because it is no longer relevant or useful. I would argue that research organisations are challenged by the dynamics of this phenomenon.



### 2.7 GAPS IN THE LITERATURE

The RBV of the firm has two major theoretical shortages. Organisations cannot know which resources actually generate their strategic advantage (Barney, 2001), and, if they were known hypothetically in one industry, it might not be valuable in another. This suggests limiting generalised applicability (Priem and Butler, 2001). Such causal ambiguity view of competitive advantage makes the RBV too narrow in explicating how resources are brought together, synergised, coordinated, integrated and put in use. I would argue that the aim of the KBV may help fill this gap. The use of the economic theory of coordination may also be useful to create the appropriate understanding for organisations to depict where exactly to target a valuable return-on-investment (ROI) from which resources.

The KBV of the firm also has theoretical limitations since we do not yet know how to measure the value of knowledge and its impact on organisational performance (Massingham, 2004; Priem and Butler, 2001). Massingham (2004) suggested creating parameters for the knowledge resource value variable in order to be able to examine the impact of knowledge loss or knowledge gain. Also, knowledge strategy would be enhanced by methods that can help prioritise knowledge resources so that managers can make trade-off decisions about future capability (e.g. make versus buy).

The activity of knowledge auditing and assessment to allow for optimised knowledge management is also a challenging task at the individual, group and organisational levels. Auditing services by management consulting organisations have made attempts to include knowledge auditing into their accounting activities for valuing knowledge assets, however, the literature shows little details about the progress in this area. This perhaps is due to IP confidentiality to allow consulting giants to produce revenues from this research area.

The available literature published by KM researchers in universities and public practice organisations may thus become lagging to the forefront of the field of KM. The consequences is significant to the business community that cannot afford access

## **CHAPTER 2: THEORISING THE STUDY OF KNOWLEDGE TRANSFER**

to valuable KM practices from the big consultancies. As it is difficult, or impossible, to manage what is not measured, the KM community should fill the gap in the literature in the area of knowledge measurement. This KM subfield would enhance the ability to transfer knowledge in a measurable fashion. Massingham (2012) developed a large survey to measure knowledge capital on the individual and organisational levels, however, this attempt requires a wide application of the survey to produce clear benchmark systems on an industry level or a business sector level. The commercialization of many KM initiatives may enhance the widespread of such measurement tools, however, the commercialization of many KM initiatives seems to face many challenges due to the tactiness of the solutions provided and the difficulty in producing a measurable ROI.

## 2.8. PART B: THE PREDICAMENT OF KT AS A SUB-FIELD OF KM

The KT domain is more concerned with knowledge *processes* or *flows*, rather than *stocks*. As discussed earlier, the underlying ‘stock’ view is a concept that places knowledge as an asset that can be moved around, which belongs to the RBV theory of the firm. The proposition of this thesis does not support that knowledge is as simple as a ‘stock’ that can easily be transported from A to B. The theory on knowing discussed earlier is indeed relevant to this section (see Polanyi, 1967). The notion that knowledge is pre-eminently dynamic, fluid and has flow attributes makes the act of ‘*managing*’ these flows the only way to *direct* rather than *transport* knowledge.

By starting from a simple point, Hamel (1991), defined KT as a *process* that consists of two critical steps: first, knowledge is disclosed by a *knower*; and secondly, disclosed knowledge is acquired and assimilated by a *seeker*. Part B of this chapter will focus on the second step while assuming the first step as taken for granted. The reason for this assumption is that if an international *knower* was unwilling to disclose knowledge then there would be little the *seeker* could do, except to perhaps address the matter through governmental or political negotiations, which is beyond the scope of this study.

From the above, I suggest three KT themes: (1) flow from external knowers to internal seekers, (2) flow from internal knowers to internal seekers, and (3) flow from internal knowers to external seekers. This conceptualisation will be further discussed in chapter 3 to construct the conceptual framework for chapter 6. I aim in the remainder of this section to present the literature that constructs these themes.

As the knower is assumed to be willing to share knowledge, the seeker, needs to ensure this willingness is well invested in and managed via an effective methodology. I will thus focus on the mechanisms that help the seeker know how to deal with disclosed knowledge. Knowledge acquisition as a process of identifying and evaluating the opportunities and liabilities of disclosed knowledge puts responsibility on the seeker to use what has been acquired (Lane and Lubatkin, 1998). An example

of this responsibility is the dissemination of knowledge which refers to the process of internalising disclosed knowledge among internal members (internal-internal KT) and then to the local community (internal-external KT).

In terms of contextualising KT, the adoption and utilisation of new knowledge involves unlearning, which links with the theory of change discussed in section 2.5.2. The ‘unfreeze-change-refreeze’ change theory lends itself as a model to teach the taxonomy of structuring KT using a transformational perspective (Woodall, 1996). The disruption to equilibrium means that KT may mean “adaptation of the existing knowledge to a specific context” (Foss and Pederson, 2002, p. 51). Social constructivism (Gergen, 1985; 1999) is based on the premise that people create their world, via a process of social exchange, which represents reality to them (Schwandt, 2000).

The need to know in knowledge-intensive organisations is a basic assumption in this study because this is what creates value. Nonaka and Takeuchi (1995) assert that the unique attribute of Japanese organisations is their willingness to link between internal knowledge needs and external knowledge marketplace. Despite knowledge complexity, this is not chaotic, nor a random process; rather, it is ‘a phenomenon with an analysable and relatively stable structure that is distinguishable by specific knowledge types and roles’ (Schreiber, 2000). The economic factor must be considered to ensure ROI in KT, as KT may become very expensive. A coordination process on *who* needs *what* may control the cost of transfer per capita, thereby, reducing the costs of KT. By building on the economic theory via coordination of costs, the examination of KT in this thesis provides context about the value of KT and which link in chapter 9 with solutions (i.e. practical outcomes).

In reality, organisations find difficulty accessing needed knowledge. This could be considered the first barrier to transferring knowledge from the external sources. Sourcing capability is an important and pre-requisite attribute for successful knowledge acquisition plans (Almeida, 1996; Dyer and Nobeoka, 2000; Gulati *et al*, 2000). Successful sourcing capabilities for an external-internal KT system require a thorough understanding of targeted knowledge. Upon this understanding, organisations need to transfer and transform knowledge into its internal systems by

identifying knowledge in and out of their environment and transforming it to be internalised (Holsapple and Joshi, 1999; Lepak and Snell, 1999). An internal-internal KT process follows, which is the second KT system. This concept assists knowledge renewal, sustained competitive advantage, and positive performance (Inkpen, 1998). Only when a successful construction of the second KT system is achieved, can the third KT system (internal-external KT) commence because the seeker in this case becomes capable of taking the role of the knower.

Going back to the external-internal KT system, there are two approaches to knowledge seeking: exploration that involves seeking knowledge from external sources, which is represented in the theme of external-internal KT (March, 1991), and exploitation that focuses on the refinement of existing internal knowledge (Holsapple and Joshi, 1999), which takes place at times when there is a knowledge surplus (Kang and Snell, 2009).

While Collis and Montgomery (1995) and Lepak and Snell (1999) justify the importance of knowledge acquisition to increase capability and hold off value decay, Grant (1996) views organisational capability as the outcome of knowledge integration that follows acquisition. He means that unless integrating mechanisms follow acquisition then value decay will occur. Although there is a rise in studying the first KT theme, not much is known about the external-internal KT (Ko *et al.*, 2005; Matusik and Hill, 1998). This important concept constructs the KT integration model in chapter 3 and links the three KT themes appropriately.

### **2.8.1 THE LEARNING ORGANISATION (LO)**

Learning is acquiring new, or modifying and reinforcing existing knowledge, behaviours, skills, values, or preferences and may involve synthesizing different types of information (Collins English Dictionary, 2009). Bohn (1994, p. 55) defines learning as “the evolution of knowledge over time”. Learning at an organisational level is conceptualised through organisational learning (OL) and the LO. Argyris and Schon (1978) defined OL as ‘a process of detecting and correcting errors’ within organisational contexts, processes and behaviours. Single loop and double loop learning (Argyris, 1976) were used to describe the ways routines (processes) and

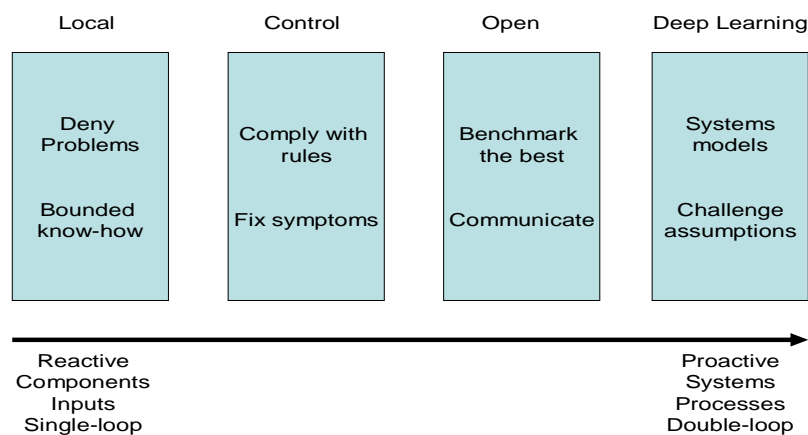
radical (underlying process) were learning (Easterby-Smith, 2000).

Lehr and Rice (2002) outlined single loop as corrective action and double loop as modification of underlying process. I see double loop learning as important in times of change, since what an organisation learns at any one time may become irrelevant or even harmful at a different time (Lehr and Rice, 2002). Triple loop learning was suggested to question not just what it has learned but the way it has learned it (Easterby-Smith, 2000). This order of learning may help as a preventive measure to decrease the likelihood of developing mental models that are recurrently false. This can be very useful for this study because it helps sustain the effect of change over time.

Senge (1990, p. 231) defined the LO as the workplace “where people continually expand their capacity to create the results they truly desire, where new and expansive thinking are nurtured, where collective aspirations are set free and where people are continually learning how to learn together”. He narrated the LO using systemic thinking, personal mastery, mental models, building shared vision, and team building. This thesis adopts the LO as the starting point for building the knowledge strategy for Saudi engineering research organisations as an aspiration model that builds competitive advantage, accelerate knowledge flows and ultimately decrease dependence on foreign expertise.

In terms of OL, Schwandt (1993) defines it as ‘a system of actions, actors, symbols, and processes that enables an organisation to transform information into valued knowledge which in turn increases its long-run adaptive capacity’. This thesis adopts OL to Saudi engineering research organisations as an approach to assess internal processes against OL practices to build accelerated learning that have efficient knowledge flows. Theorists have identified two main strategies for OL: exploration and exploitation (March, 1991). Exploration involves seeking new knowledge from external sources to add to an organisation’s core competencies, which is represented by KT in this study (Teece *et al.*, 1997; Nonaka, 1994). Exploitation involves seeking ways to improve internal knowledge to create new knowledge (Jones, 2001), which is not covered in this thesis because I contend that knowledge creation should take place once the organisation develops a sufficient knowledge base via KT.

Since OL is the *practical* approach to meeting the LO target, Argyris and Schon (1978) consider OL correctly *practiced* only when organisational members become ‘learning agents who respond to changes in internal and external environments by detecting and correcting errors while sharing results’. This indicates a link between OL and KT. Concluding that OL and KT are influential variables to achieving the LO target becomes sensible. There are four *practical* stages to OL: local, control, open and deep learning (Easterby-Smith and Lyles, 2003). Figure (2-5) illustrates this concept.



**Figure (2-5): The four stages of organisational learning (Easterby-Smith and Lyles, 2003)**

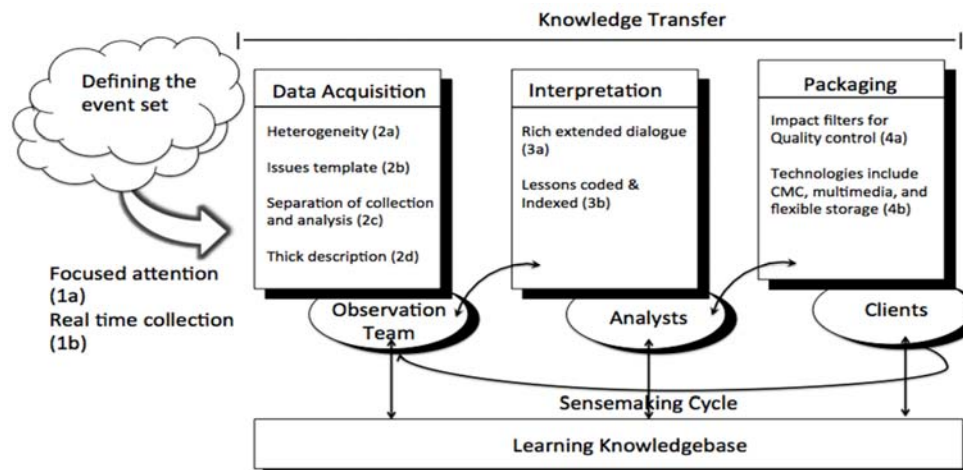
The above figure illustrates that the local stage represents knowledge based on individual experience. In this stage, those who tacitly know underlying structures and assumptions make decisions, where they tend to focus on what needs to be done rather than why it is done. At the control stage, knowledge resides in silos. Work groups generate formal routines to make processes uniform and predictable. Standardisation, performance feedback and statistical measurement are key in this stage. Learning is directed towards exploitation of the known rather than exploration of the unknown. Open and deep learning stages are the inspirational models of OL. The open stage explores wide learning possibilities including KT. Deep learning profoundly questions the way things are done and brings reflection to all actions.

The ability of organisations to transfer knowledge from outside is important for

internal innovation (Lant and Mezias, 1992). A term called *vicarious learning* describes an organisation that vicariously observes and copies the success of other organisations (Huber, 1991; Miner and Mezias, 1996). Through shared experience, organisations can learn from each other. March and Simon (1958) as well as Nonaka and Takeuchi (1995) suggested that most innovation comes from borrowing ideas, which is the process of *vicarious learning*, rather than actually inventing new ideas. This places this type of learning as key to OL performance and to this thesis.

Firms should regularly scan their industry for outside knowledge, especially in uncertain or rapidly changing industries such as engineering research (Elenkov, 1997). However, in the process of scanning the industry, Phene *et al.* (2006) suggested that firms need to search for knowledge that is familiar to them. In other words, an organisation needs to have a knowledge base about the needed knowledge to tap to external sources, which indicates a limitation for organisations to learn from external sources. This limitation is called in this thesis the knowledge capability gap that allows the organisation to identify its missing knowledge.

Strategic learning is thought of as *planned* OL (Thomas *et al.*, 2001). As with the LO, strategic learning supports the strategic goals of the organisation to gain a performance advantage (Thomas *et al.*, 2001). To demonstrate the importance of strategic learning, Thomas *et al.* (2001) implemented a ‘strategic learning’ program at the centre for army lessons learned (CALL) in Kansas as illustrated in figure 2-6.

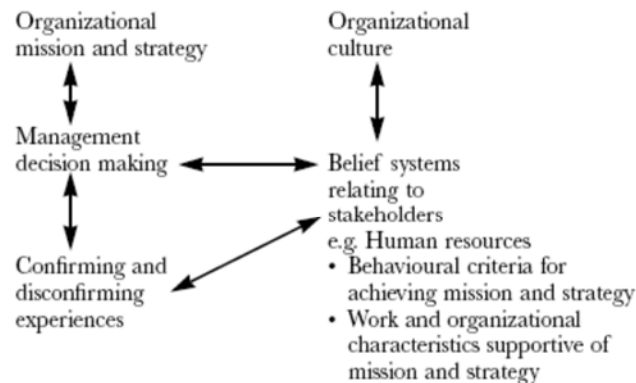


**Figure (2-6): Model for strategic learning (Thomas *et al.*, 2001)**



The following quote by a US army former chief of staff illustrates the importance of the above type of learning: “We don’t need more information, we need knowledge targets on strategically important issues. That is what CALL did for us” (Thoma *et al.*, 2001, p. 335). Thomas *et al.* described CALL as being able “to carve out learnings from only those processes that represent strategic opportunity” (p. 335). In chapter 6, I adopt this concept to identify core processes that represent a strategic knowledge target that are considered an opportunity for knowledge flow for that same purpose.

Williams (2001) offered a model to the process of OL to clarify attributing learning to organisations by designing a learning model that includes tacit knowledge, role modelling, sense making, memory, culture and motivation as components that build belief systems within organisations. Learning involves either reinforcement or challenges to belief systems that have a feedback loop to management decision-making. He states, “objective evidence of organisational learning occurs when management decisions (and their implementation) reflect consistent beliefs over time” (p. 221). He suggests enforcing accurate measures for beliefs and culture.



**Figure (2-7): A model for conceptualising the process of OL (Williams, 2001)**

Tsang (2008) identified ‘unlearning’ as a gap in organisational literature with little empirical study. He contended that addressing this gap could help in understanding the ‘stickiness’ found in KT (Szulanski, 1996). As illustrated in Table (2-7), Tsang (2008) examined how issues of organisational unlearning differed from those of organisational learning, which suggested a new research stream to be considered.

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Stages of KT	Organisational learning (Szulanski, 2000)	Organisational unlearning (Tsang, 2008)
<b>Initiation</b>	Recognizing opportunities to transfer routines and acting upon them	Convincing recipients that the transfer of certain routines is necessary
<b>Implementation</b>	Bridging the communication gap between source and recipient, filling the recipient's technical gap and improving coordination between the source and recipient	Establishing the legitimacy of a new routine, failure of which may result in the recipient's reluctance to accept the ostensive aspect of the new routine
<b>Ramp-up</b>	Resolving unexpected problems arising from using the new routine	Recipient continues to enact old routine although it is replaced by the new one
<b>Integration</b>	Removing obstacles and dealing with challenges related to the institutionalisation of the new routine	Recipient's tendency to revert to the old routine, making institutionalisation of the new one difficult

**Table (2-7): Learning and unlearning (Tsang, 2008)**

Gherardi (2001) argued in favour of the *situated learning theory* in which context was the container of 'decontextualised knowledge' (i.e. impersonal, detached, asocial, apolitical, ahistorical, immaterial). Context may be considered as pre-given or emergent (Fox, 1997). In her study of 'a highly successful organisation' she identified seven boundaries: temporal, geographic, social, cultural, historical, technical and political. These boundaries were linked to the practices of sharing identity, interacting face to face, aligning effort, learning by doing and supporting participation. However, Orlikowski (2002, p.257) identified the negative consequences as:

[S]haring identity becomes organisational groupthink, interacting face to face leads to burnout, aligning effort discourages improvisation, learning by doing is lost through turnover, and supporting participation is immobilizing because of conflicts and time delays

Orlikowski concluded that while leadership, infrastructure and corporate mission were essential, success and innovation are dependent upon collective and distributed competence framed as 'know how to do'. This draws attention to Tsoukas (1996) human-action model, which suggests a knowledge system that distributes OL. These arguments suggest that OL is a highly contextual phenomena that needs to be carefully calibrated to enable a balance between learning processes and people involved.

An overt link between cognition and action is emphasised within the above concepts (Crossan *et al.*, 1999). In order to differentiate the ontology of OL and the LO, it may be concluded that OL as a construct is about organisational *practice* while the LO construct is an organisational *target*. This thesis will adopt the LO in chapter 5 in identifying the knowledge strategy and OL in chapter 6 to identify the KT processes.

### 2.8.2 LEARNING ORGANISATION CAPACITY (LOC)

Organisational absorptive capacity refers to effectiveness at learning and acquiring new knowledge (Inkpen, 2000). This is termed LOC, which builds on *making* ‘knowledge connections’ (Katz and Tuschman, 1980; Ulrich *et al.*, 1993). Developing LOC is necessary for success in today’s global knowledge economies (Housel and Bell, 2001). LOC defines organisations that effectively manages its knowledge resources (Grant, 1996), responds to forces for change (Senge, 1990) and learns from its experiences (Coulson-Thomas, 1996). LOC is therefore seen as an ideal, aspirational model and considered best practice for 21<sup>st</sup> century organisations, particularly knowledge factories wishing to be successful in the knowledge economy such as the case-study organisations in this thesis Massingham and Diment, 2009).

In order to prove the validity of the LO, further research is needed to uncover the relationship between LO constructs and other organisational performance measures. Such measurable relationships may lay the foundation to calculate the LO tangible ROI (Yang *et al.*, 2004; Holton and Kaiser, 2000) and substantiate the legitimacy for organisations to consider the LO as an aspirational model. Yang *et al.* (2004) state: “Empirical assessment of the learning organisation is in its infancy. Substantive studies are needed to identify and confirm underlying dimensions for this complex concept” (p. 31). As it is nine years since this statement was published, it still stands.

Although Pedler *et al.* (1989; 1991) and Burgoyne *et al.* (1994) have attempted to diagnose the LO, they have not solved the puzzle of how to measure intangible organisational features. Senge (1990) provided a new dimension to the LO but lacked operationalization. To translate the literature into measurable outcomes, clearly operationalized themes need to be envisaged. This gap in the literature has limited the applicability of the LO significantly. For example, Argyris and Schon (1996) emphasized mental models but provided less attention to the organisation as a whole than Pedler *et al.* and Senge. They did not provide clear instructions about constructing a LO, which resulted in a partial view of the LO especially from an operationalisation perspective. Chapter 5 of this thesis adds to the body of knowledge by filling this gap.

## **2.9 ARTICULATION: REPOSITIONING KNOWLEDGE TRANSFER FROM A LEARNING PHENOMENON TO A BUSINESS PROCESS**

Once learning produces knowledge for an organisation, various ways to combine this knowledge and use it emerges. One way is action learning. As an efficient tool to realise knowledge usage, it provides “a process that involves groups working on real problems, taking action, and learning from those actions” (Marquardt, 2007, p. 507). This approach is based on action science that is focused on the theory and method for assessing the reasoning that underlies actions (Argyris and Schon, 1978). Bennett (2007) described action learning as a special form of team learning where the group has a facilitator, and through questioning, dialogue and reflecting, learning is achieved. This concept builds on the fundamental concept that knowledge is useless without taking it into action (McNabb, 2007).

When knowledge is used, reflection on action is necessary to generate new knowledge. Senge *et al.* (2005) explain how ‘reflection in action’ is used to institutionalise collective reflection. They showed how it helps discover answers to what, why and how questions for specific cases and events. In poorly managed organisations where learning is deficient (i.e. LOC is low), it is difficult to develop a culture that reflects on its actions, analyses after-math results and builds upon experience. To make such organisations engage in ‘reflection in action’, they need to consider change management, lean thinking and business process re-engineering. This link is not clearly defined in the literature. I will address this gap in chapter 6.

### **2.9.1 PERFORMANCE MEASUREMENT AND IMPROVEMENT**

By building on KM as “leveraging the intellectual assets of the company to meet defined business objectives” (Sveiby, 1997, p. 233), a link between performance and objectives is established. In order to act upon business objectives using performance metrics, KM requires operationalisation. The practical understanding of how KM is aligned with business objectives can be validated via KM performance measurement tools that map KM to desired objectives (Bohn, 1994). In this thesis, KM is operationalised using LOC to measure the performance of the knowledge strategy.

LOC identifies indicators that can *accurately* categorise different strategic elements and quantify them (Neely *et al.*, 1996; Crawford and Cox, 1990).

Other performance measures include the balanced scorecard (BSC) model developed by Kaplan and Norton (1996), which integrate drivers for future performance with measures of past performance. The BSC links performance to objectives using lead and lag indicators as a measure of alignment (Kaplan and Norton, 1996). On one hand, lead indicators or performance drivers represent the operational level measure, while lag indicators or core outcomes are on the strategic level. The gap in this area is that it is still difficult to distinguish the lead indicators (i.e. intangible measures) from the lag indicators, which are tangible numerically defined measures.

Performance measurement (PM) and knowledge measurement are different. The latter may support PM in providing the data for BPR as an end-to-end business process improvement tool (Braz *et al.*, 2011; Sharp and McDermott, 2001). This thesis will not measure the knowledge accounts at Saudi engineering research organisations because I am concerned with the *process* rather than the *stock* of knowledge. I will focus in this thesis on the processes of knowledge flow and on lifting the barriers to KT. The process-oriented perspective provides context to this argument. I do not see the value in knowledge through its volume per se; instead, it is through the processes of growing and using it to create value that is rooted in organisational purpose.

### 2.9.2 BARRIERS TO LEARNING PERFORMANCE

As mentioned earlier, knowledge flow may occur at multiple levels. It may take place between individuals, individual to groups, groups to groups, groups to organisations, and organisations to organisations. Within these flows, various barriers may occur. In order to analyse this phenomenon, a layered KT architecture may encapsulate the diverse complexities at different layers as will be explained in section 3.3. In this section, I address a few high-level issues that resemble possible barriers to KT.

The initiation of inter-firm KT between research organisations may be difficult because of (1) the limited *willingness* of the expert partner to disclose knowledge and (2) the limited *ability* of the seeker to acquire and assimilate knowledge.

*Unwillingness* of the knower may originate from the possibility that when knowledge is disclosed, the other partner (seeker) may abuse it for opportunistic or competitive motives (Hamel, 1991; Khanna *et al.* 1998). For this reason, the knower may be hesitant to fully disclose the know-why such as the principles underlying the technology, know-how such as procedures required to apply the technology and know-what such as specific technology configurations that different customer groups may require (Garud 1997; Larsson *et al.* 1998). It has been noted earlier in Part 2 of this chapter, that the willingness of the knower to disclose knowledge is a pre-assumption in this thesis, however, it must be accepted that this is not always guaranteed. In response, I examine the level of motivation of the knower to disclose knowledge and attempt to identify possible barriers (see chapter 7).

Previous research to facilitate disclosing knowledge suggested equity governance structures as an important condition for its viability (Mowery *et al.*, 1996; Cheng 2004). Equity governance structures protect the knower from the seeker's possibly and opportunistically abusing disclosed knowledge (Dyer and Singh 1998; Williamson 1991). As a result of such protection, the knower is likely to be more motivated to disclose knowledge and hence, to facilitate learning performance and help lift possible bottlenecks that relate to equity, IP, and the potential of released knowledge. Non-equity governance structures include collaborative and cooperative arrangements that exclude equity exchange and transaction cost economics, which require much higher trust levels, stronger social capital and relationships, as well as non-competition position (Tsang, 2000; Williamson, 1985). Within these high-level conditions, it is now important to examine the barriers that arise once KT commences.

### **2.10 THESIS FOCUS: EXAMINING THE BARRIERS TO KT PROCESSES**

This section is a core research area for this study. Successful KT may be perceived as a system that is capable of change and development through transformative processes. Conversely, forces may inhibit such development by putting up barriers to knowledge flows. What the literature points to is that successful KT requires detailed attention to increasing the types of activities to realize higher KT results. This suggests that the greater the involvement of the knower and seeker in various forms of activities, the greater the likelihood that the seeker will be able to internalise knowledge. To test this

logic, the following sections summarise the extant literature on the KT phenomena.

The critical theory claims that power suppresses the unknowledgeable and empowers the knowledgeable in a negative way (Hall and Goody, 2007). KT is consequently central in this argument because it is the essential way to convert the unknowledgeable into knowledgeable, thus, balancing the power of the relationship (Hall and Goody, 2007). Implementing KT, however, involves many obstacles. Three issues are particularly important: (1) technology issues which involve using different technologies that may collide in compatibility or applicability, (2) organisational issues which involve conflicting implementation methodologies, and (3) individual issues in which politics and knowledge sharing techniques are key. Employees often do not have time to input or search for knowledge, do not want to give away their knowledge, and do not want to reuse someone else's knowledge. It is a mistake for organisations to focus only on technology and not on methodology. Planning KM implementation will face barriers. These barriers must first be understood and addressed as a pre-requisite to developing KT technologies. Table (2-8) summarizes the important KM approaches developed over the last two decades:

Approach	Main focus
Technological	Enhancing KM quality by supplying tools for effective storage and distribution of knowledge
Intellectual asset	Enhancing KM quality by valuing knowledge assets in financial terms and reflecting them in accounting practices
Organisational learning	Facilitating knowledge creation and sharing by developing positive work environment or effective reward systems
Process	Enhancing KM quality by identifying key processes on which important knowledge flows, and managing them formally
Philosophical	Gaining a higher understanding of knowledge lead by asking questions such as 'Do we know what we do not know?' to encourage development of new ways of thinking

**Table (2-8): Knowledge management approaches (Shin, 2004).**

Systemic thinking suggests that growth should not be pushed; rather, barriers to growth should be removed (Senge, 1990). A common barrier in such attempts is weak coordination (Grant, 2006). Absence of mechanisms to integrate individuals within a system leads to inefficiency that severely affects KT activities. Relying excessively on codified knowledge as a coordination strategy can be another mistake (Haas and Hansen, 2005). According to Van Beveren (2003), a series of workshops in an Australian organisation identified KT barriers to be characteristic of hierarchal

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structure. Information flow was upwards and was prevented from flowing downwards. The structure seemed to inhibit KT because of the way the Australian organisation compliance model was designed. Very few social functions were supported. This example represents a model with the barriers of bureaucracy, control and single-loop learning. In this thesis, various barriers are expected. Examining those barriers and identifying their root-cause is considered the core essence of this thesis.

KT initiatives are long and expensive because it requires analysing KT activities in detail and modifying them. This process was categorised in seven groups in table (2-9) (Guzman and Wilson, 2005). Relevant questions are posed to explore *soft* issues to uncover how the situation is open-ended, how the external environment is uncertain and ambiguous, how organisational goals are shared, and how detailed organisational templates are. The extent to which these guidelines could apply successfully in Saudi engineering research institutions is questionable because the starting point in any study is based on assessing the present conditions to define the current gap. However, the table below will be used a general guide.

Perspective	Field questions
<b>Micro-macro link</b>	Which are the underlying reasons to transfer an Organisational concept? How do contextual factors affect personnel involved in terms of collaboration, motivation, trust and willingness? Who governs the KT process?
<b>Content of Organisational knowledge</b>	Is the concept being transferred of high or low abstraction level? What are the main assumptions regarding local conditions of operation? To what extent does the implementation of the Organisational concept demand trust, willingness and motivation from employees?
<b>Process of Organisational knowledge</b>	To what extent does the internal organisation support trust, willingness and motivation from employees? To what extent is the implementation process of the organisation an emergent concept or can it be planned?
<b>Selecting open-ended issues</b>	Is the management team prepared to use metaphors and symbols? How skilful are managers in using rhetoric?
<b>Interpreting and reflecting</b>	Is management aware of the trade-off between stability of results and updating and evolving the interpretation process? To what extent is interpretation based on the environment? Who governs the interpretation process?
<b>Clarifying preferences and problem-solving alternatives</b>	Is the management aware of the single-outcome trap during the process of selecting problem-solving alternatives? Is the management aware of the key role played by applied metaphors? Is the management aware of pros and cons of using selected metaphors in the specific situation?
<b>Gaining attention and agenda building</b>	Is the management aware of the role of issue salience and issue sponsorship in the process of gaining attention and building agendas?

Table (2-9): Guiding questions to KT (Guzman and Wilson, 2005)

KT barriers will be further reviewed using the following three-layer units of analysis: (1) knowledge characteristics, (2) individual level and (3) organisational level. Since



knowledge is the basic essence of KT, the first unit of analysis to be presented is knowledge characteristics. This unit of analysis examines the impact of the nature of knowledge on its flow. The second unit of analysis is the individual level, which examines the impact of individual capability, motivation, psychological contract and relationships on knowledge flow. The third unit of analysis is the organisational level, which examines the impact of the organisational culture, processes, policies, systems and resources on the flow of knowledge. These layers will be used as a basis for the qualitative research in identifying the barriers to KT in chapter 7.

The constructs on one level of analysis may correlate or extend to another. Therefore, further analysis is provided in this case. For example, an organisational level construct such as culture may further extend to the national level, or down to an individual level.

### **2.10.1 THE IMPACT OF THE CHARACTERISTICS OF KNOWLEDGE ON KNOWLEDGE FLOWS**

Earlier in this chapter, in Part A, definitions of knowledge, knowing and their nature were presented and discussed. This section is a continuation to this discussion but rather than a definitional approach, I will focus here on illuminating knowledge attributes that may inhibit knowledge flow. An appropriate enquiry requires an examination of what it is that makes knowledge easy or difficult to mobilise.

Characteristics of knowledge may stand as conditions or constraints to implement KT (Nonaka and Takeuchi, 1995). Theorists such as Tsoukas (1996), Varela *et al.*, (1991) asserted that a knowledge characteristics bias exists to privilege *pure* knowledge cognition over the social experience aspect of knowledge in the quest for understanding the impact of knowledge on its flow. In other words, the social human experience, as a knowledge substance in its own right, is paramount in supporting or constraining KT, just as much as cognitive pure attributes of the knowledge being transferred. This section examines the impact of both the hard (engineering knowledge) and the soft (social experience knowledge).

Quantifying what we know, whether hard or soft, experienced limited progress in the

past (King and Zeithaml, 2003). According to Tsoukas and Vladimirou (2001, p. 974), “Organisational knowledge is much talked about but little understood”, hence, difficult to measure. Therefore, the unending struggle to define knowledge, then to measure it, impacted attempts to characterise it as well. It is valuable to classify ontological knowledge properties that may constrain knowledge mobilization and become a barrier to KT. This section disaggregates the impact of knowledge on its flow by analysing the following constructs: (1) language comprehension, (2) causal ambiguity of knowledge, (3) complexity of knowledge, (4) specificity of knowledge, and (5) tacitness of knowledge. These KT constraining constructs span over “the links between individual knowledge, organisational knowledge, and human action undertaken in an organized context” (Tsoukas and Vladimirou, 2001, p. 981).

### 2.10.1.1 LANGUAGE COMPREHENSION

Language comprehension is defined as the internal, subjective process of apprehending the *meaning* of something (Carroll, 1971). In a workshop on language comprehension and knowledge acquisition back in 1971, John Carroll (p. 29) wrote:

In the study of comprehension processes we must take account for the nature of this structure [a certain cognitive structure that represents the body of knowledge in the memory store of the individual], noting, however, that it is with the structure of the individual's knowledge that we are concerned, not the “structure of knowledge” in general... [this] implies a *capacity* for acquiring new understandings and integrating them in some valid way with the knowledge already acquired. One aspect of this capacity is certainly the ability to understand *language*... and through that ability to acquire new knowledge. It is with this *language* comprehension process, and the process of acquiring knowledge through language, that this conference is concerned

This suggests a few reflections: (1) the efficacy of language communication is proportional to knowledge comprehension, (2) knowledge is derived from language comprehension, (3) pure comprehension of language correlates with processes of inference, deduction, and problem-solving that often accompany the reception of language, and (4) language competence is intrinsic to KT performance.

Since it is a practical skill for humans to express themselves using the capabilities they have in a given language, the ones who are deficient in this skill may find it difficult to pass on knowledge to other people (Firth, 1957; Klein, 1986). The issue of language use is therefore fundamental to KT in converting tacit knowledge into explicitly written documents, communicating knowledge to others orally, and sharing

experience in socially different culture orientations. Polanyi's (1969) theory of tacit knowledge does not explicitly address theory of language, but it draws attention to meaning production by use of language:

My view is that the use of language is a tacit performance; the meaning of language arises, as many other kinds of meaning do, into tacitly integrating hitherto meaningless acts into bearing on a focus that thereby becomes their meaning. (p. 11)

Polanyi tends to equate his concept of tacit integration with the process of meaning-making, which suggests that the level of skill people have in using language may determine their accuracy in meaning-making and consequently in tacit KT. Having in-depth awareness of what language can explicate to knowledge seekers may redirect KM to deriving meta-language techniques. These language techniques could elicit meaning from language as if it is *language turned back on itself* (Firth, 1957). This is especially necessary when knowers and seekers are native speakers of different languages, as in the case of this thesis. I see Polanyi's view of language here as an internal cognitive process that allows shared mental models. It is the way individuals process ideas in their mind and, in this sense, mental models emerge via meaning and interpretation found in unspoken language, i.e. the individual talking to himself.

Some linguists regard language as a *generative* automatised process (Chomsky, 1986), but others interpret language as *functional*, in that it develops from the experience of trying to make meaning in a social context (Halliday, 1973). As such, I find that language is 'learning how to mean', rather than learning how to construct words or clauses (Halliday, 1975). The understanding of how meaning is generated and then communicated could provide a profound insight to KT mechanisms and may further integrate findings in the social network domain to prove the influence of meaning on KT theory. With this brief foray into the very large and complex arena of theorising linguistic competence, the purpose here is only to highlight the existence of an impact of language as a communication constraint on knowledge flow.

### 2.10.1.2 COMPLEXITY OF KNOWLEDGE

Knowledge complexity is defined as the degree of depth and specialisation of discipline-based knowledge residing in internal and external human experts, decision-making processes, and incorporated expert system applications (Clancy, 1985; Dreyful, 1986; Meyer and Curley, 1991). Knowledge complexity can be categorised

on three levels: simple, recombined and complex (Tiwana, 2002; Schulz, 2001). Some consider explicit knowledge as simple, possible to codify and transferrable (Schulz, 2001). Recombined knowledge is compounded with existing knowledge to ultimately add to organisational knowledge. Creativity and idea innovation represents the complex level. As Weick (1979) argues, there will be difficulties in KT if during the transfer process people needed help to make sense of and resolve complex problems.

The flow of complex knowledge is usually slow (Newell *et al.*, 2000). In order to address this issue on an organisational level, business process reengineering detects knowledge complexity that leads to such slow diffusion and attempts to redesign the business process to lessen its complexity effects (Hammer and Champy, 1993). The literature suggests that the transfer of complex knowledge necessitates interaction and commitment of multiple resources (Simonin, 1999; Szulanski, 1996). On the individual level, overcoming the difficulty in comprehending complex knowledge is challenging because of the nature of complex knowledge. A way to address this is suggested through incentives provided to the knower to apply commodification and repackaging of complex ideas to reduce complexity. In this way, complex knowledge may be simplified to the understanding of the seeker (Simonin, 1999).

### 2.10.1.3 SPECIFICITY OF KNOWLEDGE

Knowledge specificity is defined as “the extent to which knowledge is highly contextualised to particular aspects of the local environment, particularly through its embedded organisational routines” (Spanos and Prastacos, 2004, p. 33). KT processes may fail to transfer the knowledge context from one organisation (the knower) to be useful in another (the seeker) because of specificity. Due to this, KT failure rates are high (O’Dell, 2000). One objective in the thesis is to identify the specificity factors within the knowledge flow system of Saudi engineering research organisations.

Choudhury and Sampler (1997) suggested two types of knowledge specificity: (1) *pure* domain knowledge specificity, which refers to technical knowledge possessed by engineers and scientists, and (2) *soft* knowledge specificity, which refers to particular circumstances of time and space relating to idiosyncrasies of particular settings of engineering work that requires transferred experience from administrators, support

staff and engineers to be mobilised and then translated to a knowledge seeker.

The process of translation is the process by which a general idea is reinterpreted in a new setting in order to become compatible and useful for the seeker (Czarniawska and Sevón, 1996; Sahlin-Andersson and Engwall, 2002). Sahlin-Andersson (1996) suggested that translation of ideas be guided by editing rules written originally by the knower. This editing process may proceed by: (1) rules of context which help *re-contextualise* an idea, by disconnecting it from its previous local context and making it appropriate for a new context, (2) the *re-labelling* of an idea in an appropriate way (called a rule of formulation) so that it seems different but familiar: and (3) use of a *plot* or rules of logic that clarify causes and effects, allowing prototypes to follow a problem-solving logic and an application process or implementation plan, to be explained in relation to the actions of certain actors (Morris and Lancaster, 2006). Editing allows migration from broad context to local action.

KT becomes expensive because the contextualisation process would depend on highly experienced individuals who deeply comprehends the situation and understands the people involved. The starting action for the knowledge seeking organisation thus needs to be to find and evaluate qualified partners who are willing to accept relationships that accommodate the contextualisation process as an essential element of the overall research collaboration process (Badaracco, 1991).

The distance between the knower and seeker can be a barrier to specificity translation. Short distance was identified by Morris and Lancaster (2006) as a condition for translating ideas because long distances between the knower and seeker suggest high specificity. While innovation operates at several levels of abstraction where important knowledge correlates with innovation output, important knowledge correlates with specificity (Lillrank, 1995). This means that innovation correlates with specificity.

### 2.10.1.4 TACITNESS OF KNOWLEDGE

The term ‘tacit’ originates from the Latin word, *tacitus*, which means silent (Chomsky, 1972). Tacit knowledge thus refers to inexpressible and oblique individual knowledge. This leads to perceiving tacit knowing as a process of knowing *silently* rather than an object of silent knowledge flowing. The difference is subtle but

significant. In section 2.2, an introduction to tacit knowing as a process was presented to differentiate the process of tacit knowing from tacit knowledge, as an object.

At a time where external-to-internal KT faces difficulty in packaging expertise for transfer, internal-to-internal KT faces fewer challenges in this regard because knowledge is mobilised within the same organisation, allowing more time and less specificity to resist the knowledge flows. However, other challenges relating to the codification of knowledge may emerge even in internal-internal KT due to the barrier of knowledge tacitness. If not addressed, tacitness may result in internal knowledge being lost when researchers leave the organisation (Starke *et al.*, 2003). Nonaka and Takeuchi (1995) introduced a dichotomy for learning (socialisation, externalization, combination, internalisation) that assumes explicit knowledge and tacit knowledge as two distinct phenomena that may involve different approaches when transferred. However, Polanyi (1969) provides a merging view in the following notion:

Now we see tacit knowledge opposed to explicit knowledge; but these two are not sharply divided. While tacit knowledge can be possessed by itself, explicit knowledge must rely on being tacitly understood and applied. Hence all knowledge is either tacit or rooted in tacit knowledge. A wholly explicit knowledge is unthinkable. (p. 41)

This may significantly impact this study because the above argument claims that codifying knowledge is impossible. Although it is known that most knowledge is tacit and difficult to articulate, I advocate Nonaka and Takeuchi (1995) in their use of dynamic conversions between explicitness and tacitness. However, I do acknowledge that experts possess critical knowledge that is largely classified as tacit and unconscious in nature (Peet *et al.*, 2011). The challenge here for the tacit-to-explicit conversion lies in the term ‘unconscious’ because experts usually *do not know what they know* (Polanyi, 1966) and consequently do not know what to share with others. This implies that tacit knowing should be exploited to configure the process of KT in such a way as to allow tacit knowing to improve the flow from the knower to the seeker. As the knower needs to exert effort in this process, the knowledge seeker also needs to intelligently elicit what they need to know. This may require that the seeker possesses pre-requisite knowledge to be able to identify what they need to know. It is this ability to know *what to seek to know* that increases the liability on the part of the seeker in the KT process and on Saudi research organisations in this study.

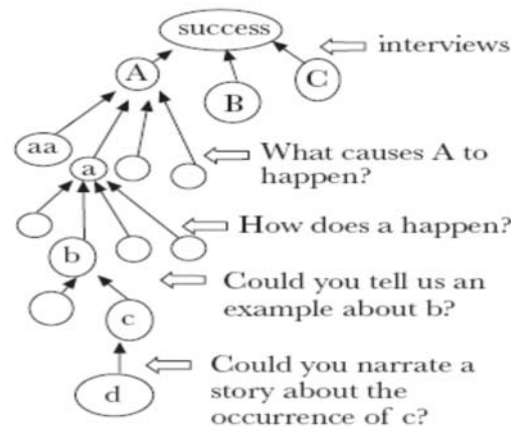
## CHAPTER 2: THEORISING THE STUDY OF KNOWLEDGE TRANSFER

External KT partners (the knower) do not support KT if their mission was to provide codified reports and 'As Is' knowledge per se. Focusing with the knower on codified knowledge only results in missing the context of required knowledge, hence, Saudi research organisations may fail in this case to raise their knowledge capabilities because the knowledge they receive is out of context (Haas and Hansen, 2005). In order to remedy this possibility, the possible barriers to codify tacit knowledge need to be identified.

Underlying constructs that may impede tacit KT are various. Empirical enquiries provide theoretical foundations to tacit knowledge exchanges that relate to trust, for example (Inkpen and Dinur, 1998; Simonin, 2004; Mayer *et al.*, 1995; Rousseau *et al.*, 1998). Tacit knowledge *exchange* requires both the knower and the seeker to become vulnerable, which implies that 'the perceptions of trustworthiness of the other side become essential for the partners to be willing' to engage in allowing tacit knowledge flow (Becerra *et al.*, 2008). Becerra *et al.* (2008) found that tacit and explicit knowledge are different in their relationship to trustworthiness and risk, which suggests that tacit KT relies more than explicit KT on trust. This implies that tacit knowledge will likely be transferred if the partner perceives the seeker as trustworthy.

Another dimension to facilitate tacit KT relates to the essential tools required to decrease the difficulties associated with the nature of tacit knowledge. Language is primary for passing on tacit knowledge, which suggests a correlation between language competency and tacit knowing. The gap between the knower and seeker in language competency may represent a barrier to tacit KT since the knower in the case of this thesis is usually an English speaker and the seeker is usually an Arabic speaker. Native speakers possess complex practical understanding of grammar, semantics and phonology of the English language that they use to pass on their knowledge. This competence is however, counterproductive during the KT process to a non-native speaker because the English level may be too advanced to tacitly connect the knower with the seeker. This further suggests that tacit knowing may contain a social component. The difficulty for the knower stems from the fact that the social aspect of the native language needs to be abandoned, thereby, wasting a valuable opportunity for effective tacit KT. This shows how tacit KT may fail (Klein, 1986).

Assuming trust and language competency were established, the social process of eliciting tacit knowledge from the knower is also a challenging theme. Although costly, the apprenticeship suggested by Polanyi (1967) seems an ideal setting to apply tacit elicitation techniques because it provides the time and space to flexibly apply different approaches. Ambrosini and Bowman (2001) developed a qualitative methodology to operationalise tacit knowledge. Using causal mapping, self-Q and storytelling, they summarised their proposed method in figure (2-8) as follows.



**Figure (2-8): Model for operationalising tacit skills (Ambrosini and Brown, 2001)**

In their approach that could be used during shadowing of experts, they suggest: (1) preliminary discussions about what causes success in a given task, to elicit constructs that begin the map (A, B, and C), (2) set up the map with the preliminary constructs as starting points that branch out, (3) begin the mapping process with questions such as: what causes this? and how does it happen?, and (4) if the flow of branching constructs stops, ask questions such as: could you give us an example of how that happened? and Could you tell us a story? In this way, the apprentice has an obligation to apply reflection and attention not to what is said by the knower but also to what the apprentice needs to ask about.

### 2.10.1.5 CAUSAL AMBIGUITY OF KNOWLEDGE

Causal ambiguity is defined as the difficulty in understanding aspects of knowledge either in terms of relational processes or characteristic attributes (Ciabuschi and Martin, 2012). Causal ambiguity is considered as a barrier due to ambiguity in understanding causal connections between actions and results in organisations (Lippman and Rumelt, 1982; Reed and DeFillippi, 1990). When causal ambiguity is



relates to the knowledge phenomena, then it is termed as *knowledge ambiguity* (Simonin, 1999; King, 2007). Alvesson and Kärreman (2001) went to the extent that they claimed that ambiguity is intrinsic to knowledge when they defined knowledge as: “a loose, ambiguous, and rich concept in nature that precludes reduction to simple sets of distinctions” (p. 998). These claims support that tacit knowledge is ‘below-view’ or invisible, which raised attention to knowledge ambiguity (Baumard 1999). This makes an important link between causal ambiguity and tacitness.

King and Zeithaml (2001) argue that there are two types of ambiguities: (1) characteristics ambiguity as in tacitness, complexity, and specificity and (2) linkage ambiguity as in processes and routines that are difficult to understand. This brings coherence to this study as it clarifies the interdependencies between the level of ambiguity and its underlying influences: complexity, specificity and tacitness (McEvily and Chakravarthy, 2002; Simonin, 1999). The more an organisation is characterised by complexity, specificity and tacitness, the more knowledge ambiguity it holds (Robertson and Swan, 1998). Engineering research organisations may represent a typical example. The construct of ambiguity will be examined for both types.

Alvesson (2001) prefers to describe such firms as ‘ambiguity-intensive organisations’ since their knowledge and knowledge processes are ambiguous and difficult to substantiate, and ‘perhaps the claim to *knowledge-intensiveness* is one of the most distinguishing features’. On this basis, ‘management of social processes appear crucial’ to resolve this dilemma through clearer ‘interpretation’, shared ‘beliefs’, pragmatic ‘expectations’, visual ‘symbolism’, and justified ‘persuasion’ (Alvesson, 2001). These soft elements will be an important focus throughout the remaining chapters of this thesis.

Philosophically, knowledge ambiguity is difficult to discuss because it highlights what we do not understand. Hence, this suggests examining how ambiguous knowledge can be transferred and used while from the outset it is not yet even understood. Managing ambiguity may perhaps be addressed through sense-making, which describes the action involved in reducing confusion and mitigating uncertainty that stems from ambiguity. In adopting this approach, Williams (2001) describes

Weick's (1995) properties of sense making as:

[sense-making] is grounded in identity construction (our self-concept develops from social interactions and serves to maintain a positive image of oneself); it focuses on things which have happened in the past; it enacts the environment (what you see is your construction of the environment not the environment itself); it is a social phenomenon in that what you see is dependent upon sharing meanings with others; it is an ongoing activity, and interruptions can arouse positive or negative emotions depending on whether they are seen as helpful or not; it focuses on and is influenced by extracted cues (i.e., we generalize from selected cues and within a frame of reference); it is driven by plausibility rather than accuracy (speed in sense-making is brought about by focusing on minimal cues, and embellishing from these minimal cues; themes of accuracy rarely dominate discussions of sense-making, but beliefs which facilitate ongoing tasks are treated as accurate since it is the consequences of action which are most believable). (p. 223)

Becker (2001) suggested a link between ambiguity and organisational form. As division of labour equates to division of knowledge, problems of knowledge ambiguity emerge. Managers struggle to obtain knowledge when it is fragmented among workers and such uncertainty makes it difficult for them to make informed decisions. Becker proposed four strategies to overcome these problems: (1) substitute knowledge by direct access to knowledge (use of IT systems), (2) recreate missing components by giving people the skills to detect and fill their knowledge gaps, (3) create coordinating mechanisms through the use of networks (Adler, 2001), (4) create more information through 'decomposition' into bite-sized chunks, and (5) increase information availability as a means of reducing uncertainty. Fieldwork questions will build on these concepts in the subsequent parts of this thesis.

### **2.11 THE IMPACT OF THE INDIVIDUAL ON KNOWLEDGE FLOWS**

During their analysis of KT, theorists focus more on the organisational level and less on individual-related capability and behaviour (Foss and Felin, 2006). The individual unit of analysis focuses on knowledge flow between a knower and a seeker within or outside an organisation. Since knowledge is essentially personal (Polanyi, 1967), this level of analysis deserves appropriate attention. Empirical work asks about how people interact with their peers, as well as how they feel when they have to work with external individuals. It surfaces particular micro-level barriers to KT. The theory on this level relates to: (1) individual capability, (2) individual motivation, (3) individual psychological contract, and (4) individual relationships.

### 2.11.1 INDIVIDUAL CAPABILITY CONSTRUCTS

Individual capability is defined as “the ability to perform a particular task or activity, to identify a need or opportunity, to formulate a response to such need or opportunity, and implement a course of action” (Helfat *et al.*, 2007, p. 71). Low individual capability is a significant barrier to organisational KT. On an organisation level, capability is defined as “the ability to integrate, build, and reconfigure internal and external competencies to address rapidly changing environments” (Teece *et al.*, 1997, p. 511). The collective individual capabilities are aggregated to build the synergy for organisational level capability. This implies that building individual capability is proportional to achieving better organisational capabilities. Specific individual capability theories that apply to the subject of this thesis relates to: (1) absorptive capacity, (2) communication, (3) work intensity, (4) innovation, (5) skills, (6) relationships and social capital.

### ABSORPTIVE CAPACITY

Absorptive capacity describes to the ability of knowledge seeking. Knowledge seeking requires individual capabilities (Grant, 1996). Bounded rationality implies that human minds are limited in absorbing knowledge (Simon, 1991). This suggests that knowledge seekers need to specialize and develop specific capabilities in specific knowledge areas to attain a reasonable absorptive capacity (AC) (i.e. Jacks-of-all-trades are masters-of-none) (Grant, 1996). Integrating individuals’ and groups’ who specialise in different areas is another difficulty (Grant, 1996). This refers to the importance of systemic thinking and linking the individual perspective with the organisational perspective in designing KT strategies.

In terms of AC within the dynamics of knowledge flow, Szulanski (1996) found that ‘stickiness’ of knowledge makes the process of transfer contingent upon three dimensions. First is generative capacity, which depends on the system’s members, research infrastructure and alliances. Second is absorptive capacity (Cohen and Levinthal, 1990). The latter is typically found in ‘environments that possess prior related knowledge, a readiness to change, trust between partners, flexible and adaptable work and management support’ (Parent *et al.*, 2007). Third is adaptive and

responsive capacity, which is second-order, reflective, and is always looking for ways to adapt in relation to the environment. These dimensions involve three levels of analysis: individual, organisational and industry (or national). This section is about the individual level of analysis.

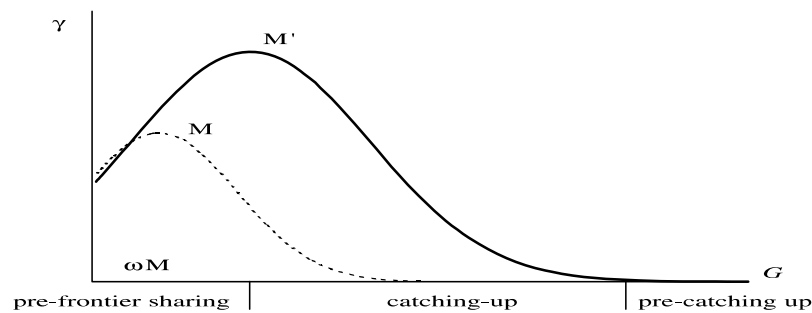
Starting from an individual level theory, when the source transfer capacity (STC) of the knower is high, and the seeker's ability to assimilate and retain knowledge, referred to as recipient transfer capacity (RTC) is low, the KT process becomes clogged (Martin and Salomon, 2003), which derives a few conclusions. Knowledge workers, as in the case of scientists and engineers, need to align their RTC with the knower's STC for optimum KT efficiency. This process contributes to: (1) filling the KT capability gap and (2) supporting the economic coordination activity, which reduces the cost of KT per capita. The difficulties in obtaining this alignment are related to: (1) the feasibility of adjusting RTC to a given STC, (2) modifying the RTC while sustaining the interest of the knower during this process (i.e. the RTC cannot be measured before the KT process, hence, adjustments implies a delay window), and (3) adapting the RTC when the STC changes (i.e. different overseas organisations working simultaneously with a single seeker).

The organisational AC is measured by the ability to recognise, assimilate and apply new knowledge (the ability to learn as an input). AC may determine the ranges of knowledge to be targeted (Cohen and Levinthal, 1990). This determination process is influenced by: (1) potential absorptive capacity (PAC), which relates to the KT capability and (2) realized absorptive capacity (RAC), which relates to the exploitation capability (Mowery and Oxley, 1995). This requires input learning capabilities to assimilate knowledge (Kim, 1998). AC output connects what is learned to what was already known (Cohen and Levinthal, 1990). AC is an integral part of this study, where KT takes place on an inter-Organisational level.

By building on the evidence from the organisational-level AC, Criscuolo and Narula (2008) provided a national-level knowledge typology for AC. Country level absorptive capacity reaches a maximum when it builds a solid knowledge base, called the pre-frontier sharing level as illustrated in figure (2-9). Absorption increases once the threshold of the knowledge base has been acquired and reaches a maximum when

the country achieves an intermediate level of development, called ‘catching-up’.

When a country is ‘compatible’ with external knowledge, it can take advantage of the progress being made by developed countries. The absorption of technological spillovers and emulation of methods already in use in developed countries can be achieved if “a developing country aligns its pattern of comparative advantage and its stage of development with the advanced countries” (Ozawa, 1992, p. 29). As a country approaches the frontier, absorptive capacity declines because the knowledge available for assimilation is smaller and the complexity in its exploitation becomes higher.



**Figure (2-9): Non-linear relationship between AC and the K-gap (Criscuolo and Narula, 2008)**

Criscuolo and Narula (2008) recommend increasing research expenditures to help the country reach the maximum level of absorption capacity and reduce the distance from the frontier point. The above figure suggests that the relationship between AC and knowledge stock on the national level to be dynamic (i.e. a function of time). Saudi engineering industries need to develop a process that takes the above analysis into consideration. The final blueprint should be designed in such a way that it helps them better learn (absorb knowledge), build capability, and have less dependence on contractors and external knowledge sources (United Nations Development Program, 2003; Saudi Arabian National Policy Plan for Science and Technology, 2013).

### COMMUNICATION

Fundamental to individual capability is communication, which derives from the Latin root verb *communicare*, meaning *to share* (Emery and Purser, 1996). It extends beyond transmission and acknowledgement of message packets between a sender and a receiver to the elements of interaction, connection, and networking. Asch (1952)

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provided four conditions essential for effective communication: (1) openness by ensuring that the communication is what it appears to be, (2) mutually shared features by a context that is equally perceived by all involved, (3) psychological similarity by sharing human ideals, and (4) trust by ensuring the above, thereby, trust follows. This places communication as a KT capability, where specific strategies could reveal better results in achieving higher KT outcomes. Figure (2-10) is a KT model by using knowledge intensive discourse.

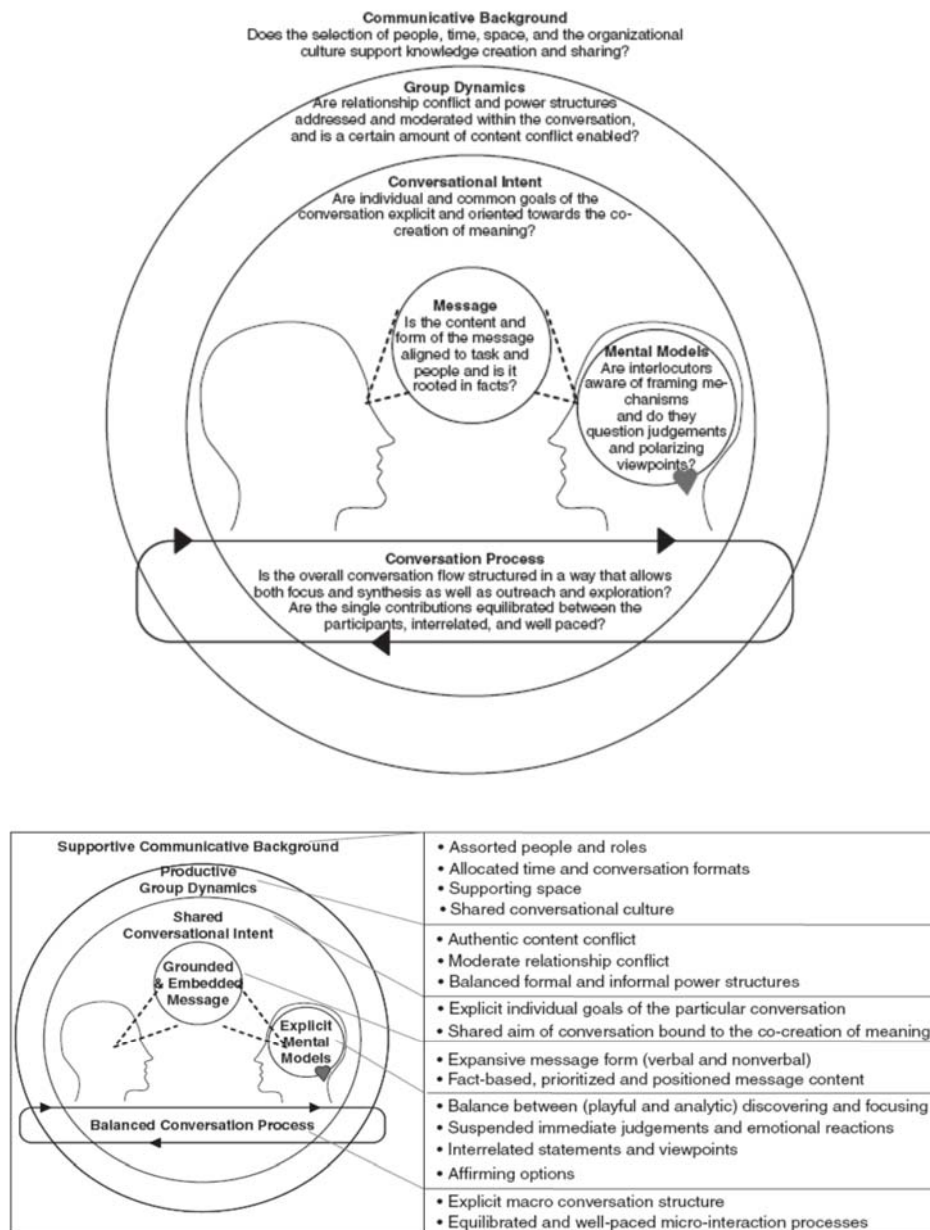


Figure (2-10): KT conversation questions (above) and framework (Mengis and Eppler, 2008)

The above figure explores the role of face-to-face conversations in knowledge processes and sense making in organisations. Mengis and Eppler (2008) asked the question “How can conversations be managed to foster developments in organisational knowing?” (p. 1291) and proposed a framework for conversations. They suggested that explicit conversational rules would add structure and purpose to many face-to-face conversations that are intended to convey organisational knowledge and thus would enhance the performance of KT.

### **WORK INTENSITY**

Work intensity studies aim to address capability sources for work effort and occupational commitments (Schulz, 2012). It differs from motivation in that it is seen as a capability in its own right. Failure to work hard among staff can result from questions such as: why should I work hard? A new perspective may stem from a KT capability lens, which essentially enquires: ‘what if the employee was motivated but not capable of working hard?’ (Berger, 1995). In other words, even if motivation was evident, yet, a capability must exist to activate such motivation.

In a study conducted by Schulz (2012), work intensity revolved around positive stimulation and enriching the character of work itself, thus making workers more capable of interacting with their work environment. Self-realization in this context implies that workers may be idiosyncratic in their capabilities to intensify their work habits. This links personal capability (individual personality) to collective capability (work dynamics) because the above suggests that personal capabilities are influenced by collective configurations. This implies that a workplace may share a similar drive to work hard or not, thereby, differing from other places.

Gourlay (2006) advocates that hard work attitude is governed by behavioural control variables through action rather than as a capability. However, training people to behave in a specific way may support that work intensity is a capability that can be created in a workplace. This implies that work is actually managed by learning sets of behaviours, hence, a capability. The behaviour of workers in a workplace can thus be seen as an observable sign of individual capability.

### **INNOVATION**

Innovation is defined as the process of creating and exploiting knowledge to produce tangible outcomes with commercial value (Kanter, 1988; Zander, 1991). It starts from the individual level and collectively translates into an organisational level. Creativity is considered to innovation (Senge, 1990). Personal mastery in Senge (1990) explained the 'creative tension' as an insight into how learning, thus creativity, builds innovative individuals. He then argued that those innovative individuals who practiced the personal mastery discipline are the ones who build creative organisations. Senge asserts the importance of two underlying triggers to creativity whether individual or collective: (1) to continually clarify what is important through double-loop learning (Argyris and Schon, 1978), and (2) to continually learn how to clearly comprehend existing reality by being aware of ignorance and incompetence. He contends that people working together while embracing these concepts create an innovative team and thereby an innovative organisation.

Innovation as an output to organisational capabilities is a significant area of study in its own right. This section aims only to emphasise that individual innovation is a capability that may impact knowledge flow since it is an output capability from skills, communication and social capital capability inputs. By linking learning with innovation in generating value from knowledge, their influence on the performance of the organisation becomes evident (Katila and Ahuja, 2002). Also, the strategic importance of innovation to KT stems from its influence on the LO target because innovation is one of the most important outcome measures to the aspired LO (Senge, 1990). Lack of innovation usually implies a low LO performance.

### **SKILLS**

Individual skills and tacit knowing are often associated with the attribute of individual ownership. This is well articulated by Polanyi (1967) when he explained tacit knowing through his example of cycling skills. Skills are as difficult to codify as tacit knowledge. Ambrosini and Bowman (2001) defined tacit knowledge as 'tacit skills' in that tacit knowledge is difficult to imitate, substitute and transfer, it is rare; and it confers competitive value. In the context of KT change initiatives, participants need



to master both KM skills (soft skills) as well as engineering knowledge domain skills (hard skills) (Brown and Duguid, 2001).

Individual skills in KT are paramount since KT is not concerned with the abstract knowledge of engineering domains, but rather, with transferring the craftsmanship of knowledge in the form of individual skills. Individual skills are socially interactive in nature, which relates to unfolding underlying social phenomena in during the process of KT. The KT quest to fill skills gaps at the recipient level require fine-tuning between the skills level of the knower and the seeker. This is similar to aligning STC and RTC as discussed earlier. To produce the most efficient and effective KT output, Hamel (1991) suggests first addressing this gap: ‘if the skill gap [between knower and seeker] is too great, learning becomes almost impossible’. The reason for such a roadblock is that the seeker may be unable ‘to identify, if not retrace, the intermediate learning *steps* between the existing competence level and that of the partner [the competence of the knower]’.

### **RELATIONSHIPS AND SOCIAL CAPITAL**

Social capital refers to the educational attainment, skills, position and prestige of contacts in a person’s social network (Lin, 2001; Putnam, 2000, cited in Gayen *et al.*, 2010; Bourdieu, 1986). Before social capital is constructed as an important source for experience exchange, one must understand the input measure to it, that is, forming relationships. When one examines how relationships originate, it becomes evident that successful formation of relationships results in forming better social capital. Understanding this phenomenon helps to builds on relationships as an input, while social capital, and its associated experience exchange and knowledge gained are an output to the system (Kang *et al.*, 2007).

In the context of Saudi engineering research organisations as knowledge seekers and overseas research organisations as knowers, it is difficult to discuss growing social capital for knowledge diffusion while knowing that major difficulties in constructing relationships exist between knowers and seekers. The differences between Saudi culture, values, location and social reality on the one hand, and their western counterparts on the other hand, makes it difficult to form relationships and thus to

form, social capital as well. Forming successful relationships thus becomes a priority. Maister *et al.* (2000) presented four distinct levels of relationships: (1) service-based, focusing on input, (2) needs-based, focusing on the business problem, (3) relationship-based, focusing on the client and (4) trust-based, focusing on the individual. A major player in this model is *trust*, which people use to decide the level of the relationship. Figure (2-11) is a summary of this model.

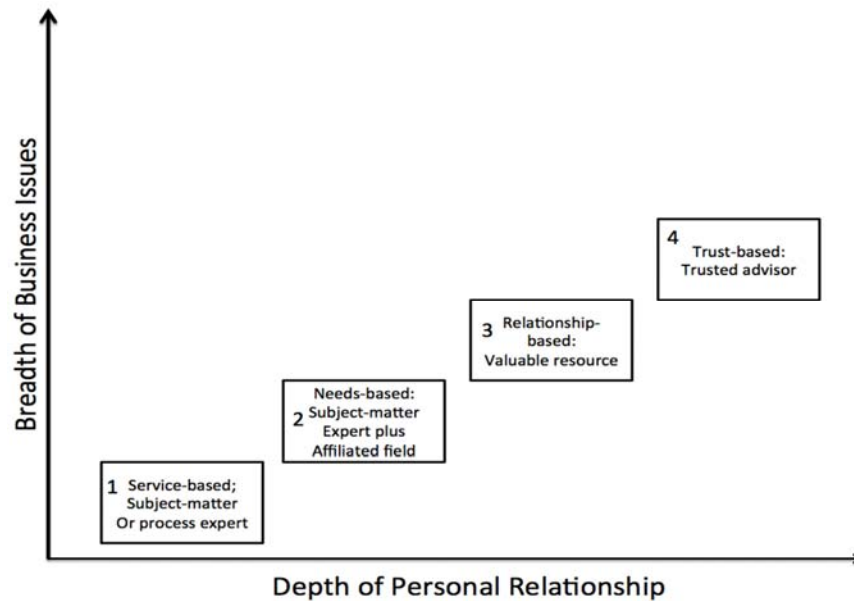


Figure (2-11): Levels of relationships (Maister *et al.*, 2000)

The above model indicates that deepest relationships (i.e. trusted advisor) best address business issues. Table (2-10) provides examples on how each relationship level maps to a business function. Importantly, the model suggests, for example, that performing a high quality service may still not produce repeat clients; instead, it is the provision of ideas, problem-solving methods, and business solutions that generate repeat business. Further, trust based relationships focus more on *understanding* the client, rather than solving his or her explicit problem per se. This links to the work of Edgar Schein (2009) on *humble helping*. In his book, the resentment of clients continues even if they get what they asked for, simply because they are really not sure what they want. Taking a step back and trying to understand the client (i.e. the knowledge seeker) can build trustworthy relationships and add to the social capital of individuals where knowledge flows with high efficacy, thereby, building a KT capability, and filling a strategic gap.

	Focus is on	Energy spent on	Client receives	Success indicators
<b>Service-based</b>	Answers, expertise, input	Explaining	Information	Timely, high quality
<b>Needs-based</b>	Business problem	Problem-solving	Solutions	Problems resolved
<b>Relationship-based</b>	Client or Organisation	Providing insights	Ideas	Repeat business
<b>Trust-based</b>	Client as individual	Understanding the client	Safe haven for hard issues	Varied, e.g. creative pricing

Table (2-10): Mapping levels of relation to business output (Maister *et al.*, 2000)

Once the social capital dimension is constructed through multiple relationships, a place for knowledge to flow is created (Bontis *et al.*, 2011; Stewart, 1994). Since Intellectual Capital (IC) is normally embedded in a social network, IC represents the core value of this network. To maximize this value, knowledge needs to be disclosed to flow within the boundaries of the network (Bontis *et al.*, 2011). From an individual perspective, there are three influences that operate on the value of social capital.

First is colleagues' attitude, which looks at attitudes towards people. This conception stands on the constructs of (1) *collective efficacy belief*, which focuses peer perception on *talent* from a capability point of view, and (2) *collective efficacy outcomes*, which is an evidence-based construct that focuses on peer perceptions on the quality of the final output work (Bandura, 1986; Jehn and Bendersky, 2003). Second comes the network structure of human interaction such as count, frequency, duration and intensity of interactions. The third is the network quality and value that relationships can generate, which is measured by quantifying reciprocity, meaning, purpose and depth of interactions. This requires respect, trust and positive emotional feelings towards other people at work (Jehn *et al.*, 2008).

Social network theory is a relational approach to managerial innovation, where people acquire knowledge via informal contact with each other. The theory of 'structural holes' (Burt, 1992) suggests that a 'network broker' connects people who might not otherwise be connected. Within such disconnected contacts, the network broker is

valuable and enjoys power and prestige (Cialdini, 1998). Brokering positions are more effective at getting what they want (Burt, 2000), such as status and rewards.

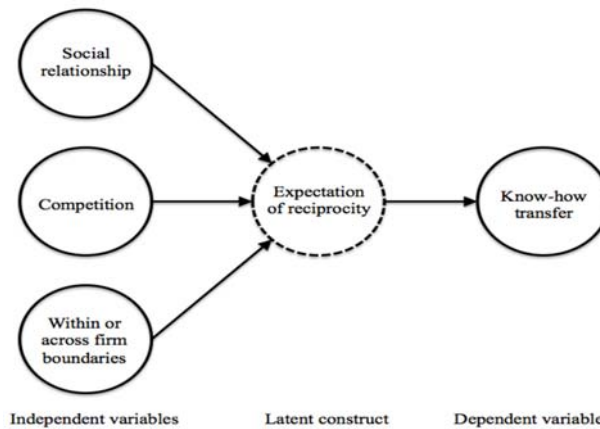
‘Structural holes are the setting for brokering strategies (Information is the substance)’ (Burt, 1992). Heterogeneity of knowledge means variety of know-how and expertise which, it is hypothesised, will be enhanced through connection with different rather than similar contacts. In essence, access to more diverse knowledge allows the broker to be more fully informed. Access to new ideas through diverse contacts may help sustain activity up to the point where a manager needs to move the project through a more formal route within his or her own organisation.

Rodan and Galunic (2004) studied 106 middle managers in a Scandinavian telecommunications company to answer the question ‘How much does knowledge really matter?’ Prior work demonstrated a link between network structure and managerial performance but inadequate attention has been paid to network content. They found that: (1) network structure is important to individual performance (Burt, 2000) and (2) network content matters to both performance and innovation, to differing degrees. Diverse knowledge is more important to innovation than it is to performance. In terms of structure, ‘having a sparse network clearly matters, but we should not confound this with the distinct benefits of access to diverse knowledge through one’s network’ (Burt, 2000).

Social capital literature tends to conclude that ‘networking’ is a good thing (Baker, 1993), and that building a network of people who are strangers to one another is particularly advantageous. Dyer and Hatch (2006) asked: ‘Can a firm that uses the identical supplier network as competitors and purchases similar inputs from the same plants achieve a competitive advantage through that network?’ The network literature suggests that this is unlikely (Gulati *et al.*, 2000), but Dyer and Hatch found that the answer was *yes*. They used the car industry as a case study (as an example) and found that suppliers to Toyota reduced defects by 50% while the same suppliers to GM, Ford and Chrysler reduced defects by only 26%. This was because Toyota worked with their suppliers to share learning and improve joint performance while US companies did not. They acted as barriers to learning. Social relationships with the network were important, so that capabilities were not easily transferred to other buyers or networks. Dyer and Hatch (2006) reports in the following quote a Toyota

manager summing up the use of knowledge as a source of advantage: ‘We are not so concerned that our knowledge will spill over to competitors. Some of it will. But by the time it does, we will be somewhere else. We are a moving target.’

The above construct clearly links social capital to KM through social factors such as relationships, social identity, Organisational culture, trust, values, membership and participation. Kachra and White (2008), illustrated in figure (2-12), found that the absence of firm boundaries (boundary spanners) contributes to higher levels of know-how-transfer.



**Figure (2-12): Modelling know-how transfer (Kachra and White, 2008)**

The above figure supports the theory of reciprocity (Dyer and Hatch, 2006) in which social, competitive and reciprocal relationships decide whether or not know-how will be transferred. This links to the social exchange theory that emphasises reciprocity and may prove as an important KT strategy as will be discussed in chapters 7 and 9.

### **SOCIAL NETWORK ANALYSIS (SNA)**

Social network analysis (SNA) is a method used to scientifically measure social capital by identifying its network structure and network quality. It emerged from sociology and psychometrics but has been recently linked with the KM field as an effective KM tool (Freeman, 2004). Specialised software to operationalise SNA is used by SNA experts to help construct complex network algorithms. In line with my perspective on KT as a process, SNA shifts from individualist, essentialist, and atomistic theories towards relational, contextual, processual and systemic understanding of social capital is created (Borgatti *et al.*, 2003).

Within the above theoretical stance, social networks are defined as sets of actors and relations, which connect actors together (Emirbayer, 1997). Actors construct a social network by exchanges of mutual interest resources. In articulating a social network, actors can be individuals, sub-organisations, organisations, or families, while resources can be information, knowledge, services, or social emotions. The interaction between types of actors and types of resources forms the social network. Social network *relations* thus define the role of actors as the holding *tie* for resource exchanges (Emirbayer, 1997). Exchange *ties* may be strong or weak, depending on factors of count, type, frequency and intimacy of exchanges (Marsden and Campbell, 1984). KT uses social networks as conduits to mobilise experience and tacit skills.

In designing a social network survey, data collection methods used are similar to those used in general social surveys are used. The additional element in such surveys is collecting relational data in addition to conventional attribute data (Burt, 1984). There are two approaches to SNA: (1) *socio-centric* and (2) *ego-centric*. Socio-centric SNA aims to measure structural patterns of individual interactions and their link to identified outcomes, like the concentration of power within a ‘closed’ network (Wellman, 1926; Garton *et al.*, 1997). Ego-centric SNA attempts to understand the underlying social processes of individuals that affect behaviour and helps to build a social structure (Coleman *et al.*, 1957). Ego-centric SNA tries to understand social processes empirically using both relational and attribute data, while socio-centric SNA attempts to measure it.

Mesquita *et al.* (2008) compare RBV and relational perspectives, within the context of learning, to examine competitive advantage. They suggest relational views to address *inter-firm* alliances rather than *intra-firm* sources of advantage. Their conclusion was that ‘relational performance’ was ‘the true source of learning dyads’ competitive advantage’. This construct is relevant to this study since it builds on work extensively conducted on relation-specific capabilities as in social networks and KT (Dyer and Singh, 1998). The individual level capability constructs have now been discussed. The next individual level constructs impacting KT is motivation constructs.

### 2.11.1.1 INDIVIDUAL MOTIVATION CONSTRUCTS

This is the second stream of constructs under the individual level analysis. The term motivation is derived from the Latin word *movere*, which means ‘to move’ (Kretiner, 1998). Motivation is defined as the “willingness to exert high levels of effort toward organisational goals, conditioned by the effort’s ability to satisfy some individual need.” (Robbins, 1993, p. 221). The need in this definition is conditioned with appearing to be attractive (Ramlall, 2012). Such need drives a search behaviour that, if fulfilled, will lead to reduction of possible tension if otherwise not fulfilled (Robbins, 1993).

Some psychological theories on motivation examined extrinsic and intrinsic effects on employees’ behaviour towards work and specifically towards knowledge sharing intentions (Lin, 2007). They concluded that: ‘A highly self-efficacious staff can be established by recruiting and selecting employees who are proactive, and who have high cognitive aptitude and self-esteem and are intrinsically motivated’ (Lin, 2007).

## LEADERSHIP

Relevant to KT theory, leadership may be defined as “any attitude or action –joint or individual, observed or imputed –that prompts new and important knowledge to be created, shared and utilised in ways that ultimately bring a shift in thinking and collective outcomes” (Mabey *et al.*, 2012, p. 2455). Conventional leadership theory lacks traction in the knowledge economy (Gibney *et al.*, 2009). Analysis of innovation and knowledge flow often overlooks the role of leadership (Van Wijk *et al.*, 2008). Creating the environment for effective KT across organisational and cultural boundaries is part of the role and responsibilities of leadership (Hunter *et al.*, 2005; Yukl, 2008).

The above draws an enquiry for the leaders of the 21<sup>st</sup> century to link knowledge with behaviour. Traditional leadership was attributed by Janowicz-Panjaitan and Noorderhaven (2009) as being procedural rather than relational. This conflicts with

the dynamics of social network theory. The assumption that leadership is a stable individual characteristic no longer stands (Reicher and Platow, 2010); rather, leadership is the flexible, shared and distributed dynamics within and across networks. These dynamics likely emerge from horizontal network interactions rather than from 'top-down' hierarchical interactions (Reicher and Platow, 2010).

Individuals who are willing to participate in organisational activities are the most suitable to occupy leadership positions because they lead the way towards change. A leadership that possesses this attribute provides their holders with status in their social network. Organisational members may observe this importance by detecting that the leader is generous and unreservedly willing to help. Enjoyment in helping others was also an influential factor, which suggests 'enhancing the positive mood state' to encourage greater leadership effectiveness. This is important to KT because effective leaders role model desired KT behaviours and attitudes such as cooperation, teamwork, and sharing.

### **PERSONAL INTEREST**

Personal interest is defined as a spirit, mindset and social phenomena that drives personal motivation to engage in what a person likes to do. KT activities need to be of interest to related staff to be efficient and effective (Szulanski, 1996). Once again, personal mastery is a good example for describing the potential of personal interest in which the 'creative tension' to change oneself from a current reality to a personal vision brings interest for change. Unless each staff member has a personal vision that is aligned with KT activities, the interest of staff in KT may diminish and cause tension and confusion to the individuals involved. Such tension is described as 'structural conflict' (Senge, 1990).

The literature identified concepts similar to personal interest such as learning intent, which focus on how much a seeker intends on learning from the perspective of interest (Baughn *et al.*, 1997; Hamel, 1991). However, because few organisations can rely on individual intrinsic intellectual fascination to drive their motivation and behavioural engagement in KT, they tend to focus on task priority and rewards, which have proven to be opportunistic and short-term (Mabey *et al.*, 2012). I see this



counterproductive for KT, and suggest that individuals must perceive a sense of personal gain in order to engage in KT.

### **CALCULATIVE APPROVAL**

Calculative approval is about being recognised by the organisation. It measures whether people are motivated to work hard for their organisation because they feel they will be recognised as an intrinsic reward (Eisenberger *et al.*, 1990). Recognition as a social phenomena is defined as a basic social acknowledgement of human worthiness that underlies forms of social participation that presents the individual as accepted as a member of a community (Honneth, 2008). Individual recognition normally occurs when an individual is recognised by peers and administration as knowledgeable, skilful and willing to share. This occurs through a social network construct where individuals form their social network position.

A number of linkages signify recognition as a distinctive position in the network and imposes potential benefits as well as liabilities on the positioned individual (Nooteboom, 2001). Mabey *et al.* (2012) draw attention to expand individual recognition into ‘shared recognition’ where shared ownership of outputs and team-based (rather than individualised) activities are recognised. In this context, recognition can be aggregated from an individual to an organisational level as a multi-level driver to KT.

### **CALCULATIVE REWARDS**

Rewards are defined as ‘all types of benefits, from cash payments to working conditions’ (Eric, 1994). The rationale behind rewards focuses on improving staff outcomes (Mahaney and Lederer, 2006). A reward system, on the other hand, aligns this rationale to performance in a way that makes it consistent with organisational strategy, which may be to retain staff with a high capabilities and tacit knowledge, or create a supportive culture and structure for performance to improve (Allen and Killman, 2001).

Calculative rewards measure whether people are motivated to work hard for their organisation because they feel they will be rewarded extrinsically (Eisenberger *et al.*, 1990). Individuals in the 21<sup>st</sup> century work longer hours and take more responsibility in order to obtain performance-related rewards (Kamoche *et al.*, 2011). It is essential to understand how people react to KT in the absence of rewards and incentives. KT performance before and after a reward system may be a logical approach. Phillips (2003) argues that rewards and recognition improve performance, encourage personal learning, and advance job satisfaction in general. He advocates that rewards and incentives provide a proxy for new work patterns, which may facilitate KT within and across the borders of the organisation (intra-organisational and inter-organisational KT). Reward can be tangible as in monetary reward or intangible such as public recognition of talent and of socially valuing authentic contributions to the organisation.

### 2.11.1.2 INDIVIDUAL PSYCHOLOGICAL CONTRACT

This is the third stream of constructs under the individual level analysis. The origins of *psychological contract* come from the work of Argyris (1960), who used the term to describe the relationship between a group of employees and their supervisor. Psychological research on mental models of employees (Stein, 1992), promise-making (Guess and Conway, 2000), mutuality (Rousseau and Schalk, 2000), and psychometrics of affective attachment (Eisenberger *et al.*, 1990) are considered the building blocks for psychological contract theory (Rousseau, 2001). The construct was further developed after Argyris (1960) to include “the mutual expectations of which the parties to the relationship may themselves be dimly aware but which nonetheless govern their relationship to each other” (Shapiro, 2000, p. 907). Psychological contract can therefore be defined as a set of unwritten expectations and subjective beliefs that exist between employees and their employers and govern the continuing development of the employment relationship, which evolves over time (Schein, 1965; Knights and Kennedy, 2005).

Psychological contracts can be viewed in two categories: transactional and relational (Shapiro, 2000; Rousseau, 2004). Relational psychological contract is concerned with concepts such as loyalty, commitment and emotional stability, which implies helping

others, sharing knowledge, supporting changes and proactively participating in organisational activities (Schein, 1990). Transactional psychological contract, on the other hand, mainly refers to monetary exchanges over a limited period of time (Robinson *et al.*, 1994; Shapiro, 2000). Rousseau (2004) suggests that this category of employees adhere to specific terms, but they tend to have narrow duties, limited employment duration, and seek employment elsewhere. This is an important concept to shape KT in this thesis. Combining relational agreements with attributes of transactional contracts is important to consider, given the global workforce changes.

The psychological contract of knowledge-intensive workers motivates staff to share what they know with their employers (Mabey *et al.*, 2012). Employers and knowledge workers develop a psychological contract to materialise the knowledge contribution provided by employees. Although this brings benefits to the employer in the form of knowledge gain, corporate learning and greater flexibility, the continuation of psychological contract in such situations requires a different career management perspective of such knowledge workers that is attributed with greater flexibility and autonomy. The next section explains sub-constructs of psychological contracts.

### EMPLOYEE SATISFACTION

Employee satisfaction is defined as “a pleasurable or positive emotional state resulting from the appraisal of one’s job or job experience” (Locke, 1976, p. 1309). The discrepancies resulting from a psychological comparison process involving the appraisal of current job experiences against some personal standards of comparison are determinant to employee satisfaction (Rice *et al.*, 1989). It may therefore arguably place job satisfaction as an index of preference for the current job over outside opportunities (Levy-Garboua and Montmarquette, 2004). Employee satisfaction is ‘an attitudinal construct reflecting one’s evaluation of his or her job’ (Ilies and Judge, 2004). Employee satisfaction behaviour is explained by social exchange theory (Blau, 1964; Cropanzano and Mitchell, 2005) and the norms of reciprocity (Gouldner, 1960). Satisfaction promotes obligation to the organisation, thereby leading employees to internalise what they know, contribute to organisational objectives and increase efficiency and effectiveness of KT practices (Leonard-Barton, 1995).

In KT, the satisfaction of knowledge seekers about their work may prove as important for KT to succeed. Knowledge seekers also need to be satisfied that the acquired knowledge is important because the recipient's stress and resistance in adapting and using new knowledge is usually linked to how the seeker perceives the knowledge being transferred (Leonard-Barton and Deschamps, 1988). There is also a possible link between work satisfaction and satisfaction about the knowledge being transferred. Satisfied seekers of knowledge are more likely to perceive new knowledge more positively (James and Tetrick, 1986).

Bontis and Serenko (2004) found that some job characteristics contribute to employee satisfaction, which in a chain of relational cause and effect concepts, contributes to efficiency. The concepts within these relationships may show a link to individual motivation. Since job autonomy, task significance, skill variety, task identity, and feedback are job satisfaction factors, job characteristics should be thus designed on the basis of including those features in knowledge intensive roles.

Individuals have strong needs for autonomy, competence, and relatedness and the extent to which individuals are able to satisfy these needs is important to maintaining psychological health. People are intrinsically motivated to maintain a sense of well-being. Job autonomy and challenge help to maintain a sense of mastery, which triggers a positive cycle of self-development, contributing to an increase in satisfaction and well-being (Deci *et al.*, 1989; Pugno, 2008). These positive experiences contribute to job perception, which results in employee satisfaction. Individuals with positive attitudes towards their job are likely to be more involved and satisfied with their work (James and Jones, 1980).

Employees who have more autonomy, task significance and variety in their jobs are likely to experience a greater sense of control, which contributes to their satisfaction. Empirical research also supports the link between challenging work and higher job satisfaction (Podsakoff *et al.*, 2007). Challenging work allows employees to use their knowledge and skills and to engage in a wide range of activities (Evans and Fischer, 1992) that may lead to higher self-efficacy (intrinsic motivation) and greater opportunities for recognition (extrinsic motivation) (Liden *et al.*, 2000).

### EMPLOYEE LONGEVITY

Employee longevity is defined as the length of time that an individual has been working in the same job (Katz, 1978). Social scholars position job longevity as an important situational factor that ‘help[s] shape individual reactions and attitudes over time while shifting through a variety of tasks in a career path (Parsons, 1951; Schein, 1967, 1971). Chew *et al.* (2004) contends that employee longevity relies on relational psychological contracts. Early career years are characterised by establishing one’s own identity within the organisation (Schein, 1971). In his three-dimensional model of an organisation, Schein (1971) emphasized that the movement of a person across any intra-organisational boundary results in some temporary loss of centrality for that individual. During this short period, therefore, relocated or perhaps promoted employees become preoccupied with establishing their new situational identities. This suggests a negative factor on KT because such change dispositions them to focus more on their new situation, rather than contributing to KT.

The construct of job longevity and its importance was explored a few decades ago as illustrated by Katz and Kahn (1978) notes who stated:

Social scientists interested in socialization processes have always considered job longevity and Organisational longevity to be important situational factors that help shape individual reactions and attitudes. In particular, Parsons (1951), Brim (1966), and Schein (1967, 1971) explicitly point out that an individual's relationship to the workplace depends upon one's job and career stage. (p. 32)

By career stage, he meant the extent in which an employee ages in the same organisation. Not only does an employee need job growth to be satisfied and motivated, for it is also the employee’s growth needs as well contribute to his or her longevity. Autonomy and skill variety have already been linked to KT in the literature while showing a strong correlation with overall job satisfaction and longevity (Katz, 1978). This suggests that employees who had autonomy and the opportunity to build a variety of skills were those who have passed the early stage of their employment. In early employment years, they were likely focused on establishing social position and security within their new organisation; rather than on autonomy and skill diversification. This may suggest that individuals at a later stage of employment are more committed to achievement, challenge, and autonomy.

### EMPLOYEE LOYALTY

Employee loyalty may be defined as the commitment and complete, steadfast allegiance to a person, a group, a cause, or an organisation, and to beliefs, practices and relationships that benefit all involved (Smith and Rupp, 2002). Loyalty requires a very conscious set of purposes that stands on high ideals and principles to keep its strength and validity over time. From a pragmatic perspective, Logan (1984) defined loyalty as a ‘strong tie that binds an employee to his company even when it may not be economically sound for him to stay there’. He argues that employee loyalty is considered the basis for lateral transfers to leadership positions. This links to KT and change in that loyal employees are most suited as change agents. From an RBV perspective, employee loyalty may resemble a source for competitive advantage.

For an environment to have a sense of purpose, Logan (1984) suggests five principles: (1) *universality*, where all employees from all ranks accept the purpose, (2) *transcendence*, where the purpose exceeds the immediate self-centred pursuits to go to a deeper meaning, (3) *permanence*, where the purpose is solid and does not change quickly over time, (4) *worthiness*, where responsibility is seen by the employee as intrinsically gratifying and worth personal sacrifice, and (5) *responsibility*, where every employee values his or her responsibility within the team and the organisation. This sense of purpose links well with loyalty and is extremely important in transformative KT change initiatives. As AlAlwai *et al.* (2007) report in the following quote, not having the above measures in place may severely affect KT:

I used to be very transparent about everything I know. I learned now that information must take the official channel-flow for people to learn about it. This is because I lost my confidence in people around me when I knew they tend to misuse the information before it reaches the intended parties. (p. 27)

It may be noticed that most of the environment five principles were present in the empirical case of of AlAlwai *et al.* (2007). Figure (2-13) illustrates another model for loyalty for the context of knowledge-workers.



Figure (2-13): A loyalty process model for knowledge workers (Smith and Rupp, 2002)

As a major form of psychological contract, mutuality is a pillar for establishing employee loyalty. It implies the agreed beliefs the employee and organisations have with each other about loyalty, commitment, flexibility, security and career advancement. Any imbalances in power or in ability to share knowledge, and rights to consent or reject will have implications on mutuality and therefore on employee loyalty (Rousseau, 2001). Loyalty may thus be sequentially modelled and understood.

### EMPLOYEE COMMITMENT

Employee commitment is defined as the individual level intrinsic attachment to work in a specific vocation as an act of commitment, trust and pledge to the workplace (Merriam-Webster, 1999). In organisational terms, studies on employee commitment explore employee behaviours, thinking and attitudes towards their workplace (Oliver, 1990). I found most studies on employee commitment to focus on sustainability of human resources. There are studies explore how individuals not only develop commitment to their organisations but also to the knowledge they interact with, thereby they stay committed to their organisation for this reason. Developing knowledge commitment translates as well into developing their competence in using, and transferring the committed to knowledge (Leonard-Barton, 1995). Individuals begin to maintain a working relationship with knowledge, and are willing to put extra effort into acquiring the knowledge they are committed to (Mowday *et al.*, 1979).

Employee commitment is essential for KT because it allows the organisation to

transform itself while preserving its context and essential competitive resources. This suggests that employee commitment and KT success are positively proportional. On the individual level, Hawkins (2000) defined five drivers for employee commitment: (1) recognition of the importance of an employee's personal and family life by organisational management, (2) provision of personal growth opportunities, (3) satisfaction in fulfilling customer needs, (4) communication of employee benefits, and (5) development of skills that meet job requirements. On the organisational level, these elements prove that it is difficult for the organisation to *buy* employee commitment, but rather, it must be *earned* by fulfilment of the suggested drivers.

### TRUST

Trust is “the willingness of a party to be vulnerable to the actions of another party based on the expectation that the other will perform a particular action important to the trustor, irrespective of the trustor's ability to monitor or control that other party” (Mayer *et al.*, 1995, p. 719). Trust is an important attribute influencing psychological contract in organisations, therefore, a potential individual motivator for knowledge sharing (Massingham and Diment, 2009; Davenport and Prusak, 1998; Nahapiet and Ghoshal, 1998; Teece *et al.*, 1997).

On the organisational level, Connell and Voola (2007) explored the link between trust and KT and concluded that KT partners should focus on intangible assets such as trust, as much as they do on tangible assets. Ardichvili *et al.* (2003) identified lack of trust as a barrier to KT and suggested enforcing various types of trust, ranging from knowledge-based to institution-based. On the other hand, Ardichvili *et al.* (2003) report that fear, of criticism for example, is associated with mistrust. Empson (2001) identified two factors that impede trust and thus KT: (1) *fear of exploitation* that is due to possible problems arising from attempts to transfer technical knowledge and resulting in imbalances between tacit and explicit knowledge, and (2) *fear of contamination* which regards the codified knowledge of the knower as inaccurate. Adler (2001) describes trust in terms of four dimensions (sources, mechanisms, objects and bases) as in table (2-11).



<i>Dimensions</i>	<i>Components</i>
Sources	Familiarity through repeated interaction; calculation based on interests; norms that create predictability and trustworthiness
Mechanisms	Direct interpersonal contact, reputation; institutional context
Objects	Individuals; systems
Bases	Consistency, contractual trust; competence; benevolence, loyalty, concern, goodwill, fiduciary trust; honesty, integrity, openness

**Table (2-11): Dimensions for Trust (Adler, 2001)**

On the group level, Adler described the ‘dark side’ of trust within teams as complacency, elitism, familiarity and poor innovation (Kim, 1998). Adler suggests that ‘reflective trust’ is a model for the future. It is a sceptical form of trust, where integrity and competence are ranked more highly than loyalty. He concluded that trust will flourish if it is: (a) balanced by stability and equity, (b) balanced by flexibility and opportunity, and (c) seen as a reflective process rather than traditionalistic and blind where people are asked to trust without thinking how could it render legitimate.

On the individual level, since employee loyalty contributes to organisational growth, employees need trust to offer their ‘loyalty’ in return (Rosanas and Velilla, 2003). This means if host organisations do not trust their employees, then employees will not be loyal. The issues presented in the next section on trusting leadership represent further reasons as to why loyalty related knowledge blockages exist. López (1993) classifies trust into functional trust and personal trust. Functional trust is based evaluation of abilities to doing a job ‘well’. Personal trust relies on the quality of the motives of the trustee in being transcendent (López, 1993). The case at host organisations relate to both types but is more significant at the functional level, which justifies the need to build capability, thus increasing functional trust.

## 2.12 THE IMPACT OF THE ORGANISATION ON KT

The organisation is perceived by the literature as the most widely published and most important unit of analysis in KT because this is the level where value makes a tangible impact (Iqbal and Mahmood, 2012). An organisation is defined as a purposeful system that contains at least two elements, which have a common purpose relative to which the system has a functional division of labour that can respond to each other’s behaviour through observation or communication (Ackoff, 1971).

## CHAPTER 2: THEORISING THE STUDY OF KNOWLEDGE TRANSFER

Some KM authors indicate significant differences between private and public sector organisations in implementing KM (McNabb, 2007; Watson and Carte, 2000; Moon, 2002). Since this thesis examines public sector engineering research organisations in Saudi Arabia, it is important to examine this issue on an organisational level of analysis. The ‘public administration theory’ confirms differences between private and public sectors in personnel management, decision-making, and information systems (Watson and Carte, 2000). These differences are based on: environmental, structural and processual factors (Watson and Carte, 2000). Since the public sector is less attached to markets, it usually provides less attention to performance, rewards, and flexibility within its internal systems (McNabb, 2007). However, these constructs are important to the success of KT, which suggests that private companies may be more effective in KM than the public sector. This implies that KM for the public sector may prove to be more complex and experience more barriers.

In order to integrate the levels of analysis in one framework, Shin (2004) presented KT as influenced by four factors: knowledge transferred, source, recipient, and the context in which KT dynamics functions. In his taxonomy, he mapped each factor with the relevant level of analysis as shown in Table (2-12).

Entity	Barriers preventing effective KT	Level of analysis
Knower	Fear for loss of hegemony (Hippel 1994; Szulanski 1996); Lack of up-to-date knowledge (Detmer and Shortliffe 1997); Lack of commitment, or negligence (Williams and Gibson 1990; Huber 1991)	Individual, organisational
Context	Weaker co-location (Kogut and Zander 1993; Appleyard 1996); Unfriendly relationship between source and recipient (Ghoshal and Barlett 1994; Nonaka 1994); Limitations in individual’s network of knowledge or doubt about the network (Robertson, Swan <i>et al.</i> 1996); Cultural incompatibility (Lam 1997); Knowledge diversity due to lack of common experience or to environment (Pascale 1999)	Knowledge, individual, organisational, country
Knowledge transferred	Limitation of interpretative ability (Dougherty 1992); Immobility (tacitness) of knowledge (Stopford 1995; Grant 1996); Causal ambiguity (Szulanski 1996)	Knowledge
Seeker	Limited knowledge-processing capacity (Cohen and Levinthal 1990); No information on knowledge existence or limitations in pre-existing knowledge (Cohen and Levinthal 1990; Huber 1991); ‘Not invented here’ syndrome (Williams and Gibson 1990; Hu, Huang <i>et al.</i> 1998); Limitations in the capacity to institutionalise new knowledge application (Williams and Gibson 1990; Szulanski 1996)	Individual, organisational

**Table (2-12): Barriers to KT (Shin, 2004)**

The table above illustrates how each KT element (or factor) can be analysed using different levels of analysis. For example, the knower and the seeker may be seen as an individual or as an organisation. Similarly, the context of KT may be perceived from a knowledge, individual, organisational or national perspective. The organisational level of analysis expands this discussion by examining the following organisational elements: (1) culture, (2) policies, (3) processes, (4) systems and (5) resources.

### 2.12.1 ORGANISATIONAL CULTURE

Organisational culture is defined as the “shared beliefs and practices of people in the organisation” (McDermott and O’Dell, 2001, p. 78). Culture is one of the main barriers to knowledge sharing (Szulnaski, 1996). Hall and Goody (2007) assert that the most significant barrier to effective knowledge sharing is culture. McDermott and O’Dell (2001) also contend that culture is the key inhibitor of effective knowledge sharing. However, they contend that ‘culture’ is used as a catch-all category to explain failure. On the organisational level, a primary weakness in many KM implementations is failure to understand cultural internal forces within organisations (Cook, 1999). Such forces are usually between staff and process routines within the organisation. Unless such forces are guided by a clear set of values, beliefs and vision, it may create loss of identity and cause failures in different organisational locations and levels.

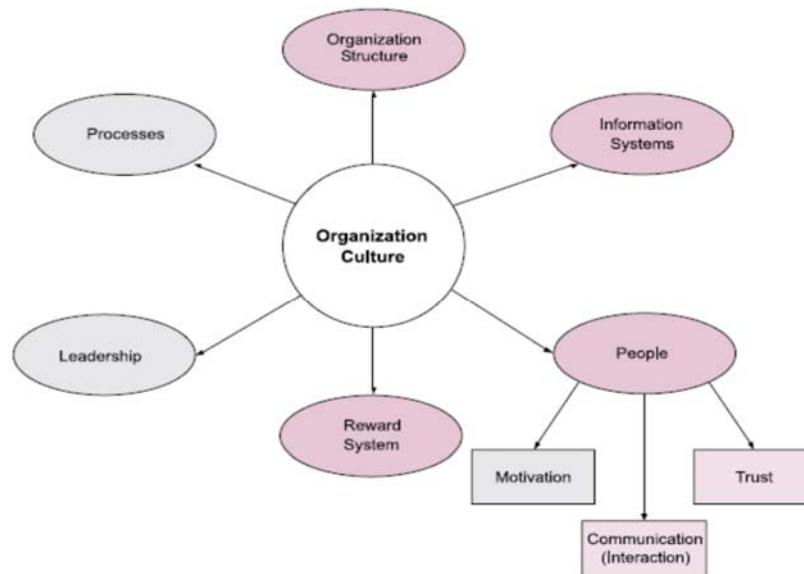
As part of the economic coordination theory, cultural alignment may prove to be essential to ease the coordination process on the team, departmental and organisational levels (Nonaka 1994; Simonin, 1999; Kogut and Zander 1992). Ethnography as a methodology for cultural alignment is not commonly used, but there are examples such as Marshall (2008) in *Organisational Learning* and Ambrosini *et al.* (2001) who operationalised cultural tacit knowledge through ethnographic methods in the context of the RBV of the firm.

Technical and client knowledge represents the source of value to the firm (Alvesson, 1993). The power an employee possesses by having this knowledge is perceived by some individuals to diminish as soon as this knowledge is codified or shared. Empson (2001) suggests that some organisational cultures may encourage some staff to think

that way, hence, an incentive for individuals to preserve their knowledge and ‘resist the firm’s attempts to establish *property rights* over his or her knowledge’ (Morris, 2001). If such a culture of denying others access to knowledge becomes dominant in an organisation, how can knowledge be shared within the organisation or with the outside world? This relates to both internal and external KT.

As figure (2-14) illustrates, people are core to culture. The visible dimension is usually expressed in mission statements and aspirations. The invisible dimension is tacit, relating to unspoken core values (i.e. be careful to avoid risk). The visible and invisible dimensions are linked by behaviour. The danger of culture stems from its sustained efforts to reach new organisational members as soon as they join the organisation. This is highlighted in the definition of culture provided by Park *et al.* (2004):

[T]he shared, basic assumptions that an organisation learnt while coping with the environment and solving problems of external adaptation and internal integration that are taught to new members as the correct way to solve those problems. (p. 111)



**Figure (2-14): Culture (Gupta and Govindarajan (2000) cited in AlAlawi *et al.* (2007))**

Conceptually, Park *et al.*, link communication, trust and morale together as the ‘people’ dimension of organisational culture. They found that factors such as communication between staff, IT systems, interpersonal trust, rewards and organisation structure play an important role in defining the relationships between staff to improve KT. They found that KT is improved when relationships are good. In

their support, Van den Hoof and Ridder (2004) analysed responses from 444 employees in six case study organisations and found a positive link between the culture of communication, KT, and psychological contract.

Further, on the country level, a major factor affecting KT is failure to take account of how national culture perceives knowledge (Holden, 2001). Ambitious organisations in developed countries always perceive their existing knowledge as never enough, which motivates their culture to support knowledge mining. This implies that some sort of social and cultural interaction needs to take place as a KT element in its own right to transfer this culture from organisations in developed countries to the cultures of developing countries. KT therefore includes *soft* skills and culture, rather than the sought hard knowledge per se. This has twofold advantages: (1) organisations in developing countries will develop a capability to change, and (2) they will culturally align themselves with the knower, thereby, easing the stickiness of *hard* KT.

However, significant and profound differences in culture exist between developed and developing countries, which may prove to be difficult to alter during the KT process. Cultural barriers may distort transferred knowledge into a different context and cause tension and confusion. It is for this reason western best practice checklists may become less useful for implementation in developing countries such as Saudi Arabia because they are built on configurations of different cultures. The reason for failure of such implementations is therefore culture, and not the best practice itself. Considering incremental cultural adjustments may represent as a possible strategy, however, further investigation on this issue will be addressed in detail in chapter 7.

### 2.12.2 ORGANISATIONAL POLICIES

An organisational policy is defined as a plan of action designed by the organisational decision makers in which they specify the intended action for organisational members in relation to possible states or situations (Zeng *et al.*, 2005). In public sector organisations, adherence to policies are of high importance, hence, it resonates with a high impact on KT activities. The adoption of best practices from related industries may prove to be a useful guide to decision makers to plan their policies. By developing a thorough understanding of how others do what they do, policies may be

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devised to build resources and capabilities in an efficient manner (Boyett and Boyet, 2001). Policies should (1) control the organisational activities to adhere to organisational constraints, and (2) guide the organisational members to make optimized decisions on specific situation (McNabb, 2007). Depending on the quality of organisational policies, they may become enablers or barriers to KT.

Although there are already a large number of KM activities implemented in Organisations, many of them lack the ability to link KM to the organisation in terms of strategies, human and technological resources due to rigid policies that act as KM blockages (Zack, 2002; Maier and Remus, 2002, Bo Bernhard, 2005; Smith, 2007). For example, if an organisation institutes a policy to prohibit hiring people over the age of 55 years then this could become a significant barrier to tacit KT because many experienced and valuable researchers are above this age. As a source for value, organisations should seek wisdom in their policies from best practices to understand the critical success factors, options, and systematic steps in devising and implementing successful policies. Success in devising such policies may support designing and implementing a successful KM strategy (O'Dell, 2000). Ignoring the experiences of others may result in an expensive reinvention of the wheel.

However, it is known that public policies are extremely difficult to amend (McNabb, 2007). For this reason, it is more important in the case of governments to employ competence and capability in designing organisational policies to avoid falling into amendment traps (McNabb, 2007). Governments usually have long accumulated experience generated from iterated actions and reconstituted from different contexts (McNabb, 2007). Failing to learn from this experience can bring devastating results to many governmental agencies especially the knowledge-based activities.

This was explored by Weick (1996) and Weick and Roberts (1993) in their studies of airport plane accidents where fire-fighters and aircraft crew were unable to act competently in emergency settings due to a lack of a clear instructions code of act policies. Employees were not able to apply their learning because the policy did not support their experiential learning. This is a typical governmental policy barrier to KT and OL in general. The concept of embedded practice to replace explicit policies is always a challenge to governments. The idea that 'best practices' can be transferred

across the organisation requires policy support. Knowledge or knowing as an embedded practice is at odds with the notion of ‘transfer’ if policies restrict it. Policies therefore may help propagate or inhibit best practice. This implies a need to align policy with strategy (Esty and Porter, 2005).

### 2.12.3 ORGANISATIONAL PROCESSES

An organisational process can be defined as any repetitive system for producing a product or service that uses people, procedures, machines, and/or software in that system (Bohn, 1994). A business process is defined as a set of logically related tasks performed to achieve a defined business outcome (Davenport and Short, 1990). Processes are key to converting personal knowledge into organisational knowledge (Mentzas *et al.*, 2001). Personal knowledge becomes organisational through the application of rules that have been generated by a previous body of knowledge in which “individuals draw and act upon a corpus of generalizations in the form of generic rules produced by the organisation” (Tsoukas and Vladimirou, 2001, p. 978).

A process that has the output  $Y$  can be defined by a variable vector  $x$ . By using the function  $Y=f(x)$ , it is possible to control the process outcomes through altering the input  $x$ . Since alterations should not be arbitrary, the alteration process requires knowledge about the arguments and behaviour of the governing function  $f(x)$  (Bohn and Jaikumar, 1992). Knowledgeable manipulation of input variables may therefore efficiently improve the output of the business process. Lack of knowledge in the process behaviour and its inherent inner variables (i.e.  $x_1, x_2, x_3, \dots, x_n$ ) may result in ineffective improvements and an intended outcome  $Y$ . This shows that processes are complex phenomena that require substantial knowledge and controlled analyses.

As a further layer of detail on organisational processes, the following section presents an introduction to systems thinking. This type of thinking is advocated to be an effective approach to understanding organisational processes, thereby being more able to alter the possible outcomes from those processes, especially in the context of knowledge intensive process. This is considered a profound research area for this thesis (see chapter 6).

### SYSTEMS THINKING

Systemic thinking is perceived as the most compatible concept for understanding the nature of processes. Systemic thinking is best articulated by Senge (1990) as:

[A] discipline for seeing wholes. It is a framework for seeing interrelationships rather than things, for seeing patterns of change rather than static 'snapshots'. It is a set of general principles... spanning fields as diverse as the physical and social sciences, engineering, and management. It is also a set of specific tools, techniques, originating in two threads: in 'feedback' concepts of cybernetics and in 'servo-mechanism' engineering theory dating back to the nineteenth century. (p. 78)

Once again, Senge (1990) relates systems thinking to scientific and social study streams that strive to understand our world and nature. He re-asserts that systemic thinking is:

[T]he discipline that integrates the disciplines, fusing them into a coherent body of theory and practice. It keeps them from being separate gimmicks or the latest organisation change fads. Without a systemic orientation, there is no motivation to look at how the disciplines interrelate. By enhancing each of the other disciplines, it continually reminds us that the whole can exceed the sum of its parts. (p. 121)

A reflection of enquiry is due here to examine how can KT fit in the concept of systems thinking. A focus on the concept of processes may lead to an answer. For example, how could a physician receive a patient complaining from a health problem, apply numerous tests on his or her organs (heart, kidney, lungs, liver, etc.) and reach the conclusion that the organs were normal, yet the problem persists. This implies that the problem lies *between* the organs and not from an organ. Processes connect the parts to illuminate the whole. An organisation may require a similar thinking where problems may not exist in improving a department; rather, the *whole* organisation is improved through improving the structure of business process. Since KT exists within business processes, a systems thinking approach may provide to be useful.

Further contemplation reveals that even if an ideal knower (i.e. knowledgeable, trustworthy, high STC, willing, motivated, articulate, etc.) and an ideal seeker (i.e. high RTC, interested, committed, honest, etc.) existed, an ideal KT could be guaranteed. The reason lies in the unknown variables of the processes that interlink the knower and the seeker to form the KT system. By balancing all explicit and implicit system feedback processes to achieve the desired goal (Senge, 1990), the KT phenomenon fits and makes use of systems thinking. An understanding of reinforcing and balancing feedback loops within KT processes as well as *system delays* could



profoundly diminish the barriers found in KT change initiatives.

The systems approach to an organisation has four attributes: (1) a holistic view of diverse interacting elements within an environment rather than focusing on its parts, (2) acknowledging that the behaviour of the system (i.e. the organisation) is driven by relationships and interactions rather than by the parts (i.e. individuals, teams, departments), (3) perceiving the system as a hierarchy of sub-systems with properties emerging differently from them, as well as perceiving the mutual causality both within and between levels, and (4) people, as social systems, will act with differing purposes or rationalities (Mingers and While, 2010). This perception has been embraced by various learning frameworks (Senge, 1990). Cybernetics, system dynamics, and soft system modelling are further underlying theories to systems thinking. A summary of each concept is provided below.

Cybernetics provide a rationale for systems thinking by exploring information flow through a system and the way information is used by the system as a mean of controlling itself (Ashby, 1956). Cybernetics applies to artificial intelligence, robotics, adaptive systems, large-scale socio-economic systems, man-machine systems, and systems science (Johannessen, 1998; Rudall, 2000; Tilebein, 2006; Vallee, 2003). Stafford Beer was the first to apply the principles of cybernetics to improve management performance and efficiency (Beer, 1959). Cybernetics is seen as the 'science of effective organisation' (Beer, 1959).

Jay Forrester at MIT established the construct of system dynamics, arguing that the behaviour of systems can be attributed to flows, delays, and feedback relations (Mingers and White, 2010). System dynamics concerns the interplay of positive or reinforcing loops that lead to continual growth or decay, and balancing loops that lead to stability. There are two stages in this process: (1) identifying and mapping causal loops and (2) quantifying them into a model (Mingers and White, 2010). Work often may stop at the first stage of producing a causal-loop diagram where the aim of the project is greater understanding of a situation (Mingers and White, 2010).

Soft system modeling (SSM) is a methodology and a learning system (Rosenhead and Mingers, 2001) that was used for problem solving and in the management of change.

To intervene in business situations, it uses the notion of a 'system' as an interrogative device that will trigger debate amongst concerned parties. By discussions and exploration, the decision makers arrive at accommodations (or, exceptionally, at consensus) over what changes may be systemically desirable and feasible.

### 2.12.4 ORGANISATIONAL SYSTEMS

Organisational systems are defined as a collection of interrelated moving parts or components that work together to perform a complete function or purpose (McNabb, 2007). In the context of KM, organisational systems relate to knowledge flows through the interaction between subsystems (McNabb, 2007). This means that the better KM aligns organisational systems with the knowledge strategy, the more favourable the KM outcomes will be to close capability gaps that exists in those systems. Tsoukas (2002) found a tacit component in organisational systems. In other words, organisational systems have visible and invisible dimensions. The visible is structure (i.e. how work is organized and managed via hierarchies). The invisible dimension here is the corpus of generalisations, where managers know only a fraction of what their subordinates know. In this case, when tacit knowledge is not transferrable vertically, then the power of hierarchy becomes a threat to knowledge activities (i.e. the invisible is a threat to the visible system). Bureaucracy and hierarchy are therefore barriers to knowledge flow.

In order to transform a system such as an IP department to align with a knowledge strategy, there are many measures to be considered. When organisations seek scarcity rents from KT, they must take into account setup costs, including infrastructure investments, adaptation time for employees, and organisational process re-engineering. When adaptation time of employees and other managerial costs are also taken into account, the cost total can increase considerably. From an RBV perspective, the object of spending substantial budgets is to generate rents from the use of valuable knowledge, which can be gained by implementing KM systems to the extent that it is hard for competitors to imitate (Tsoukas, 2002). The following sections are suggested by the literature as effective organisational systems for KT.

### COMMUNITIES OF PRACTICE (CoP)

A CoP is a group of people who, through working together and sharing experience, develop into a cohesive community with a mutual understanding (Lindkvist, 2005). It is now a well-established and highly influential in conceptualising groups within organisations (Lindkvist, 2005). A CoP is an ideal arena for KT because knowledge flows are optimised within groups of like-minded people who learn through common purpose and through doing (rather than describing). Staff outside the CoP will find it hard to learn from the CoP because non-members cannot engage by doing. This links to economic coordination in that KT is optimised to perform with people with a high AC. This requires organisations to support knowledge workers to join their relevant CoP and then to provide consultation to staff outside the community. This links to competitiveness by optimising knowledge flows with minimum costs.

CoP marks a shift of interest away from technical solutions towards human factors. Tacit knowledge sharing is ideal in a CoP because experts share the same language. The term CoP interfaces with OL as both describe the process of shared learning and practice that occurs when groups of people with common objectives interact and work together (Senge, 1990). Since knowledge resides in social relations, knowing is part of becoming an insider in a CoP, which means that knowers and seekers exchange roles in a CoP (Gherardi, 2001). This concept is directly relevant to this thesis since it is one of the main processes that may provide an effective conduit for KT and reduce the strict boundaries between the knower and the seeker.

Brown and Duguid (2001) described the knowledge a CoP may hold as: (1) sticky (von Hippel 1994, 1998; Szulanski 1996); (2) leaky (Liebeskind *et al.*, 1996; Wernerfelt, 1984); and (3) mobile (Hoopes and Postrel 1999). The latter two can best be understood when conceptualising organisations as collections of communities whose members stand at the intersection of the organisation and the network, allowing passage of leaky knowledge to mobilise. However, the first type indicates that some knowledge may be sticky due to the need for learning by doing within the CoP. This concept links to this thesis from a strategy perspective by explaining how a CoP could strengthen the organisation from an RBV perspective.

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Brown and Duguid (2002) perceive knowledge as only local and shared among 'tightly knit' groups because meaning varies across time and space. The Silicon Valley region for example, contains particular clusters that are populated by networked communities or 'ecologies' as a stimulating and innovating space (Tsoukas, 2002). Swan *et al.* (2002) show how managers build causal loop systems via professional groups. Robertson *et al.* (2003) found that collective identity helped to draw out creativity and expertise of individuals as claimed by Tsoukas (2002). The tightly knit quality of CoP does not fit short-life organisations or temporary project groups, according to Lindkvist (2005). The difference between traditional organisational teams (i.e. committees or task forces) and CoP's is that the latter is voluntary.

Toyota showed how network-level processes create advantage (Dyer *et al.*, 2000). By creating a strong network identity, with stringent eligibility criteria for admission into the CoP, Toyota was able to: (1) motivate members to participate and openly share valuable knowledge (while preventing undesirable spillovers to competitors), (2) prevent free riders, and (3) reduce costs associated with accessing different types of valuable knowledge. Dyer *et al.* suggested in the following quote that:

[I]f the network can create a strong identity and coordinating rules, then it [CoP] will be superior to a firm as an organisational form at creating and recombining knowledge due to the diversity of knowledge that resides within a network. (p. 351)

Young *et al.* (2001) described the admission to a CoP as a form of recognition. In the following statement, Scott (1990) was quoted in Young *et al.* (2001) in support of the positive impact of a CoP on transfer of ideas, hints and innovation:

[B]eing embedded in a network of social relations [i.e. CoP] can bring one news of innovations, support for adoption, helpful hints regarding implementation, and social support encouraging change. (p. 172)

In terms of using technology, the literature suggested building frameworks of virtual knowledge brokers (VKB) and virtual customer environments (VCE) (Verona *et al.*, 2006). Verona *et al.* (2006) suggested using staff knowledge brokers (KB) to assess those virtual network structures as a CoP in supporting KT. They found that the technology created a new organisational form for CoP. Through brokered knowledge, knowing was made more accountable and more usable to serve locally at any given

time. It also helped knowledge being dissembled and reassembled (Meyer, 2010).

### **INFORMATION TECHNOLOGY SYSTEMS (ITS)**

As information and communications technologies represent the third chief building block for KM, in addition to people and processes for knowledge sharing (Joch, 2004), KM has become the key to entering the knowledge economy and efficient management systems in private and public sector organisations (McNabb, 2007). IT systems are relevant to this discussion since Organisations, when seeking scarcity rents from KT, must take into account setting up their infrastructure, which requires hardware and software investments, adaptation time for employees, and Organisational process re-engineering. From an RBV perspective, spending substantial budgets to generate rents from the use of idiosyncratic knowledge is justified. In order to be effective in this direction, KM systems are used generate, transfer and use this knowledge in the organisation. Further on the RBV perspective, KM systems also help making it hard for competitors to imitate this knowledge.

IT systems were the major driving force in KM in the 1990s, leading to highly sophisticated tools (i.e. intranets, KM systems, workflow technology). Cabrera and Cabrera (2002) found that IT solutions were no longer a barrier to KT across time and distance, but rather the barriers are social variables and co-workers' behaviours. Three solution types were proposed in this regard: (1) increase the pay-off to knowledge sharers, making it worth their while either by reducing the cost of sharing or substantiating the benefit; (2) increase people's perception of efficacy, by making them aware of the positive impact of exchanging insights; and (3) foster cooperation by increasing group identity and sense of personal responsibility. Creating KT CoP was identified as a way of achieving this. These elements will be considered in deigning the research tools for this thesis.

Although the practice of KM shows continual use of IT-based frameworks as an approach for storage and distribution of explicit knowledge (Mertins *et al.*, 2003), tacit knowledge is neither storable nor distributable. This dilemma makes IT solutions impaired without the support of humans to fill this gap. While codification should be adopted, the fact that not all knowledge can be codified must be accepted.

## 2.13. PART C: LITERATURE ON KT INITIATIVES

This part of the literature review presents some attempts to modelling and implementing KT project initiatives. In an attempt to understand how recent developments in systems thinking and social construction can influence the understanding of KT, Parent *et al.* (2007) proposed a systems-based Dynamic Knowledge Transfer Capacity model (DKTC). They proposed the components required for social systems to generate, disseminate and use new knowledge to meet their needs. They proposed a KT paradigm that views knowledge as a systemic, socially constructed, context-specific representation of reality. Their proposed model was in sharp contrast to past attempts, focusing attention on the capacities that must be present in organisations and social systems as a precondition for KT to practically occur in an implementation project. Figure (2-15) describes this paradigm:



Figure (2-15): Dynamic KT Capacity model (DKTC) (Parent *et al.*, 2007)

In the figure above, the model includes pre-existing conditions for implementing KT initiatives (need and prior knowledge) and four categories of capacities (generative, disseminative, absorptive and adaptive/responsive) that social systems must possess for KT to take place. In their view, Parent *et al.* (2007) found that KT initiatives would fail if the three capacities were not taken into account.

In their RandD specific focus, Armbrecht *et al.* (2001) suggested in figure (2-16) a knowledge flow model for RandD firms. The model provides a practical cycle for KT and covers important elements on an ontological and epistemological level. It also links strategy with implementation.

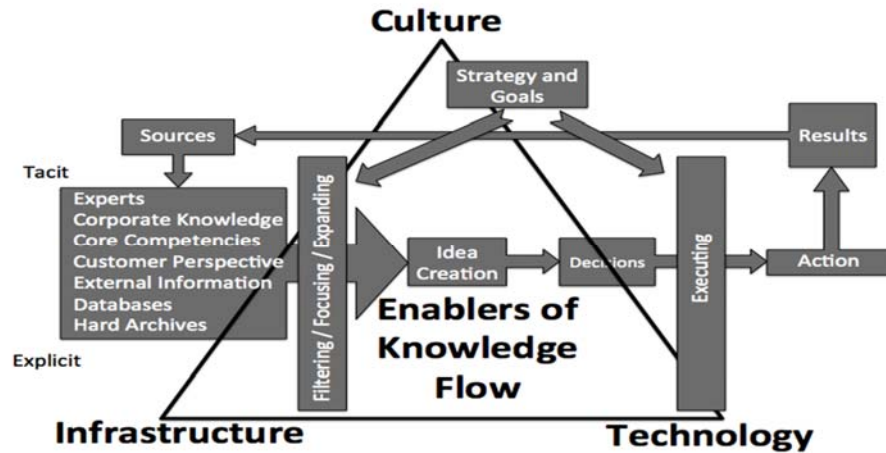


Figure (2-16): The three enablers of knowledge flow (Armbrecht *et al.*, 2001)

Although the above figure focused on an effective stream for knowledge flow while developing a KM strategy, it abstracted the KM process into a narrow model because it did not discuss how to deal with knowledge flow barriers. This thesis will address this gap. They focused more on the enablers perspective, which is why they added to the knowledge flow process a wider view that takes into account a multifaceted approach on knowledge, individual and organisational levels.

The approach used by Mertins *et al.* (2003) is based on BPR with the perspective of KM criteria added to build the KM solution. The following table shows examples of some of the achievements KT has brought about over recent years in different US manufacturing and engineering firms:

Company	Potential achievements
<b>Buckman Laboratories</b>	Knowledge transfer and best practices supported new product revenues to up to 10%, an increase of 50% since 1992
<b>Texas Instruments</b>	The company generated from free wafer fabrications an annual US\$1.5 billion by transferring best practices between 13 TI fabrication plants.
<b>Dow Chemical Chevron</b>	By implementing ideas to reduce-company wide energy costs, 100 people comprising the Chevron's network generated an initial US\$150 million as savings in annual power and fuel expenses
<b>Kaiser Permanente</b>	A new women's health clinic was opened smoothly with no costly start-up problems by implementing benchmarking of internal best practices

Table (2-13): Potential achievements from knowledge sharing (Shin, 2004)

O'Dell (2000) identified five stages in the implementation of successful KT: (1) getting started, which includes creating a vision, igniting a spark and collecting

success stories to be shared within the organisation, (2) connecting the KT effort to the business need and finding advocates for KT who will support the identification of KT initiatives and explore different possibilities, and continue the effort by spreading success stories about KT within the organisation, (3) launching KT initiatives and supporting them through support strategies, activity and outcome measures, (4) creating a support structure for the selected pilots, building capability to expand and support the KT process, bringing the KT initiative up to the enterprise level and continuing on activity and outcome measures that were initiated in stage three, and (5) institutionalising the KT initiative and sustaining business measures to reflect the benefits of KT activities via the way of doing business, i.e. the routines, processes and norms of the organisational functioning.

As a holistic solution model, implementation of stages of KT initiatives involves both gaining buy-in and making enormous cultural change (O'Dell, 2000). Entering prematurely into addressing the business case and measurements is consequently an inaccurate initial step (O'Dell, 2000). The content of each step should tally with the stage of implementation in terms of cohesiveness and tangibility. Statements of the notion 'if...then' represent tangible effects and provide a sense of promise of gain from the KT initiative. These statements may then be translated as acceptable tools to measure the expected ROI of the initial stages. Sustained KT know-how and clearly defined measurable gains are required in the advanced stages of the implementation process as well (O'Dell, 2000). In advanced stages, a management competency level in KT should become part of the normal budget debates along with other major expenditures of the organisation's other management competencies (O'Dell, 2000).

Another view to KT solutions was proposed by Gorelick *et al.* (2004) who designed the 'KM Bridge' below in figure (2-17). It allows the easy movement of knowledge between separated organisational 'islands' of external and internal knowledge. It has a two-way flow, where knowledge utilisation and learning directions exist to support performance goals. It may be conceptualised as a 'knowledge creating spiral' that moves upward in an organisation, creating new levels of knowledge and new levels of performance, at both tactical (operational improvements) and strategic (long term performance) levels (Gorelick, *et al.*, 2004). New knowledge is created through



persistent after-event review, assessing knowledge content, and focusing on the ways where knowledge is utilised and its context (Gorelick, *et al.*, 2004).

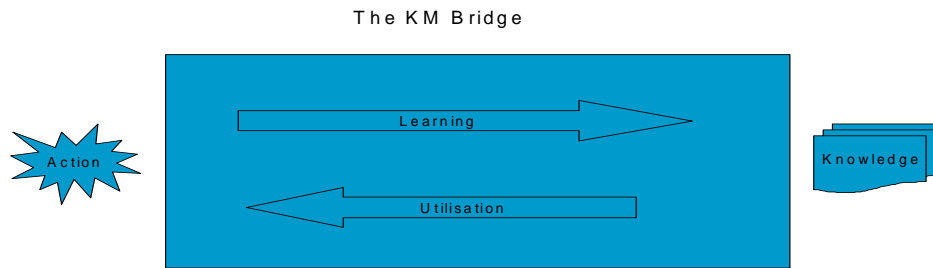
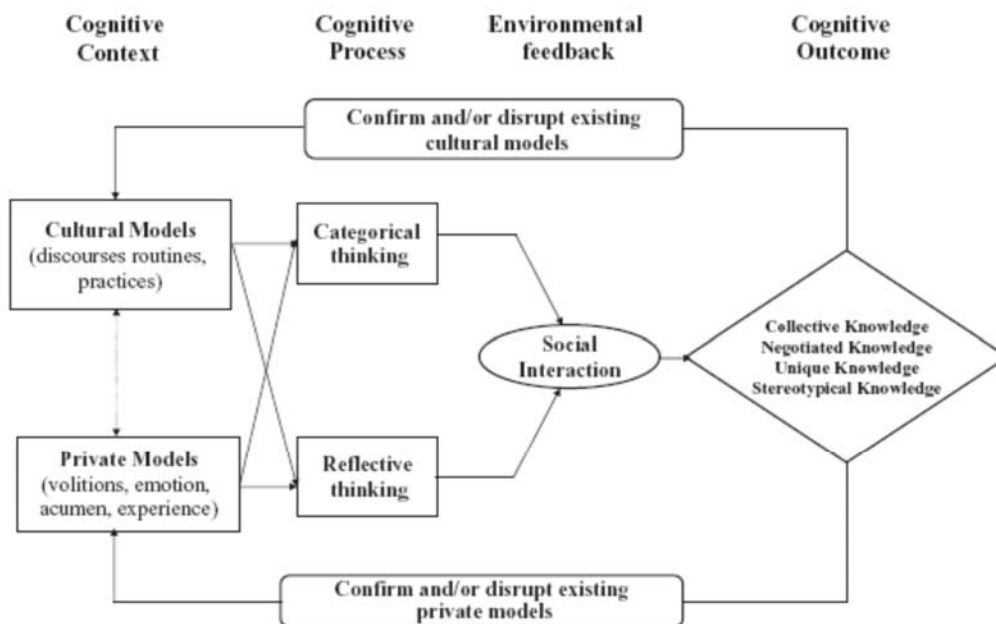


Figure 1: The KM Performance connection-  
knowledge bridge, (source Gorelick et al 2002)

**Figure (2-17): The knowledge bridge (Gorelick *et al.*, 2004)**

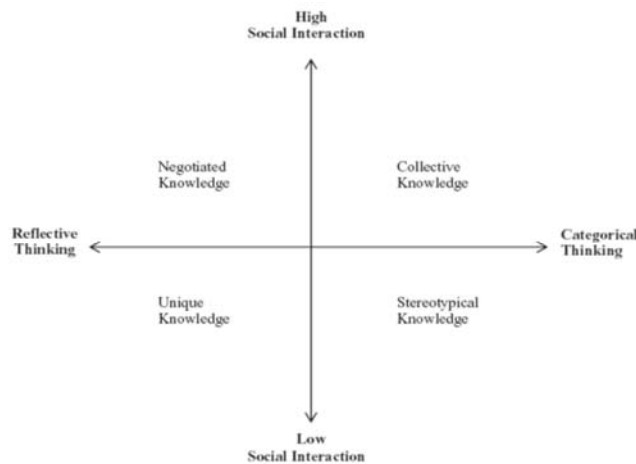
Ringberg and Reihlen (2008) critique the dominant research streams of positivism (underlying the RBV of the firm) and social constructionism (underlying practice-based-knowledge) in which texts and practices are assumed to contain within them coded keys that can be unlocked to allow smooth KT. A socio-cognitive approach, as the one proposed in figure (2-18) suggests that meaning is mediated by private and cultural models generated by the individuals' own cognitive dispositions, including memory and emotions, as well as socio-cultural interaction.



**Figure (2-18): Cognitive outcomes in KT (Ringberg and Reihlen, 2008)**

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As per the above figure, they set out a socio-cognitive model showing links between context, process, feedback and outcome. Ringberg and Reihlen also used a bipolar typology in figure (2-19) (below), which is a typical structure in psychology, along axes of high-low social interaction and reflective-categorical thinking. The intersection of these constructs produces quadrants of knowledge transfer outcomes: negotiated knowledge, unique knowledge (combining reflective thinking with low social interaction: such persons may be considered socially inept, extreme idealists, or even nerds), collective knowledge and stereotypical knowledge. The managerial challenge is to match knowledge transfer types with the needs of the organisation.

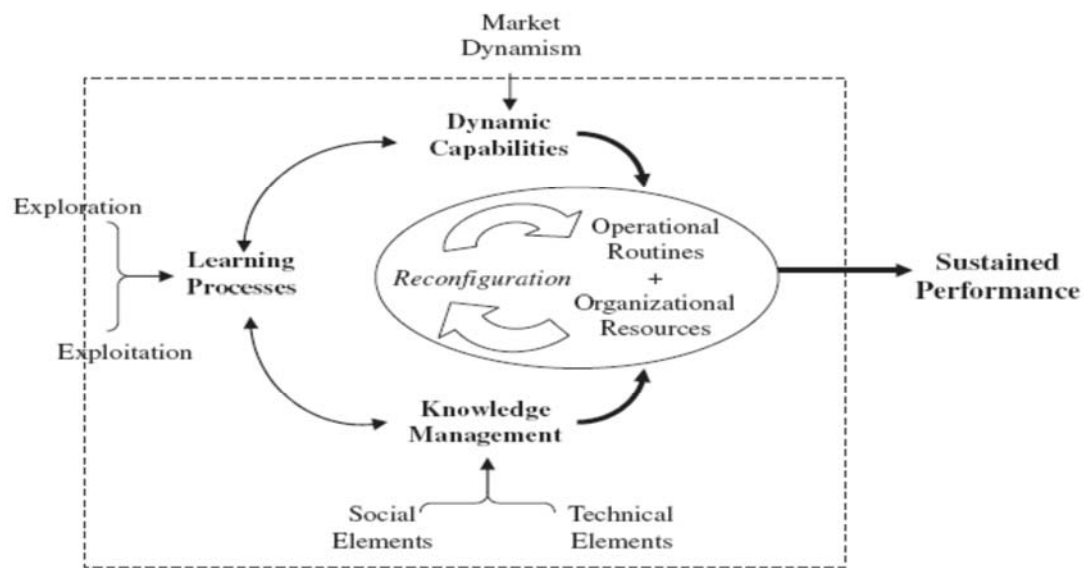


**Figure (2-19): KT outcomes (Ringberg and Reihlen, 2008)**

Easterby-Smith and Prieto (2008) introduced ‘dynamic capabilities’ and ‘knowledge management’ in a holistic framework by looking at ‘how best to manage organisations in dynamic and discontinuous environments’. They suggest that the solution is by building and sustaining competitive advantage (Eisenhardt and Martin, 2000; Teece *et al.*, 1997; Grant, 1996). The authors look at the two constructs separately and give a theoretical account that explicitly links them. Organisational learning is one of the processes that lead to improved performance and innovation through development of new products. Learning has been conceptualised into the firm structure by Winter (2006) as stipulated in the following quote:

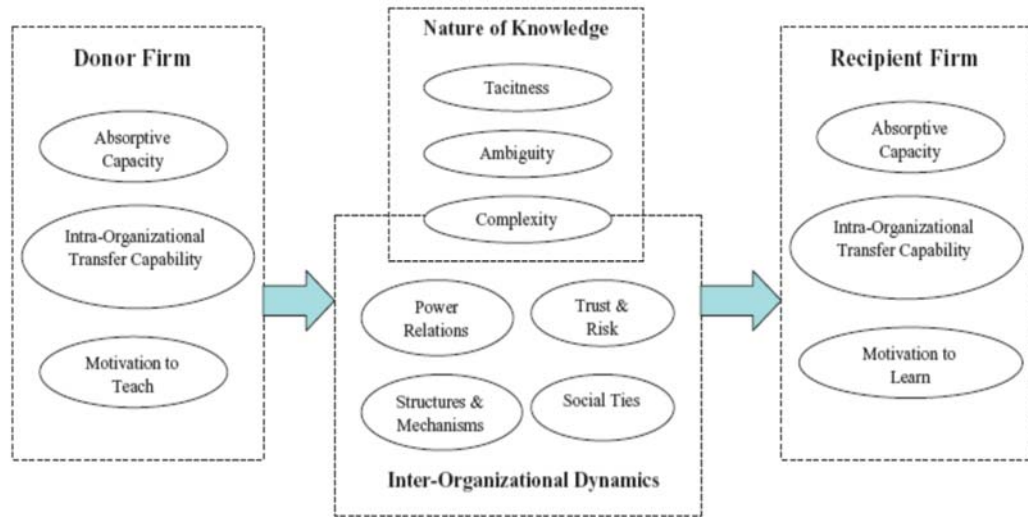
[B]y differentiating a capability hierarchy in which operational (zero-level), dynamic (first-order) and learning (second-order) capabilities are intrinsically linked to one another. Operational capabilities or routines are geared towards the operational functioning of the Organisation; dynamic capabilities are dedicated to the modification of operational routines; finally, learning capabilities facilitate the creation and modification of dynamic capabilities. (p. 995)

Easterby-Smith and Prieto (2008) link knowledge change and adaptation with learning, noting that ‘knowledge management can be considered as ‘managed learning’ within organisations’; and that ‘both dynamic capabilities and knowledge management researchers have identified knowledge resources that are critical to achieving and sustaining competitiveness’ (Tidd *et al.*, 1997). They use these connections to create an integrative framework, summarised above in which KM is a first-order capability and learning mediates between KM and DC. Competitive advantage comes from reconfiguration of resources and routines, which are the visible outcomes of DC.



**Figure (2-20): Linking KM and dynamic capabilities (Easterby-Smith and Prieto, 2008)**

Based on the model reproduced below, ‘Factors influencing...’, Easterby-Smith *et al.* (2008) identify promising areas for future research: (1) the role of boundaries (organisational, national and industrial cluster), (2) the relationship between inter-organisational and intra-organisational KT e.g. national cultural differences are more pronounced in intra-firm KT, but power relationships matter more in inter-firm transfer (Van Wijk *et al.* 2008); and (3) qualitative methods provide better description and lead to fuller understanding of how things change in time or topics such as the role of culture, but quantitative methods are considered to be better at measuring change at a given time or topics such as cooperation versus competition. Easterby-Smith *et al.* recommend the application of mixed methods to gain the best of each.



**Figure (2-21): Factors influencing inter-organisational KT (Easterby-Smith *et al.*, 2008)**

The last part of this chapter (literature on KT initiative solutions) presented studies on possible ways to design and implement KT projects. In those studies, researchers consistently cover three distinct processes. First, they identify a knowledge gap for seekers and explore methods and strategies that may fill this gap. Then they attempt to outline mechanisms for knowledge acquisition and knowledge flow from knowledge providers to knowledge seekers. Finally, they review the ‘post-action’ phase where knowledge seekers share, internalise and learn from the experiences of the previous process implementation. This suggests that previous research follows a cascaded approach to design and implement KT initiatives.

In summary, the models outlined above provide an empirical agenda that operationalises their constituent elements. In this sense, I presented the relationship between dynamic capabilities and knowledge, the role of KM infrastructures and the contingency aspect of technical versus social as well as exploration versus exploitation in trade-off approaches.

## 2.14. CONCLUSION

A first overall understanding suggests that future organisational activity in KT needs to be devoted to building high organisational learning capacity and appropriate core competences in engineering organisations rather than relying on a technological fix to construct formal knowledge management systems. In the context of the engineering research industry, outside resources are mainly outside engineering knowledge, seen in patents that other organisations hold. Organisations therefore can create and exploit competitive advantage by combining existing internal resources with outside resources to create new resources, in the form of new innovations. Since technology is dependent upon innovation, the thesis puts forward the proposition that the more a firm exploits its access to technological resources, the more innovative and competitive that firm will be.

A second overall understanding concerns the major differences between the engineering evidence base—typically explicit, quantitative and methodologically agreed—and a more flexible and contested body of KM (literature/practice). I raised in this chapter a large number of different and even competing social science literature streams, which indicate that engineering research organisations need to review and decide which approach makes most sense to them, using local contextual circumstances. Another important point is that KM should not be perceived narrowly as a highly technical or IT driven activity but as critically important from social, political and cultural perspectives.

From a strategy perspective, RBV and KBV suggest that knowledge is a critical resource for firms. Theories of KM posit that firms need to actively manage the acquisition of knowledge, and that corporate strategies need to be centred on the resource of knowledge in order to gain and sustain a competitive advantage. However, I doubt that diffusion of knowledge can be taken as a *fait accompli* when knowledge codification is achieved. Theories of OL indicate that all firms within an industry are not equally positioned to engage in knowledge acquisition; internal factors of the firm affect the ability of the firm to acquire and use information. Thus,

in one industry, such as the RandD industry, one would expect differences among firms in their ability to absorb and use outside knowledge. National culture may magnify these differences.

KM requires a dynamic network of knowledge flows to facilitate knowledge acquisition and transfer (Holsapple and Joshi, 2002). Knowledge flows from one activity to the other are realized by sending and receiving knowledge messages (Holsapple and Joshi 2002). These knowledge messages may vary in form from procedural as in specifying how activities should be carried out to nonprocedural as in dealing with what knowledge is needed (Holsapple and Joshi 2002). It can range from being explicit as in instructions or implicit as in indirect recognition of a need. It may require fast or routinely flows. These attributes are especially important to this study when designing the architecture of the framework system in terms of the KT processes involved and its specifications.

It is the context-specific, tacit intangible knowledge grounded in organisational processes that tends to differentiate organisations and thus creates a competitive advantage (Zack, 2002). The KBV is based on humans as dynamic beings, and firms as dynamic entities (Nonaka *et al.*, 2000). In this chapter I have presented the KM strategies that can assist in capturing necessary knowledge for Saudi engineering research firms to achieve competitive advantage. These KM strategies have been drawn from the literature e.g. see part C described earlier in this chapter. The KM strategy would then implement internal KT techniques to internalise knowledge. The main conceptual frameworks developed in this chapter were particularly devoted to KT barriers, i.e. individual, organisational, knowledge. Each level of the KT barriers provides a new level of understanding to the KT problem. This chapter has provided a literature review to the debate on many concepts. The measurement of LOC and KT processes in chapters 5 and 6 will provide a platform to accurately identify KT barriers in chapter 7. In the following chapters, I aim to uncover different concepts relating to the KT problem that may enable the design of an initial KT strategy for Saudi engineering research organisations (Wright, 1993, Newbern and Dansereau, 1993).

# CHAPTER 3: CONCEPTUAL FRAMEWORK

*“Although the expert diagnostician, taxonomist and cotton-classer can indicate their clues and formulate their maxims, they know more than they can tell, knowing them only in practice, as instrumental particulars, and not explicitly, as objects.”*

*(Polanyi, 1958 cited in Dreyfus, 1988)*

## 3.1 OVERVIEW

This chapter presents the conceptual framework for the thesis to examine knowledge flows at three engineering research organisations in Saudi Arabia. The conceptual framework that will guide this study builds on the literature review (see chapter 2). It represents a continuation to the theoretical lens and practical work carried by previous researchers in this area. The theory from previous research was used to design the research instruments, which include questionnaires, interview questions and focus groups. As this chapter is considered a basic platform for this research, the theoretical lens for this chapter focuses primarily on the following elements:

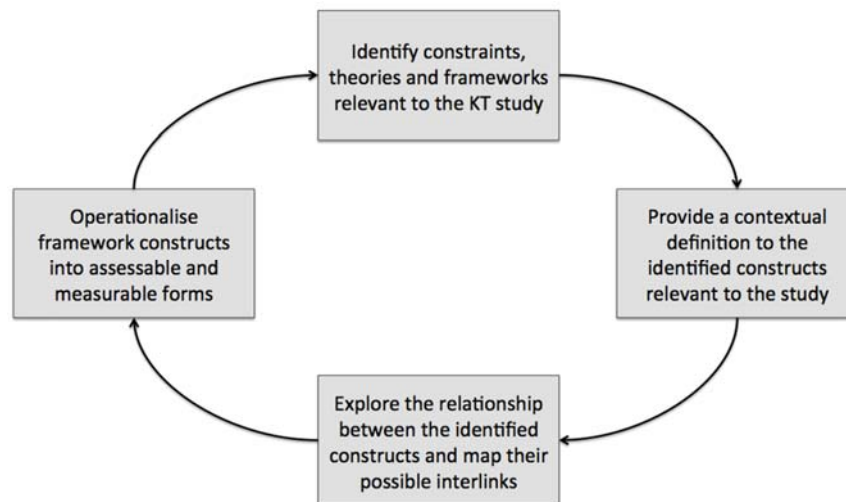
- (1) What is the current and aspired performance of the knowledge strategy at the selected Saudi engineering research organisations? (i.e. the learning capability gap)
- (2) Where is knowledge currently flowing within and across the selected organisations? (i.e. the actual knowledge flow within core business processes)
- (3) What are the barriers impeding current knowledge flows within KT processes? (i.e. the underlying behaviours that create problems in KT processes)
- (4) How can an appropriate knowledge transfer strategy be initiated to address the above? (i.e. the formulation of the KT strategy)

### 3.1.1 ON ELICITING MEANING FROM PREVIOUS THEORY

My understanding of KT draws on a wide range of theories and conceptual frameworks. In the previous chapter, I examined theories on knowledge, organisational strategy, knowledge management, OL, and the LO. I have also examined the theory of SNA, communities of practice (CoP), systems thinking, communication, psychometrics, BPR, individual capability, motivation and organisational culture. These provided a cohesive theoretical basis for this thesis. It was essential to synergise the above elements into an appropriate fit that addresses, in a meaningful way, the jigsaw puzzle of the KT phenomena. This chapter explains how previous research was used to design a KT framework for this thesis. However, as Veal (2005) explains, this chapter was a great initial challenge:

The development of a conceptual framework is arguably the most important part of any research project and the most difficult ... A conceptual framework involves concepts. These are general representations of the phenomena to be studied -the 'building blocks' of a study. (p. 33)

The challenge associated with the development of a conceptual framework is how to operationalise the study into an assessable or measurable form (Veal, 2005). The process involved identifying and positioning fragmented constructs relevant to KT by understanding each construct and positioning them in a logical order to form the final list of theoretical constructs (Veal, 2005). From a qualitative perspective, the resulting list allowed for a theoretical foundation that would evolve as the study matured. Figure (3-1) presents the steps that took place to depict this process.



**Figure 3-1: Conceptual framework development process (Adapted from Veal, 2005)**



The above figure explains the systematic approach adopted to build the conceptual framework. However, the way each of the boxes were operationalised depended on the type of construct and its relevant literature. New models to measure and operationalise these constructs were designed when the literature did not provide suitable means to fulfil my requirements. These models represent my theoretical contributions, which are highlighted when they occur throughout the thesis.

### 3.1.2 USING CONCEPTUAL FRAMEWORKS FOR EMPIRICAL STUDIES

A conceptual framework is defined as “an understanding of an issue or area of study that provides structure, and communicates relationships within a system for a defined purpose, and supports decision-making and action” (Phaal *et al.*, 2004, p. 11). The challenge in analysing complex hierarchical phenomena like knowledge flows increases with the exponential growth of fragmented KM literature (Dwivedi *et al.*, 2011). A scientific plan can be seen as a guided rationale for the researcher that needs to be informed by previous studies. Without evidence of background research, it is difficult to sustain structure, cohesiveness and legitimacy, especially when the study is qualitative. A conceptual framework that is supported by a theoretical base, therefore, safeguards empirical research from deviating from the scientific path.

Problems occur when concepts are disaggregated from cohesively dynamic phenomena into reproduced near-cohesive man-made intellectual structure. This disaggregation risks losing essential dynamic elements that are embedded in the original system where connections were being broken (Lee and Chen, 2012). It is legitimate to ask, then, why do we need conceptual design for research if it risks losing the essence of reality? Trying to emulate reality directly does not offer control measures, and in research, we need to control cause and effect in a controlled environment (Checkland and Holwell, 1998). Cause and effect will become vague and loose without discrete variables. By defining those variables, it will be possible to explain how reality repeats itself, which is a major objective of science. Conceptual modelling thus strives to capture reality, which begins here with an initial conceptual design for examining knowledge flow. This is therefore an evolving activity that will evolve as long as our understanding of the phenomena evolves.

### **3.2. CONCEPTUAL FRAMEWORK DESIGN**

This research will use measurable constructs, based on existing literature, wherever possible. For some constructs, measurable instruments do not exist in the literature and therefore, new measures will be created. The literature review chapter highlighted that knowledge flow across and within the borders of organisations is highly contextual, culturally sensitive, social in nature, and with changing variables and fraught theoretical and empirical representations (McMahon, 1997). This implies that the study of KT is likely to be organisation-specific (i.e. what applies to organisation X may not apply to organisation Y and vice versa). Therefore, the inherent dependency of this study on time and place makes it impossible to be sure that theory A applies to an elsewhere organisation X unless it has been empirically tested over a reasonable time frame.

From this perspective, my approach in this thesis is to combine validated theory emerging from similar empirical studies and apply them to the organisations of this study. I do not claim though that the findings of this study will apply to other industries or countries. This could only be stated if the study is empirically re-tested. In order to examine the problem of KT, and ultimately devise a KT strategy, it is essential for this thesis to consider the various variables (constructs) involved. The conceptual development will cover: (1) testing the knowledge strategy, (2) examining KT processes, (3) examining underlying barriers, and (4) proposing a KT strategy.

#### **3.2.1 THE KNOWLEDGE STRATEGY**

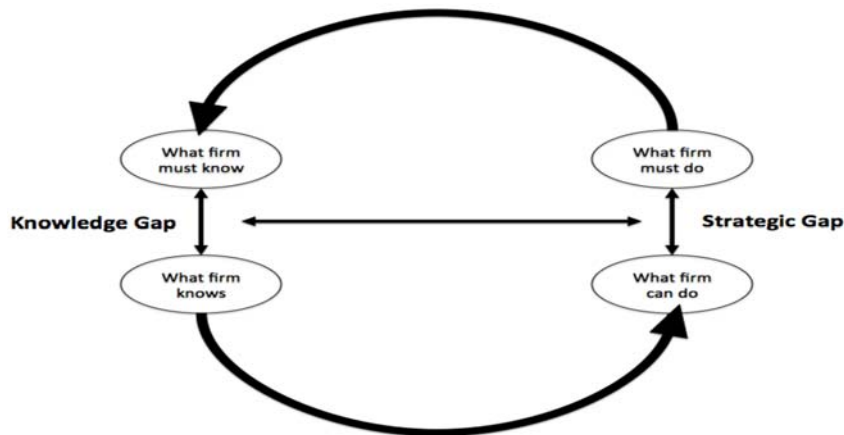
The KM literature suggests that any implementation framework should start with a knowledge (capability) strategy. This strategy should set a base line for benchmarking existing capability (i.e. how is our capability) against intended capability (i.e. how should our capability be) (Grant, 1996; Zack, 2002). A knowledge strategy may branch into several KM strategies to fill the identified capability gap. KM strategies however, require specific capabilities to guide the knowledge activity (dynamic movement of knowledge) at an organisational level and devise plans for implementation. One important KM strategy that focuses knowledge flows is the KT

strategy. Examining the knowledge flow to provide a platform for building a KT strategy for Saudi engineering research organisations is the goal of this thesis.

In order to build coherence to this complex study, I begin with aligning business strategy with knowledge strategy and then examine the knowledge flows towards a KT strategy. In this section, the knowledge strategy theme builds on two constructs: (1) alignment with the overall business strategy and (2) setting the LO aspiration model to build the learning performance capability.

### 3.2.2 THE BUSINESS ALIGNMENT CONSTRUCT

One of the most widely discussed models for knowledge strategy is the alignment between knowledge and business strategy. The well-known SWOT model for strategy building was adapted to a K-SWOT model. K-SWOT is a fundamental way for aligning knowledge with business strategy and providing an external versus internal focus (Zack, 2002). The strategic linkage between SWOT and K-SWOT illustrates what the organisation was *doing* with what it already *knew* (existing capabilities) (Zack, 2002). Aligning strategy with capabilities is illustrated in figure (3-2).



**Figure 3-2: Knowledge strategy alignment with business strategy (Zack, 2002)**

According to Tiwana (2002), linking business strategy with knowledge strategy includes examining the need for external and internal knowledge. The internal capability mapping can determine the focus of the organisational knowledge strategy. This can be implemented through a KM strategy. The external knowledge mapping, which includes both strategic SWOT and K-based SWOT will determine the KM strategy. Table (3-1), a summary version of Table (2-6), describes this construct.

	Knowledge dimension	KM strategy description
1	Internal knowledge source	Knowledge activities within the organisation's boundaries.
2	External knowledge sources	Knowledge activities outside the organisation's boundaries.
3	System (codification)	Codifying, storing, sharing and using an organisation's explicit knowledge
4	Human (personalization)	Acquiring and sharing tacit knowledge and interpersonal experience.
5	Exploitation (leveraging knowledge)	Focus on creating new knowledge
6	Exploration (creating knowledge)	Focus on incrementally expanding existing knowledge base
7	Centralized knowledge profile	High degree of integration in knowledge flows across different functions in an Organisation
8	Decentralized knowledge profile	Each sub units or functional departments has its relatively independent knowledge requirements
9	Deep knowledge base	Focus on specific domain of knowledge or core competencies
10	Broad knowledge base	Multiple/generic knowledge and product. Integrated different knowledge streams

**Table 3-1: The link between knowledge and KM strategy through external and internal mapping**

In chapter 2, table 2.6 provided strategy relationships with KM constructs, while table 3.1 above lists the strategic choices necessary to develop a knowledge strategy. The dimensions presented in table (3-1) are perceived as knowledge strategic choices (Zack, 1999; Asoh, 2004; Choi and Lee, 2003; Bierly and Daly, 2002; Bierly and Chakrabarti, 2000). Asoh (2004) for instance, stated that strategy requires some sort of compromise in terms of selecting a KM strategy. Since the act of compromise entails a decision being made with full understanding of the consequences of a particular choice, it is essential to be conscious of the differences between KM strategies. Organisations thus select their knowledge strategic goals and focus on one KM activity or the other as a strategic decision that can lead to the success or failure of the knowledge strategy (Asoh, 2004).

A knowledge-based SWOT analysis (Zack, 2002; Mertins, *et al.*, 2003) of Saudi research organisations may reveal possible strengths and opportunities for a knowledge strategy that supports KT. For example, Saudi research organisations can offer to attract potential external knowledge sources by using some strategic strength such as the advantage of having engineering research sites nearby oil industry resources. This strength means overseas knowledge sources can gain access to

valuable field data that it is rarely possible to access without actually working with the Saudi research organisations. This trade-off scenario could further be developed into true partnership and perhaps spin-off products.

An organisation's knowledge strategy specifies how much it will focus on developing its capabilities (by transfer or creation). This position is reflected directly by customer perceptions, IP products and services, and/or internal innovations (McDonough *et al.*, 2008). The knowledge strategy also identifies the position intended to resemble the organisation self-recreation, such as new processes and procedures. The organisation's knowledge strategy also reflects the extent of innovation, ranging from incremental refinements to radical change, and the degree of newness to the customer or market that it wishes to incorporate into its external innovations.

### 3.3.3 THE LEARNING ORGANISATION (LO) CONSTRUCT

As an aspiration model for knowledge strategy, the LO is defined as 'the organisation where people continually expand their capacity to create the results they truly desire, where new and expansive thinking are nurtured, where collective aspirations are set free and where people are continually learning how to learn together' (Senge, 1990). The focus of this thesis is on the measurement of existing LOC. In other words, organisations design knowledge strategies to measure their learning capacity and implement relevant strategies to increase it using KM. Those that are successful, apply KM measures to align the knowledge flow path with the knowledge strategy to meet their specific business strategies.

Measuring the knowledge growth rate capacity is different than merely measuring knowledge stock (i.e. OKB). While OKB is a measure of knowledge resources and capability at a point in time, the aim of measuring the LOC extends beyond increasing organisational learning, where KT is a key process to measuring the rate of the current knowledge growth. By focusing on growth rate rather than a static measure, more meaning is revealed. For example, if the ability to sustain knowledge growth at a rate of 10% per annum, then the knowledge stock would *grow* by almost 60% in 5 years. This means ensuring a *fixed* knowledge growth rate (i.e. fixed at 10%), despite aiming

for increasing it (i.e. >10%), is more productive than focusing on checking existing OKB because it gives no indication to the future as the growth rate does.

Moreover, having a fixed OKB is alarming and involves the risk of falling into a knowledge decay curve, which means that the value of knowledge is declining (Massingham and Diment, 2009). It is therefore important to monitor knowledge growth rate capacity because this will probably ensure growing or at least sustaining the OKB. Thinking of sustaining the OKB could be misleading because knowledge quickly becomes obsolete (decays) if it does not grow (Massingham and Diment, 2009). Organisational knowledge strategy thus needs to align with knowledge growth rate to meet business strategic objectives. From this perspective the LOC is considered a measure for the knowledge strategy (Massingham, 2012).

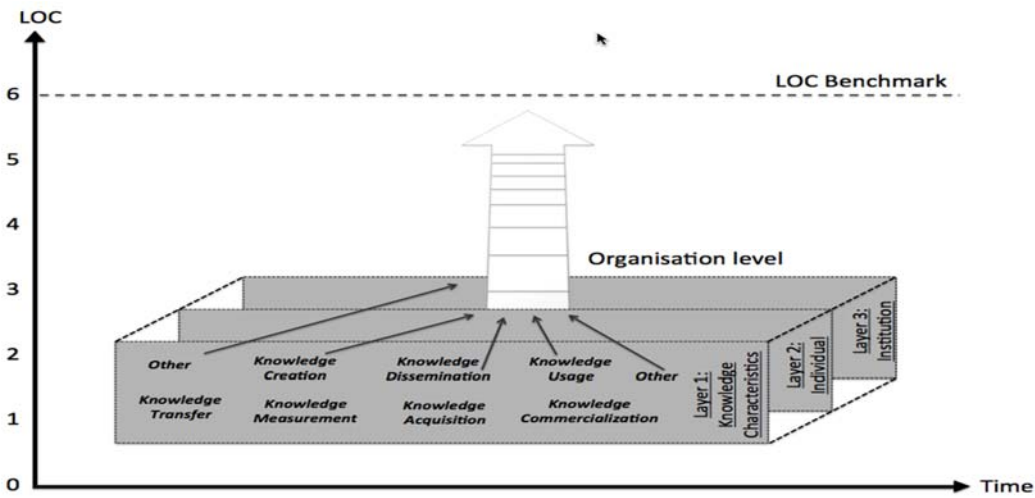
OL, on the other hand, serves as a profound catalyst for knowledge growth rate, as opposed to a measure in the case of the LOC. Although the LOC is more holistic than OKB growth, as it represents the knowledge strategy as a whole, it is accepted as a valid measurement benchmark for the increase of OKB (Massingham and Diment, 2009). Once the LOC is identified, an awareness of weaknesses in the knowledge strategy may emerge, and perhaps potential solutions. Through analysis, reflection and planning for action, organisations become aware of changes they should implement to improve their LOC to fill their capability gaps and achieve their knowledge strategy. To operationalising the LOC and identify a benchmark (the aspired capability - AC)), The capability gap can be filled via this formula:

$$\text{Capability Gap (CG)} = \text{LOC}\{\sum(\text{Aspired Capability (AsC)} - \text{Current Capability(CuC)})\text{Kd}\},$$

where Kd is knowledge domains that represent strategic competitiveness.

LOC serves as an efficient construct to operationalise learning capability, knowledge flow efficiency, organisational productivity, cultural adaptation, leadership attitude, and social capital (Phillips, 2003). It provides a gap measure for knowledge strategy to implement improvement through the aspiration of increasing the LOC score. Through measurement of the gap (knowledge strategy), and then implementation (i.e.

KM processes), the LOC score can be improved. As figure (3-3) shows, improving LOC includes a set of supporting activities (KT is only one of these activities).



**Figure 3-3: Improving LOC to close the knowledge strategy gap using different KM strategies (author's interpretation compiled from the literature)**

Variables that define the LOC measure have been identified by the work of Dr. Peter Massingham and validated through his Australian Research Council (ARC) project with the Australian Defence Department (2007-2011). Dr. Massingham has identified core variables that can measure the LOC status of an engineering-based organisation. These measures have been adapted to the needs of the knowledge strategy of the organisations under study in order to operationalise their LOC. Figure (3-5) summarizes the knowledge strategy elements that characterise the LOC construct.

Creating a knowledge strategy for an organisation means first that the current and aspired knowledge capabilities at the organisation have been clearly defined. The LOC measure combined with a benchmark can define this gap. Second, a knowledge strategy also means that the organisation has reached a clear understanding on the best ways for closing the identified capability gap. This implies selecting an appropriate KM strategy. Seven KM strategies were suggested by Mentzes *et al.* (2001): creation, application, exploitation, transfer, encapsulation, sourcing, and learning. Figure (3-4) illustrates the first conceptual element in this thesis, that is the conceptual model for the knowledge strategy.

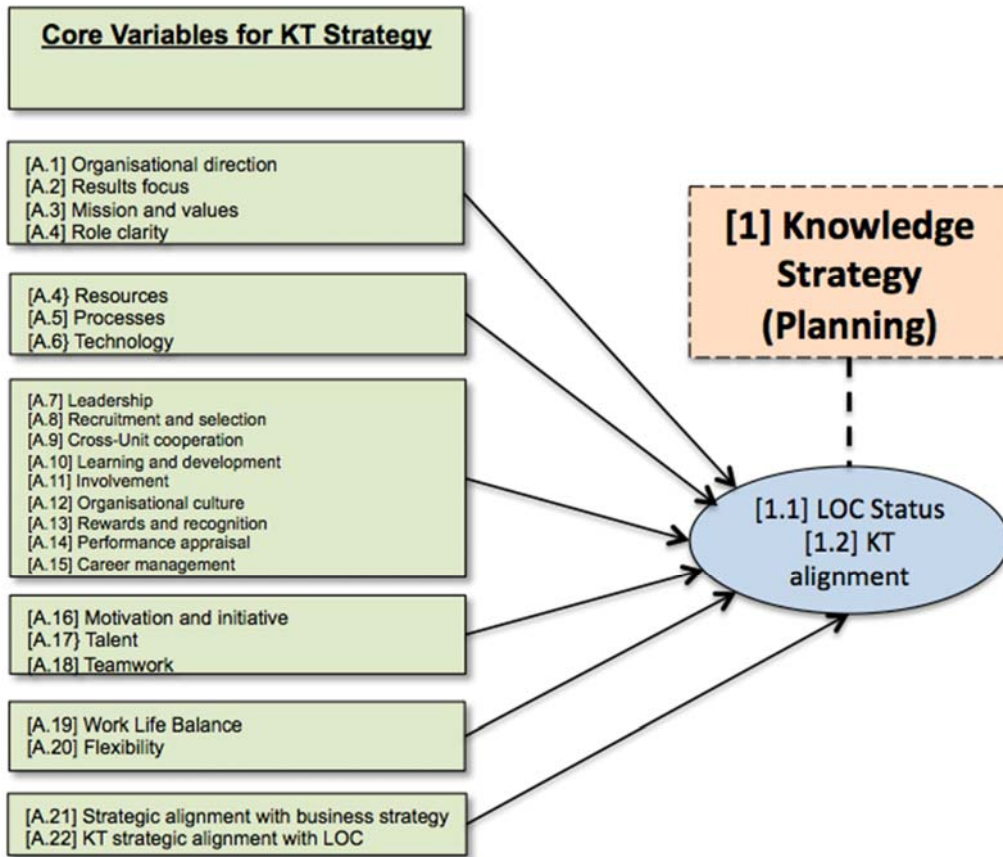


Figure 3-4: Operationalising the KT strategy element (Massingham, 2012)

The above figure shows how the LOC measure is built on broad range of KM field activities. Organisations that possess LO best practice performance must first harness many capabilities. These capabilities require different KM strategies, one of which is the KT strategy. Saudi engineering research organisations will undergo this measure to compare the results with selected international best practice organisations to identify the gap in the performance of Saudi organisations as learning organisations. This part of the study will take place in chapter 5 of this thesis. Table (3-2) provides definitions to the LOC variables listed in figure (3-4).



### CHAPTER 3: CONCEPTUAL FRAMEWORK

Table 3-2: LOC Construct Definitions		
Construct	Definition	Literature references
<b>(1) Purpose</b>		
<b>Organisational direction</b>	Focus on learning organisation goals	Mertins <i>et al.</i> (2003); Kluge <i>et al.</i> (2001)
<b>Results focus</b>	Set targets and conduct benchmarking	Kluge <i>et al.</i> (2001)
<b>Mission and values</b>	Shared mental models based on awareness of knowledge management	Moilanen (2005)
<b>Role clarity</b>	Staff understand their role and its contribution	Moilanen (2005)
<b>(2) Enablers</b>		
<b>Resources</b>	Physical environment, information	Kluge <i>et al.</i> (2001)
<b>Processes</b>	Procedures/standards aimed to ensure consistent and efficient work flow	Moilanen (2005)
<b>Technology</b>	Information technology and information systems	Mertins <i>et al.</i> (2003)
<b>(3) Participation</b>		
<b>Leadership</b>	Effective listening to staff and communication with staff	Marsick and Watkins (2003)
<b>Recruitment and selection</b>	Candidates are targeted for their contribution/fill gaps	Bontis (1998)
<b>Cross-Unit cooperation</b>	Inter-group knowledge sharing	Marsick and Watkins (2003)
<b>Learning and development</b>	Staff are continually learning (personal mastery)	Moilanen (2005); Kluge <i>et al.</i> (2001)
<b>Involvement</b>	Staff feel they are consulted and able to provide feedback (empowerment)	Marsick and Watkins (2003)
<b>Organisational culture</b>		Mertins <i>et al.</i> (2003)
<b>Rewards and recognition (Calculative reward and Calculative approval)</b>	Staff feel rewarded and recognised	Marsick and Watkins (2003)
<b>Performance appraisal</b>	Staff are evaluated in terms of desired learning organisation behaviours	Mertins <i>et al.</i> (2003)
<b>Career Management</b>	Competency mapping	Marsick and Watkins (2003)

### CHAPTER 3: CONCEPTUAL FRAMEWORK

Table 3-2: LOC Construct Definitions		
Construct	Definition	Literature references
<b>(4) People</b>		
<b>Motivation and initiative</b>	Staff intrinsic drive	Marsick and Watkins (2003)
<b>Talent</b>	Staff perception of the quality of other staff	Bontis (1998)
<b>Teamwork</b>	Staff work well in teams	Marsick and Watkins (2003)
<b>(5) Peace</b>		
<b>Work Life Balance</b>	Work and family balance	Marsick and Watkins (2003)
<b>Flexibility</b>	Staff autonomy and control over work decisions	Marsick and Watkins (2003)
<b>Passion Index</b>		
<b>Organisation commitment</b>	Staff emotional attachment to the organisation	Eisenberger <i>et al.</i> (1990)
<b>Job satisfaction</b>	Staff happiness at work	Eisenberger <i>et al.</i> (1990)
<b>Intention to stay</b>	Staff willingness to stay	Robinson and Rousseau (1994)
<b>Progress Index</b>		
<b>Organisational objectives</b>	Staff satisfaction with organisational performance overall	Bontis (1998)
<b>Change and innovation</b>	The organisation is changing, learning, and improving	Marsick and Watkins (2003)
<b>Customer satisfaction</b>	Engagement with customers and satisfactory performance	Bontis (1998)

**Table 3-2: LOC constructs (Massingham, 2012)**

### 3.4 THE KNOWLEDGE TRANSFER PROCESS

The knowledge capability gap means that KT performance within business processes is not optimal. This informs the KT strategy by implying the need for further examination of knowledge flow processes. It is not possible to propose a KT strategy without examining how knowledge currently flows and what are the problems associated with this flow. After the LOC showed the gap in knowledge capability, an understanding to the existing KT process becomes essential. This implies a shift in focus from the broad range of KM strategies to exclusively focus on the KT process. In doing so, the thesis will focus on the KT element activity for the objectives of (1) improving knowledge flow, (2) lifting knowledge flow barriers and (3) proposing an initial KT strategy that will accelerate knowledge flows and ultimately will reflect on improving LOC status. This part of the study is presented in chapter 6 of this thesis.

Referring to the KT theory literature, researchers assert that KT is about *managing fluid dynamics* rather than transferring stocks of knowledge from A to B (Polanyi, 1967; O'Dell, 2000). It is not possible to manage fluids directly; rather, fluids are managed by managing their carrier. In other words, KT is about managing the conduits in which fluid (knowledge) flows. As with water, knowledge cannot be mobilised without a carrier (conduit, pipe, canal, etc.). Smoothly moulding the edges of the conduit while cautiously minding internal flow obstacles that increase resistance to flow could result in a faster flow.

One main carrier for knowledge flows is core business processes, which carry instructions, decisions, rules, advice, guidelines, experiences, social interactions, know-how and codified documents from one person to one or more persons within and out of the organisation. Hence, rich knowledge content inherently flows within those processes, thereby resembling the embedded tacitness of learning by doing (Tsoukas, 2003). Unfortunately, business process routines, like physical fluid carriers, are often (1) ill-designed (i.e. too long, too many bends, too thin, breakable, etc.), (2) contains obstacles inside their flow path (i.e. not clean, rigid, filled with unwanted particles, etc.), and (3) mixed up (i.e. tangled with other fluids in the same conduit). The conduit is therefore physically unplanned, polluted and distorted (i.e. inefficient).

From a process improvement perspective, using the BPR construct revolutionises the KT process into a completely new level of performance (see chapter 6). BPR improves processes so that they become efficient carriers of knowledge (i.e. it eliminates waste elements) (Braz *et al.*, 2011). With the BPR approach, I focus on how knowledge is flowing in the organisation and how organisational interactions encapsulate and address business needs. This supports a well-defined business process from a design perspective for KT processes.

In chapter 5, the performance of the knowledge strategy as a whole we measured via the LOC, however, the focus is narrowed down from the wide and complex dimensions of knowledge as a strategic resource to specifically the flow of knowledge. In chapter 6, the focus is on business processes (i.e. business processes are knowledge carriers) that allow knowledge to flow. The rationale behind the transition from chapter 5 to chapter 6 comes from the perspective that the measurement of the health of the organisation as a LO (i.e. chapter 5) comes logically as an 'X-ray' assessment that precedes 'remedy'. Chapter 6, through the BPR approach, is considered the remedy to improve knowledge flows within processes.

### 3.4.1 THE BUSINESS PROCESS REENGINEERING (BPR) CONSTRUCT

The most essential driver for the pursuit of KM in organisations is accelerating knowledge flows (Armbrecht *et al.*, 2001). This implies that knowledge loses value if it is flowing too slowly. The faster knowledge can be exchanged, the more value an organisation can deliver to further its growth. The question becomes: how can knowledge flow velocity align itself with business processes? If KM can help align knowledge activities around organisational objectives, then this alignment may result in increasing productivity and creativity speed (Armbrecht *et al.*, 2001). For example, speed of decision-making, in the context of KT, aims to get the right knowledge to people who need it when they need it. BPR can target this objective.

In the context of improving knowledge flows, addressing the organisational capability requires (1) mapping core business processes, (2) identifying waste points in those processes that stand as knowledge blockages, and (3) addressing those knowledge

blockages. Figure (3-6) summarizes the KT process elements that will help build further understanding to the improvement of KT processes. Table (3-3) provides definitions for various variables related to the KT process as listed in figure (3-5).

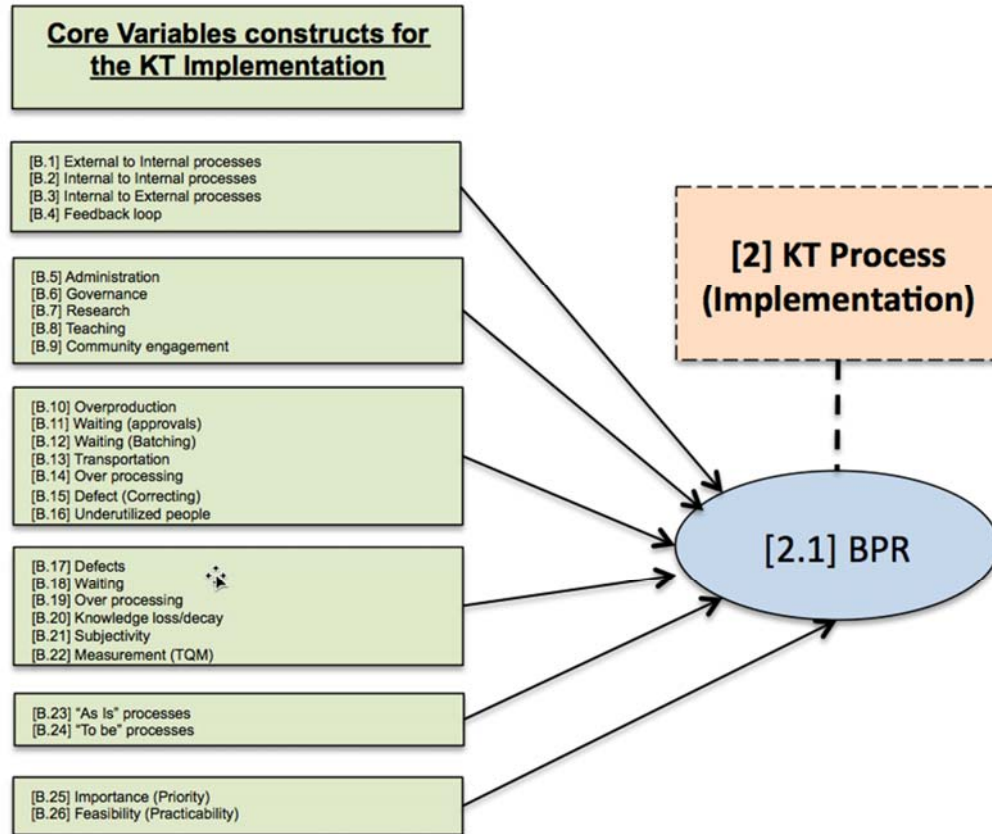


Figure 3-5: Operationalisation of the KT process (Massingham, 2012)

The elements B.1 to B.9 are unique to this thesis. The models that govern these concepts are presented in chapter 6. Most of this work is built upon the ARC project conducted by Dr. Peter Massingham (2008-2013), which provides a validity and reliability dimension. While the elements from B.10 to B.16 were sourced from the performance measurement and business process improvement literature, the elements from B.17 to B.22 are new in that they link KM concepts with quality concepts such as TQM. The elements B.23 and B.24 are based on lean thinking concepts. B.25 and B.26 are emergent elements due to my realisation of the large number of issues as well as the limited capacity to address them all at once. This thesis takes account of the multi-disciplinary nature of KM and therefore attempts to find appropriate methods to integrate the different constructs into a KM-BPR model.

### CHAPTER 3: CONCEPTUAL FRAMEWORK

Construct	Definition
<b>External-Internal KT System</b>	The inter-organisational process of knowledge flow from overseas external expert knowers to internal case study knowledge seekers.
<b>Internal-Internal KT System</b>	The intra-organisational process of knowledge flow from internal expert knowers to internal knowledge seekers.
<b>Internal-External KT System</b>	The inter-organisational process of knowledge flow from internal case study knowers to external local industry knowledge seekers.
<b>KT feedback loop System</b>	The process of comparing the input with output to feed-in as a control measure
<b>Administration activities</b>	The activities related to strategies, policies, routines, practices, culture and beliefs of executive level management.
<b>Academic governance activities</b>	The activities related to strategies, policies, routines, practices, culture and beliefs of middle management level
<b>Research activities</b>	The routines, practices, culture and beliefs of the research arena that the knowers and the knowledge seekers belong.
<b>Teaching activities</b>	The routines, practices, culture and beliefs of teaching activities
<b>Community engagement activities</b>	The routines, practices, culture and beliefs that connect organisational knowers with their local communities.
<b>Overproduction</b>	The excess of work output units that provide little or no use to the organisation in terms of performance, productivity or profitability.
<b>Waiting (approvals/batching)</b>	The time consumed where the process is on an idle status (i.e. no activity taking place).
<b>Transportation</b>	The time each task within the process needs to be transported from a service provider to the other (i.e. department to department or employee to employee).
<b>Over processing</b>	The calculative excess of task processing precision cycle units that provide little or no use to the organisation in terms of performance, productivity or profitability.
<b>Defect (correcting)</b>	The calculative irregularity in processing work tasks that result in re-processing of the same task that results in negative effects to the organisation in terms of performance, productivity or profitability.
<b>Under-utilised people</b>	The calculative shortage in task assignment to capable staff that result in negative effects to the organisation in terms of performance, productivity or profitability.
<b>Defects</b>	The existence of design problems in the process
<b>Over-processing</b>	The processing that add little or no value to the output of the process
<b>Knowledge loss/decay</b>	The knowledge that is embedded within the process that is not preserved
<b>Subjectivity</b>	Processes that rely on individual tacit expertise that does not use objective approaches. These processes are difficult to assess in terms of accuracy, efficiency or value.
<b>Measurement (TQM)</b>	The level of adherence of processes to given standards and guidelines to operationalise quality and efficiency of operations.
<b>‘As Is’ processes</b>	The current way a business process functions.
<b>‘To Be’ processes</b>	The targeted way a business process is aimed to function.
<b>Feasibility</b>	The level of capability in improving a process
<b>Importance (Priority)</b>	The priority level in importance to address a process problem on a scale of 1-10.
<b>Feasibility (practicability)</b>	The ability of the organisation to modify a process in terms of internal ability and process flexibility to be modified on a scale of 1-10.

**Table 3-3: KT constructs (Massingham, 2012)**

### 3.5 THE UNDERLYING KNOWLEDGE TRANSFER BARRIERS

From a static perspective, business processes usually face *unplanned* blockages that prevent or impede knowledge flow embedded within a business process. Such blockages can be removed or remedied without altering the business process design structure if an attempt is made to resolve the root-cause of the blockage (i.e. loyalty, trust, commitment, absorptive capacity, language, etc.). Once the cause of the barrier is addressed, knowledge flow can start to mobilise as planned by the business process.

The organisational level perspective is the primary focus. However, whenever an individual level factor influences the organisational level, then it is considered a variable in this thesis. Individuals are viewed as part of these flows because individuals are sending and receiving knowledge. Human behaviour from a human and relational capital is inherently embedded in the organisation unit of analysis as (1) major elements of the business process workflow and (2) possible impediments to the flow of knowledge. This recognizes that individuals represent the basic building block of collective action within organisations.

Chapter 2 provided a three-level taxonomy for knowledge flow blockages that exist in business processes. The knowledge characteristics level was concerned with knowledge itself and explored further sub-constructs of the attributed knowledge and knowing (see section 2.2 of chapter 2 for details). The individual level taxonomy was concerned with human level phenomena, which also branches into further taxonomy. Organisational level blockages provide the essence of the knowledge flow study and are classified into policies, processes, resources, systems and culture.

As business process design could negatively impact attaining high LOC, knowledge flow blockages may also be responsible for resisting the attainment of the LOC ideal status. Looking at the KT phenomena from both a processual point of view (see chapter 6) and a situational barriers point of view (see chapter 7) aims to sustain focus on the objective of this thesis in providing a deep diagnostic understanding of the challenges faced by engineering research organisations in Saudi Arabia. The purpose in trying to understand the KT phenomena is to remove obstacles to knowledge flow

and identify a KT strategy that may reflect a high LO status. All process improvements suggested in this thesis fall under targeting a higher LO status. In the following sections, I conceptualise the underlying KT barriers to relate to: (1) knowledge barriers, (2) individual barriers, and (3) organisational barriers. The literature provided further theoretical constructs that will conceptually guide the examination of KT barriers. The following sections provide an introduction to each.

### **3.5.1 BARRIERS RELATING TO KNOWLEDGE LEVEL CONSTRUCTS**

The fact that knowledge is hard to define, impacts the ability to explore its effects on the KT process. Blockages related to knowledge characteristics in terms of causal ambiguity, complexity, specificity, tacitness and knowing of language are considered pertinent constructs in the literature to identify the KT blockages that may occur within business processes (see chapter 2). This thesis will aim to examine these issues and provide a qualitative assessment to their impact on Saudi research organisations.

### **3.5.2 BARRIERS RELATING TO INDIVIDUAL LEVEL CONSTRUCTS**

Individual level KT helps transfer explicit and tacit knowledge that ultimately may aggregate into the organisational level. In order to transfer tacit knowledge to organisations, individuals must behave in a suitable way and under specific conditions to transfer and share knowledge. These behaviours and conditions include transparency and teamwork while accompanying each other through social networks.

KT individual capability is likely to influence research outcomes to the extent that it determines productivity in performing tasks, and proficiency in applying functionality in decision-making and problem solving. It is observed that KT individual capability plays a large part in the overall technical research performance. In addition, psychological contract and motivation plays a significant role in promoting for KT.

### **3.5.3 BARRIERS RELATING TO ORGANISATIONAL LEVEL CONSTRUCTS**

The literature that connects knowledge strategy, implementation and barriers is disparate (Hill *et al.*, 1998). This study adds to this by arguing that organisational differences between developed and developing countries may have a major impact on



knowledge strategies and thus, require original research. The factors within organisational characteristics of the knowledge recipient organisations in Saudi Arabia requires the inclusion of national culture and its dynamics. The organisational factors in this area that will be examined include (1) organisational culture, (2) organisational policies, (3) organisational processes, (4) organisational systems and (5) organisational resources.

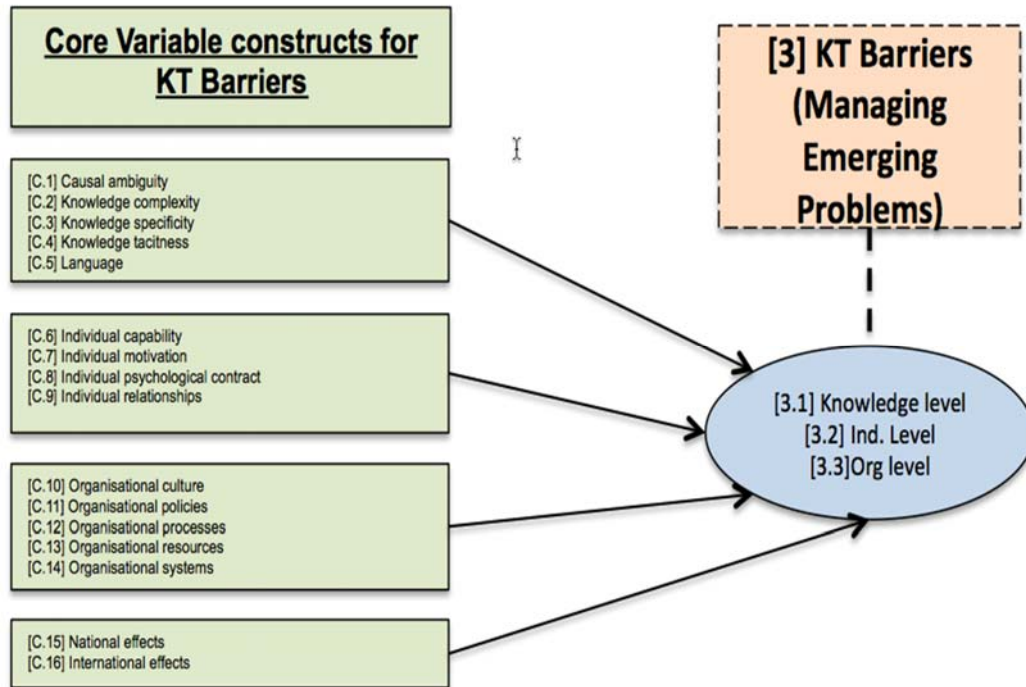
Each factor will be explained in detail in chapter 7. As an illustration, organisational culture is discussed. Culture can be seen as a major barrier or enabler to KT. Understanding that culture is the combination of shared history, expectations, unwritten rules and social mores that affect the behaviour of all employees in the organisation, shows the positive and negative impacts it can make on organisations (O'Dell and Jackson, 1999). Culture plays a vital role in connecting people together in order to bring about higher orders of tacit KT. As KT is a human activity, we therefore believe that the organisational culture construct is an important element for KT. The following table provides a summary on cultural constructs.

	<i>Study</i>	<i>Construct</i>	<i>Description</i>
<b>1</b>	Davenport, De Long and Beers (1998)	A knowledge friendly culture is the most important factor for successful KT.	<ol style="list-style-type: none"> <li>1. Has three characteristics:</li> <li>2. Employees are innovative and have a positive attitude towards knowledge.</li> <li>3. People do not have any fear of sharing knowledge.</li> <li>4. The Organisational culture must fit with the firm's objectives for knowledge management.</li> </ol>
<b>2</b>	(O'Dell and Jackson 1999).	Organisations that are team-based are more effective and efficient in KT.	<ol style="list-style-type: none"> <li>1. Slow cultural changes are due to it being a function of the past.</li> <li>2. Rewards, technology and facilitators are only effective if the current culture is a sharing one.</li> <li>3. KT works in healthy, sophisticated and collaborative cultures.</li> <li>4. Cross-functional communication is critical to K-sharing and know-how.</li> </ol>
<b>3</b>	Simonin (1999) Cummings and Teng (2003)	Differences between organisational culture of the transferor and the recipient has direct and indirect effects on KT	<ol style="list-style-type: none"> <li>1. The distance in respect of organisational culture between the source of knowledge (transferor) and the knowledge recipient increases the indirect likelihood of ambiguity in the knowledge that is to be transferred.</li> <li>2. The degree of similarity between the organisational cultures of two firms has a direct effect on the effectiveness of knowledge transfer.</li> </ol>

**Table 3-4: Cultural effects on KM activities**

Organisational culture plays a large part in the overall factors related to organisational performance. In the same way, other organisational level constructs can be analysed

from within to uncover possible hidden KT barriers. Figure (3-6) summarizes the KT elements that characterise KT barriers. Table (3-5) provides definitions for the barrier variables listed in figure (3-6) as sourced from the relevant literature references.



**Figure 3-6: The conceptualisation of possible underlying KT barriers (Massingham, 2012)**

The elements C.1 to C.5 relate to the KT barriers of a knowledge characteristics nature. The elements from C.6 to C.9 relate to individual level KT barriers. These factors may relate to internal individuals or the corresponding external experts, as individuals. The organisational level KT barriers are categorised in the elements from C.10 to C.14. National and international related KT barriers are grouped in C.15 and C.16 respectively. These elements are discussed in detail in chapter 7 of this thesis. I present Figure (3-7) to explain how both knowledge processes and barriers integrate into one scheme.

The figure below illustrates business processes within and across three organisations (see dotted circles for organisation X, Y and Z). The business processes represent channels for knowledge flows. The purpose of this figure is to illustrate how work processes combine both workflows and knowledge flows to mobilise tasks and knowledge respectively. This movement takes place within a complex networks that mobilise knowledge internally and externally across organisations.

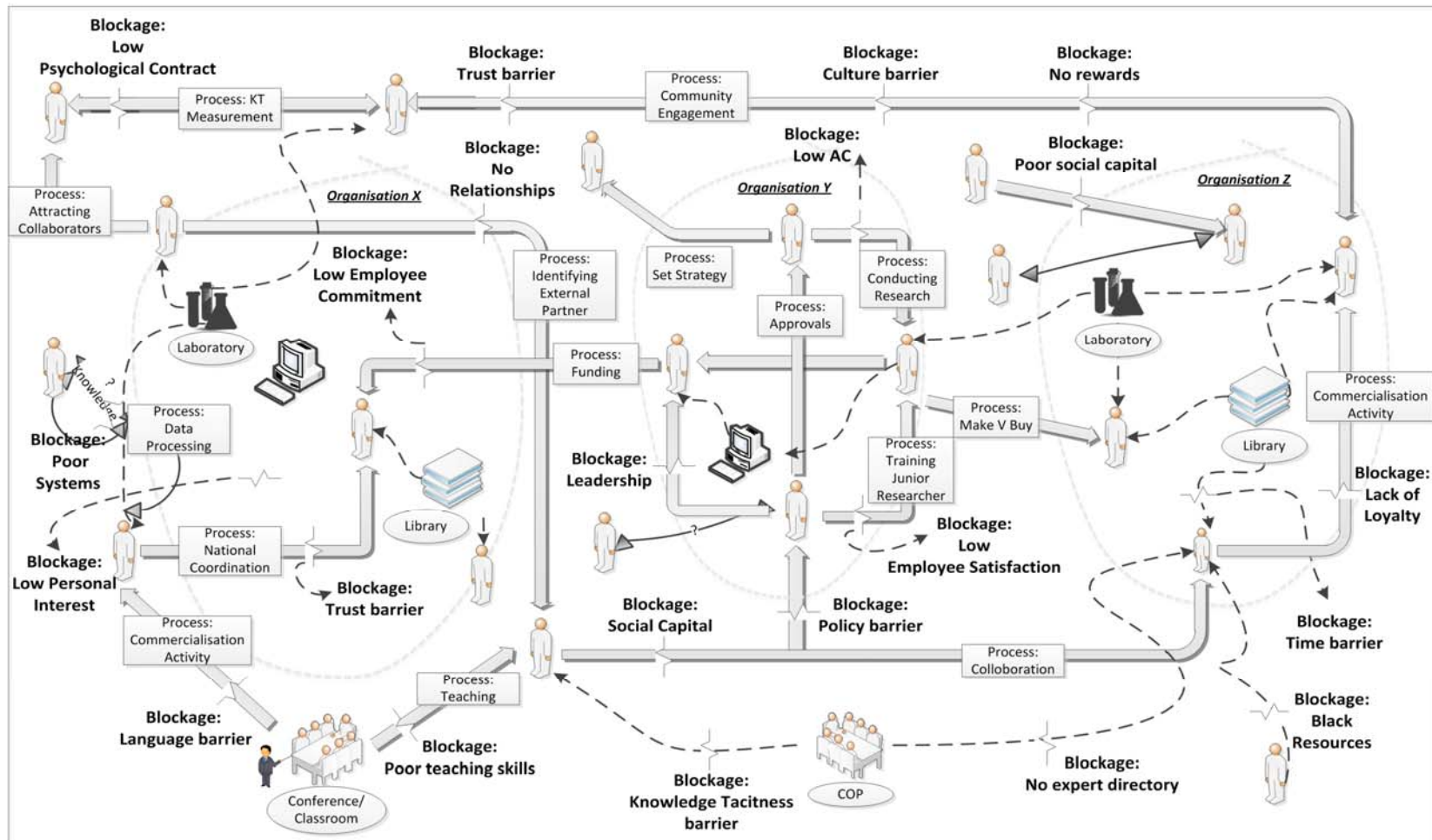


Figure 3-7: Illustration of knowledge blockages within business process for 3 organisations in a KT environment (author's interpretation compiled from the literature)

By starting from the right side of the figure, a process called ‘commercialisation’ shows a workflow within organisation Z. In this process, individuals who use other people, the library and a laboratory process tasks that lead to ‘commercialisation’. These individuals are simply doing their job. However, there are invisible knowledge flows that take place with workflows that only show visible tasks being processed according to the overall business process ‘commercialisation’. Knowledge flows deductively and inductively between people and through learning-by-doing. This means that when business processes face difficulties then so does the knowledge flows within them. KT barriers share with processes the underlying root-cause barriers. For the ‘commercialisation’ process, the underlying root-cause barrier is lack of loyalty. This barrier affected knowledge flows within the ‘commercialisation’ process. Such root-cause problems are called KT barriers. While task inefficiencies are visible and can be defined location-wise, KT barriers are usually invisible.

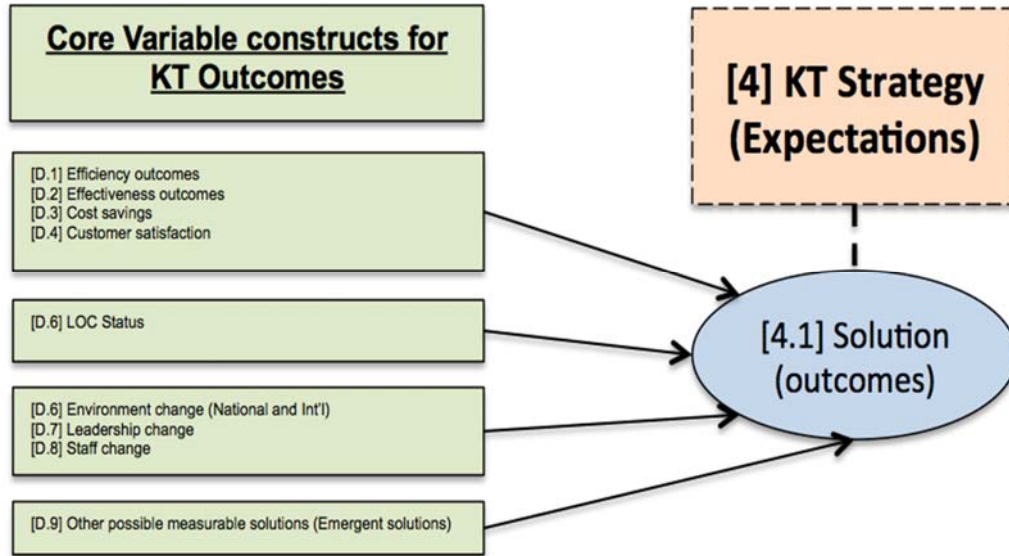
The fact that both business tasks and knowledge are mobilised as a by-product to doing normal business implies that KT is an evitable activity in any organisation. However, KT loses its value when (1) knowledge flows to the wrong individuals, teams or departments within the organisation, (2) it reaches the ones who need it at the wrong time, or (3) reaches the ones who need it at the right time but is incomplete or insufficient. For these reasons, managing knowledge flows is a serious matter for improving the value of the most valuable resource to organisations today, which is, knowledge. Saudi engineering research organisations need to eliminate KT barriers so they can accelerate knowledge flows to become learning organisations.

### 3.6 THE KT STRATEGY

The ultimate objective for this thesis is to assist Saudi organisations improve their LOC status to decrease their dependence on buying knowledge from overseas. The KT strategy, however, must first be informed by the following research activities:

- (1) Examining the LOC to identify the capability gap in the knowledge strategy
- (2) Examining the KT processes to identify waste points
- (3) Examining the KT barriers that cause the identified waste points

The KT strategy then builds on the above to allow for a significant change in LOC to occur. Figure (3-8) presents the conceptualisation of the KT strategy. This study will focus on the examination part that informs the development of the KT strategy. Nonetheless, an initial blueprint for the KT strategy will be presented in chapter 9.

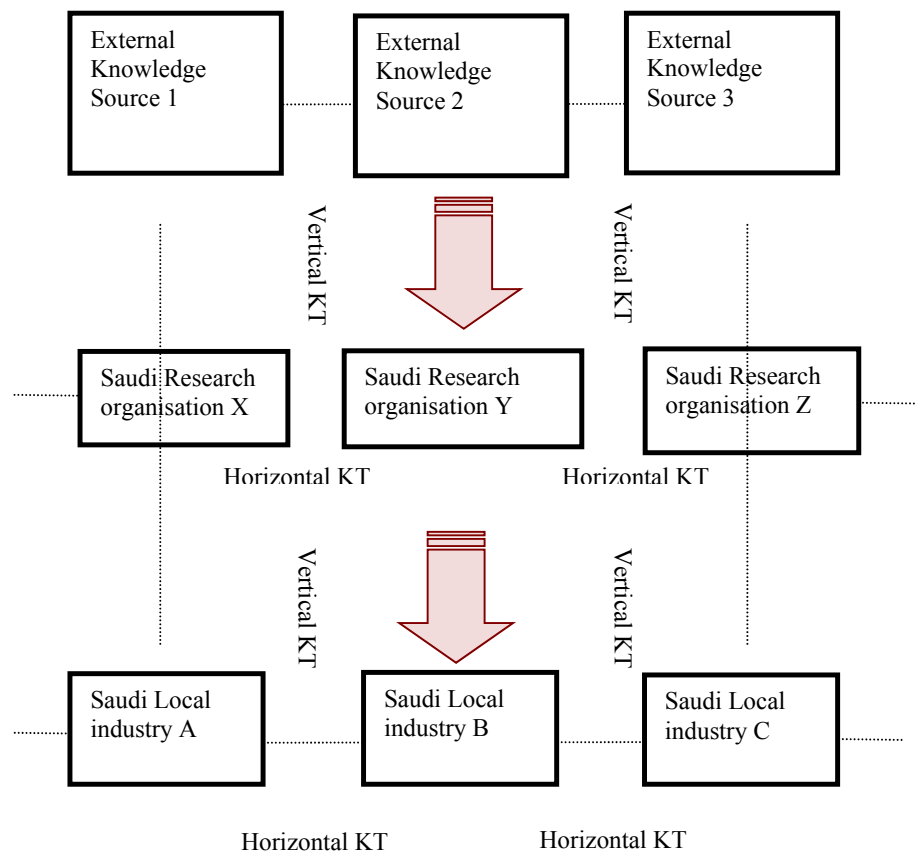


**Figure 3-8: Operationalising the KT strategy (author's interpretation compiled from the literature)**

Preliminary KT strategies will be presented in chapter 9 to establish the theoretical platform for providing a wide range of solutions that are filtered by a single model. However, it should be noted that the thesis aims to provide the platform for an initial KT strategy; rather than to develop the ultimate KT strategy. The scope of the thesis took a significant time to analyse as the thesis became very long. Therefore there was limited room to explore final solutions. Chapter 9 will present a roadmap for the host organisations to develop their KT strategy and to take this research further.

### 3.7 TOWARDS A SAUDI KT INTEGRATIVE SYSTEM

As leading Saudi engineering research organisations undergo in-depth surveys, interviews, observations, and focus groups, this research aims to have an impact on reality through change. The most critical aspects of their *raison d'être*, that is, the cause of existing, is to ultimately have a positive impact on the Saudi economy. This can only take place if research organisations produce commercial results based on optimum organisational performance to help the local industry expand. This implies including the local industry in this study. This section will explain how the previous conceptual framework will be constructed using a three-tier system that integrates overseas research experts with the local industry using the three research organisations as research proxy. Figure (3-9) illustrates the suggested KT system.



**Figure 3-9: Integrating external knowledge sources with the Saudi local industry**  
(author's original idea)

### 3.8 VERTICAL AND HORIZONTAL KNOWLEDGE SUPPLY CHAIN INTEGRATION

The process of KT from overseas sources is only the beginning of a longer process that empowers Saudi engineering capabilities to become globally competitive. In order to integrate a multiple level KT system that mobilises knowledge from overseas to local Saudi factories, an examination to supply chain is required (Swart *et al.*, 2001). Knowers and seekers may exchange places in the scale of time and context. The Saudi engineering research organisations might be knowledge seekers at one point but may become knowers at another. Saudi research organisations should act as knowledge catalysts for Saudi industry. In taking the role of catalysts, I suggest that Saudi research organisations take the role of knowledge seekers from external overseas sources at an initial stage, then take the role of knowers to support the local industry at a later stage. The above figure illustrates this concept through vertical KT.

The Saudi engineering research organisations may also integrate their knowledge with other research organisations in Saudi Arabia horizontally, as illustrated in the figure above. By working with peer research organisations, they can fill more gaps with less contextual adjustments. Also, once knowledge begins to mobilise towards local industries such as factories and consultancies, they may begin to share their knowledge horizontally within their respective industries a peer-to-peer fashion or collaborative alliances. There are rivalry issues that could emerge, but most local industries need to rethink their relationship with industry peers if they want to change their nation's weak competitive position in the face of rising international rivalry (Porter, 1990). The horizontal integration is important to fill the gaps for vertical integration and provide synergy that overcomes contextual and cultural challenges.

Building on this concept, I suggest that the vertical and horizontal knowledge integration processes in the figure above become a role model for engineering research organisations in Saudi Arabia (Prencipe, 1997). Empirical findings for the case of Saudi Arabia should provide a significant contribution to the study of vertical and horizontal knowledge flows defined as a national knowledge integration model. This thesis will focus on examining vertical integration knowledge flow processes.

### 3.9. FOCAL PROBLEM STATEMENT: SETTING THE STAGE

The conceptual and practical approach to developing an initial KT strategy for Saudi engineering research organisations is based on conducting an in-depth examination of vertical knowledge flow processes and identification of their underlying barriers. Figure 3-9 illustrates, starting from the left side, my view to implementing this study. First, under high uncertainty conditions, the performance of the knowledge strategy is examined via the LOC measure.

Second, the outcome of the LOC should guide the research activity to develop interview questions that help identify KT processes. Once KT activities are identified into logical core business processes, BPR, TQM and lean thinking may be applied to scrutinise process waste points. In the case that the number of KT processes was large, KT processes may be organised into feasibility versus importance matrices to prioritise them for inclusion in the initial KT strategy.

Third, the outcome of the identifying the list of KT processes and the waste points requires uncovering the underlying reasons for those waste points. These are called KT barriers where each barrier represents a root-cause for one or more waste point. The barriers are then filtered using an architecture, as illustrated in the figure below. This was explained earlier in section 2.3.3.

Fourth, the outcomes of the underlying root-cause for KT process waste points can then offer a clear target for addressing the knowledge flow problem at Saudi engineering research organisations. The process of planning a solution to the identified issues represents the platform for the initial KT strategy. These solutions should address LOC weaknesses, KT process efficiency problems (i.e. BPR) and KT process effectiveness problems (i.e. addressing root-cause). A long list of issues may require that the KT strategy be limited to highest priority issues. This process should be iterative, as illustrated by the dotted system on the right of figure (3-9). On the top of figure (3-9), the level of uncertainty, timing of steps, and the cyclic behaviour (in dotted lines on the top right) is highlighted.



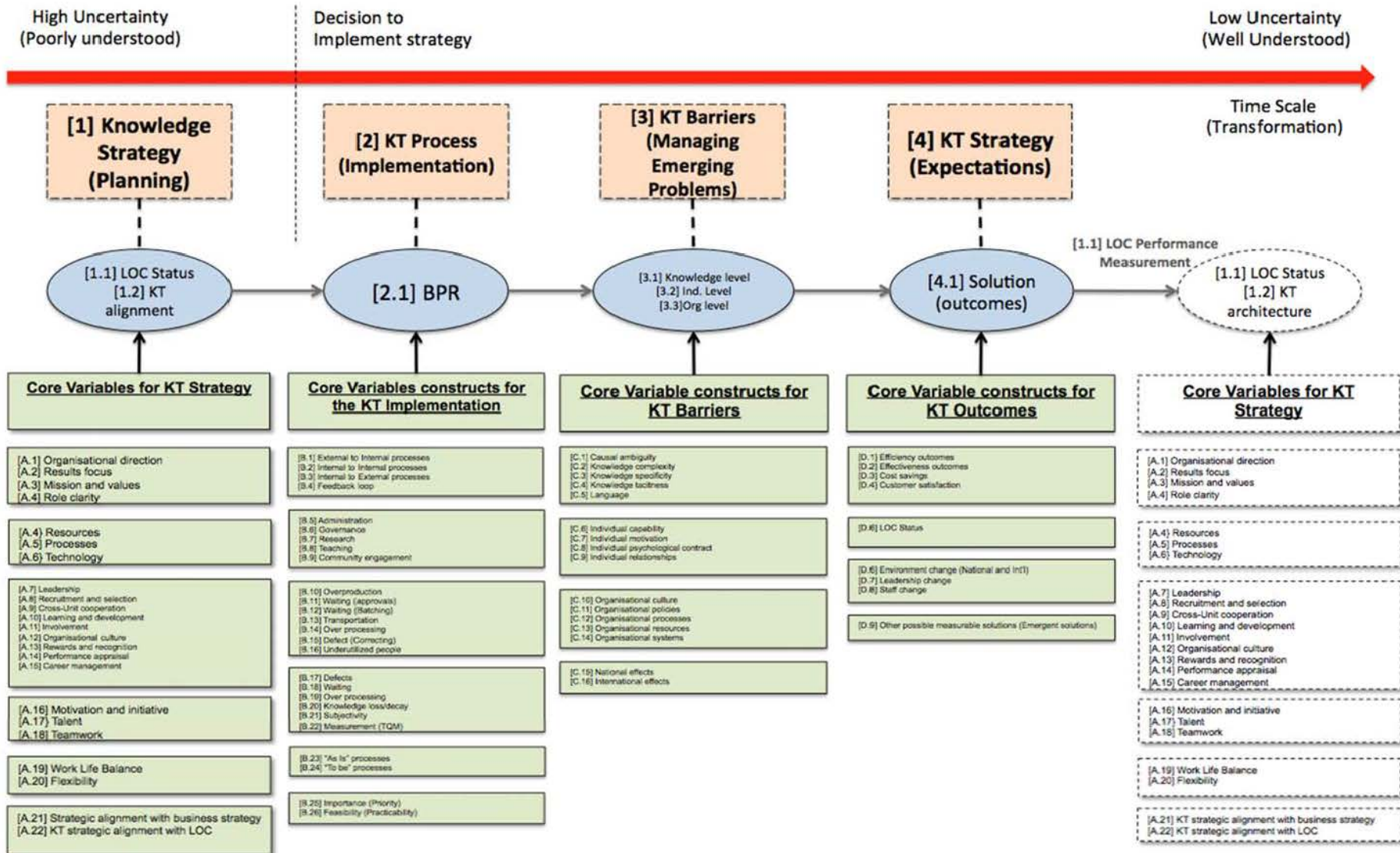


Figure 3-10: Thesis conceptual framework

The challenge in implementing the above conceptual framework lies in the selection of the appropriate approach to operationalise the constructs underlying each stage in figure (3-9). The theory from chapter 2 provides details on each construct in this figure. These constructs will be empirically examined in each relevant stage using a knowledge flow lens. Other KM theorists used the same constructs in their KM studies but with different lenses. For example, Nelson and Winter (1982) investigated organisational routines; Teece (1977, 1982) analysed technology transfer and proprietary knowledge; Nonaka (1990, 1994) contributed to knowledge-creating theory; Prusak (1997) investigated retention of knowledge in organisations; Davenport and Prusak (1998) studied how organisations manage what they know; and Serban and Luan (2002) offered a holistic overview of knowledge management. In this thesis, the focus of each construct is specific to accelerating knowledge flows.

The approach in this study scrutinises the three organisations on a micro-level. The way work is done on the individual level, the knowledge being transferred, the impact of the previous levels of analysis on the organisation and the national and international effects will be investigated. The starting point is from knowledge itself. These attributes of knowledge flow are especially important to this study when designing the architecture of the framework model for the initial KT strategy. Although, the examination process applies a micro-level approach, the initial KT strategy will offer a macro-level solution. Future research should provide further solution specifications to how the initial KT strategy could be broken into micro-level tasks.

Unlike functional science, which focuses on uniformity, I apply systematics, which focuses on the study of diversity (McKelvey, 1982). Systematics is based on the taxonomy, evolution, and classification of reality. In this chapter, I suggested figure (3-9) as way to uncover the reality of knowledge flow behaviour. My KT taxonomy approach of social reality in this framework should be viewed as a sense-making structure that facilitates the development of a conceptual model (Cavusgil *et al.*, 2003; Dayasindhu, 2002; Szulanski, 1996; Parent *et al.*, 2007).

### **3.10. CONCLUSION**

In terms of how KM intervenes in improving LO status, KM takes the form of change initiatives that modify organisational learning activities to increase the OKB. KM fits into this theme as it becomes disaggregated into activities and processes, making KM the contemporary approach to OL. There are eight building block KM systems, and each one of them in some way contributes to OL. KT is one of the eight building blocks (or strategies) for increasing OKB. This thesis argues that tracing the chain of cause and effect results ultimately in achieving high LOC status. This is the logic of the thesis and accordingly it places different chapters to cohesively interrelate in the context of achieving a high LOC.

In conclusion, the conceptual framework in this chapter does not yet constitute a fully developed conceptual theory of KT, but an initial formulation, based on a set of theoretical constructs and interrelated theories. This simplicity represents both a virtue and weakness. Its ability to highlight analytical activities embedded within KT processes is a strength, while its position as a primitive stage of theoretical development is a weakness. I aim to apply significant theoretical and empirical examination to assess its validity and theoretical contribution.

## CHAPTER 4: RESEARCH METHOD

*“If social scientists truly wish to understand certain phenomena, they should try to change them. Creating, not predicting, is the most robust test of validity-actionability”*

*(Kurt Lewin, cited in Argyris, 1997)*

### **4.1 BACKGROUND: THE PHILOSOPHICAL STANCE OF ACTION RESEARCH AND CHANGE**

Action Research (AR) is a research methodology defined as social research carried out by both the professional researcher and the members of an organisation for the purpose of improving a situation (Greenwood and Levin, 1998). Ragsdell (2009) defines AR as “[A] process that simultaneously aims to bring about change in organisational practices and to increase understanding of social science through researchers and organisational members working as partners in situations that are perceived to be problematic” (p. 566). This thesis advocates the philosophical stance that change is a process, not an event (Rosenfield and Gravois, 1996). Ideally, change is a process for improvement and growth (Senge, 1990). Whether it is the individual, the organisation, or the nation, it is certain that change events will occur, and consequences will follow, whether positive or negative in the form of a process. Given this certainty, change should not be left to happen; rather, it should be a legitimate process.

In this thesis, change (or better said, improvement) may take place at three levels: (1) individual, (2) organisation, and (3) country. Individual level improvement must embrace an inner change in beliefs, personal missions and long-term plans. Only then can positive change be realised (Goodson, 2001). Change for organisations should not be about data and analysis per se; rather, it should transform people within the organisation (Roettger, 2006). Organisations sharing an industry should develop standards and norms to benchmark against national change schemes. This places AR as a methodology that converts pure research into

practical research (Greenwood and Levin, 1998).

In this chapter, the factor of recurring change is also discussed (Checkland and Holwell, 1998). The absence of this factor prevents three research elements: (a) readiness to replicability (Ziman, 1968), (b) stability of variables in multiple locations, and (c) being homogeneous through time (Keynes, 1938 cited in Moggridge, 1976). While the power of scientific experimental methods lies in *replicability* to transform findings to public knowledge (Ziman, 1968), social methods, including AR, generate propositions that need further re-testing, re-confirming and re-aligning to other situations. Previous AR for KT cannot be adopted without testing each specific context (Foster, 1972); hence, there is no universal KT solution because compatibility issues always arise upon implementation of other research. This concept shows the original contribution of this work.

In order to ensure that action (what to do) follows an informed process (how to do it), sequencing is critical (Ryle, 1949). Previous research suggests that change initiatives cannot achieve success without embracing an action sequence carried out collectively by internal organisational members (Lewin, 1973; Schein, 1987; Cecez-kecmanovi and Moodie, 1999; Gibbons, 2001; Starkey and Madan, 2001; Corsini, 1984). Providing guidance on ‘*what to do*’ and ‘*how to do it*’ is thus at the heart of AR projects (Bjørn and Boulus, 2011). However, radical change is not a matter of mechanistic implementation, because the values necessary to realise the ‘ends’ are likely to be subverted, en route, if required values in the ‘means’ are absent (Shah *et al.*, 2007). The ends are vision and future perspectives and the means are values and belief that drive how one might progress towards it. It thus makes good sense to perceive transformational change as ‘a change in values, conceptions and attitudes’; rather than simply a change in technique of ‘how to do things’ (Winter, 2003).

Good AR changes values via its attempt to reflect on experience (Atwood, 2002). Bakhtin (1984) calls AR ‘a conversation in progress’, which evolves into further conversations and further questions. The bottom line is that AR does not claim to provide a *final* solution. The role of AR is above all based on questioning and being open to change. Thus AR should be a matter of questions posed without attempts at closure or achieving mastery (Olson, 1995). This view overlaps with Bakhtin’s (1984) concern to move dialogue from a magisterial genre into a more sceptical and questioning Socratic dialogic form. As such, this thesis provides an *unfinished* change journey. Only part of the journey is known because change journeys are long and emergent, hence; telling part of change journeys is legitimate AR.

**4.1.1 A HISTORICAL ARCHAEOLOGY OF AR**

One historical origin of AR lie in the literature of social change and group dynamics (Levin, 1994). AR originated from Lewin's work on change, represented by his three stage process: (unfreezing, changing, freezing) conceptualisation and the T-group technique (Greenwood and Levin, 1998). A chronological order for AR can follow this path: Lewin (1947), Blum (1955), Foster (1972), Clark (1972), Susman and Evered (1978), Hull and Lennung (1980), Argyris et al. (1985) and Susman (1983). Over the past 70 years, AR has evolved into a range of approaches such as Action Science (Argyris et al., 1985), Action Learning (Revans, 1982), Experiential Learning (Kolb, 1984); Reflective Practice (Schon, 1983); Soft Systems (Checkland and Scholes, 1990); and Innovation Action Research (Kaplan, 1998), to name just a few. Along these lines, Reason and Bradbury (2001) state:

The action research family includes a whole range of approaches and practices, each grounded in different traditions, in different philosophical and psychological assumptions, pursuing different political commitments. (p. 66)

Another source to AR was from the concepts of Critical Theory (Freire, 1985). The concept of critical theory is based on exerting focus on the nature of self-conscious critique and the discourse of social transformation that follows (Friere, 1985). In other words, the action that follows critical theories can be framed in social processes of transformation. Such process of critique then action can be applied to business and cultural social studies to produce a new concept of pedagogy that goes beyond teaching and schooling as it was originally intended (Friere, 1985). In this way, Action Research (AR) was considered a framework to guide the specifics of this process (Leonard and McLaren, 2002). AR thus seems to provide a useful link between the outputs of Critical theory and the inputs of practice in a circular fashion (Reason and Bradbury, 2001).

AR, however, always provided a commitment 'to ensure that research remains an opportunity for growth in understanding of ourselves, of the task, and of the other people involved in it; and growth in awareness of relevant bodies of knowledge' (Winter, 2006). Since its beginnings, AR, diverged into a family of methodologies, each of which preserved the elements of growth (Klocker, 2012). These elements include learning, understanding, reflecting and reporting of results, which are governed by four basic themes: empowerment of participants; collaboration through participation; acquisition of knowledge; and social change (Nielsen, 2005). AR produces knowledge from shared experiences that help in

achieving change in practice. AR enhances respect towards AR participants whose current understandings may initially be different from each other.

Other research methods were assessed for this thesis, such as the *case study* method. It was found to be a non-intervention method, which meant less effect of research on real-life outcomes (Gibbs, 2007). Trying to modify the research activity to fit within a situation is considered ‘single loop learning’ (Argyris and Schon, 1974). However, the intended research in this thesis goes beyond this insight to question the governing variables of the real-life situation and subject them to critical scrutiny so that to change or modify them. This is considered ‘double loop learning’ (Argyris and Schon, 1974). Governing variables were always questioned as if the grounded research approach was always implicitly present to discover new emerging variables.

## 4.2 SELECTING THE APPROPRIATE ACTION RESEARCH APPROACH

From the above historical waves of AR development, the approach for this study is derived. The AR approach to this thesis follows a step-by-step unfolding (later on called research cycles), that gradually addresses change tensions and resistances encountered. In many instances, I articulate a pragmatic approach to find the solution through understanding root-cause problems. At each stage (cycle), I peel off another layer of the '*onion*' to penetrate genuine underlying reasons for the problem. This follows the 'Socratic' method of scientific enquiry where the researcher continues to question until the answer or truth is found (Zuber-Skerritt and Fletcher, 2007). In AR, this process is endless (Greenwood and Levin, 1998). In my view, this is due to sustained change in how participants relate to their situations.

On an organisational level, firms are expected to perform as sites for the practice of civic virtues (sensitivity, compassion, patience, courage, honesty, diligence, etc.) (Levin, 2012). On this basis, necessary relationships and business processes, between those engaging in business should be based on a shared understanding of governing values (Levin, 2012). In AR, these virtues can find a fertile ecology that enables growth in knowledge, thereby, increased organisational performance (Gustavsen, 2008). As an example to illustrate honesty in applying AR, people should share their experience as part of their civic virtues. Honesty, therefore, is considered a main enabler to successful KT (O'Dell, 2000). Without this virtue, KT could provide misleading results when people hide their useful knowledge and share less useful knowledge.

On an individual level, reaching a shared understanding between AR participants to build transparency is a cornerstone for AR processes to reflect the actual success in improvement (Larsen, 2004). Final framing of results remains honestly placed as provisional, questionable, and continually incomplete (Schein, 1987). All involved, explicitly accept this limitation and acknowledge that they have no final answer (Winter and Badley, 2007). They tend to focus on exploiting their findings to generate new cycles for further reflection and action (Winter and Badley, 2007). This thesis adopts the view that the final findings and practical outcomes are provisional.

For AR to be sustained as a scientific method, it must have a clear set of timely sequential



framework themes that distinguishes it from merely being anecdotal (Checkland and Holwell, 1998). Figure (4-1) illustrates this sequential concept of AR that starts with a framework of ideas/constructs (F) (chapter 3), and proceeds through a method (M) (this chapter) to explore an area of concern (A) (chapter 2) (Checkland and Holwell, 1998). The concept is based on declaring the elements F, Mo, and A, not in hypotheses but using a thematic framework, F (explained in chapter 3) (Checkland and Holwell, 1998). The process of Figure (4-1) represents a learning cycle that plans for new experience cycles to evolve (i.e. Mo where o=1, 2, 3, n).

In chapter 3, I identified F (Conceptual framework themes/constructs) and in chapter 2, I identified A (exploration of the underpinning area of knowledge flow and relevant phenomena). In this chapter, I explicate the Mo element of this process. The learning *yields*, illustrated in Figure (4-1), generates knowledge from recurring AR cycles. Each cycle will be presented in a chapter. The modifications to F, M and A in this study were signs of new knowledge and experience generation (Shah *et al.*, 2007). The *learning about* arrows feed modifications processes to F, M and A to transform into new knowledge.

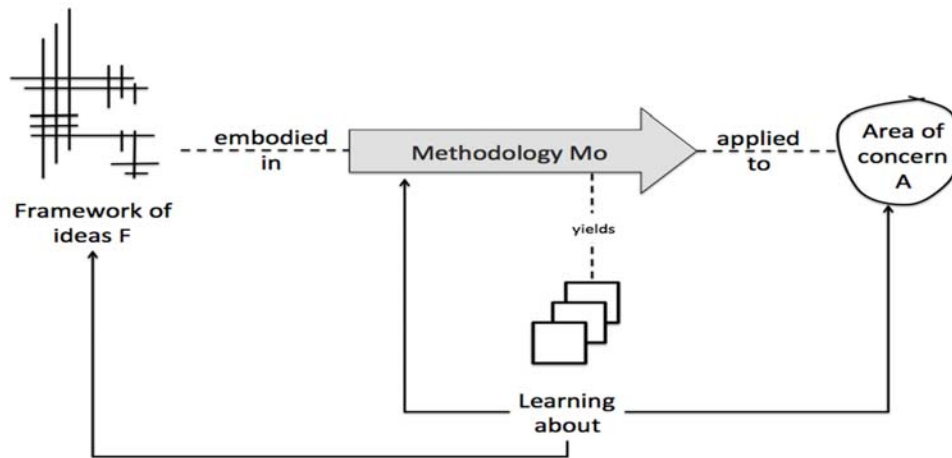


Figure 4-1: Conceptualisation of this AR study (Checkland and Holwell, 1998)

Based on the thematic conceptualisation framework (F) in chapter 3, the AR approach (M) was spirally shaped into *four* action cycles:

- (1) The KT strategy cycle (chapter 5)
- (2) The KT process cycle (chapter 6)
- (3) The KT barriers cycle (chapter 7)
- (4) The KT output cycle (chapters 8 and 9)

Each cycle consisted of six phases: engaging in the situation, finding the emerging definition of the cycle, planning for action, taking action, reflecting and reporting (Newcombe and Hartley, 1952; Schindler and Eppler, 2003). Before I engage in the next cycle, I reflect on the experience gained to inform the variables F, M and A of the following cycle accordingly (Grundy, 1982).

In contrast with other methods, AR demands that the researcher no longer maintain a distance or separation from the situation being researched (Dick *et al.*, 2009). This is a profound difference with the traditional view of research, which seeks objectivity in the research process. AR encourages subjectivity by recognizing that the researcher is part of the phenomena under investigation. This fits well with Lewin's slogan, "the best way to understand something is to try to change it" (French and Bell, 1978, p. 37). Change is therefore incorporated into the research process as a major source for growth and learning (Senge, 1990, 2006). I see learning through change and repetition of cycles as central to AR. This is often referred to as 'learning-by-doing', where doing feeds theory. This is conceptualised in Figure (4-2).

As much as chapters 2 and 3 were concerned with conceptual definitions, assumptions, relationships, and causality, this chapter will focus on measures that describe how I measure specific variables. Iteratively, the measurement task was achieved by referring to specific actions to indicate the presence of a construct. Such constructs are perceived in the real world, and believed to exist in reality. Hence, measurement instruments are discussed in this chapter to validate the suggested constructs in chapter 3, whereas reflection and analysis of the gathered data are discussed in the subsequent chapters.



Figure 4-2: The "learning by doing" process (Checkland and Holwell, 1998)

By critically comparing what people do and say, learning outcomes emerge through realising deviations between the two (Argyris, 1980). Realisation is a first step to eliminate this deviation. Improved effectiveness is suggested to be the outcome of matching *theory-in-use* (what we do) with *espoused theory* (what we say we do) (Argyris, 1980). When a mismatch occurs, Argyris and Schön (1974) call for single-loop (are we doing the thing right?) or double-loop learning (are we doing the right thing?). This is illustrated in Figure (4-3). In this process of questioning, reflecting and acting, AR builds upon the basic ‘trial and error’ model of *learning from theory and practical action* (Kemmis and McTaggart, 1988). Single-loop learning focuses on improving the tactical level of action that makes action more efficient as per existing rules (Usher and Bryant, 1989). Double-loop learning, more invasively, involves questioning values, policies and the governing variables that underlie action strategies and rules to bring more profound consequences (Argyris and Schön, 1974).

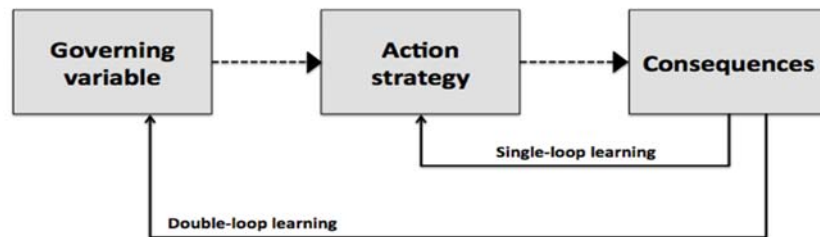


Figure 4-3: Using single-loop and double-loop learning in AR (Shah *et al.*, 2007)

From a sequential perspective, each learning cycle must explicitly derive knowledge from the preceding cycle and pass it to the next, using single and double loop learning processes. Knowledge passes up and to the bottom simultaneously as a two-way process. In this way, AR can be placed at three distinctive levels: namely, *strategic*, *tactical*, and *operational*. By aligning the learning gained with levels of management, AR cycles cohesively integrate. The KT framework should evolve therefore into a pragmatic thinking system. Each strategic level applies a number of AR cycles to answer its questions before moving down to the next strategic level. Figure (4-3) illustrates AR cycles distributed over the three strategic levels. This design was aligned to integrate the conceptual framework of chapter 3 methodologically.

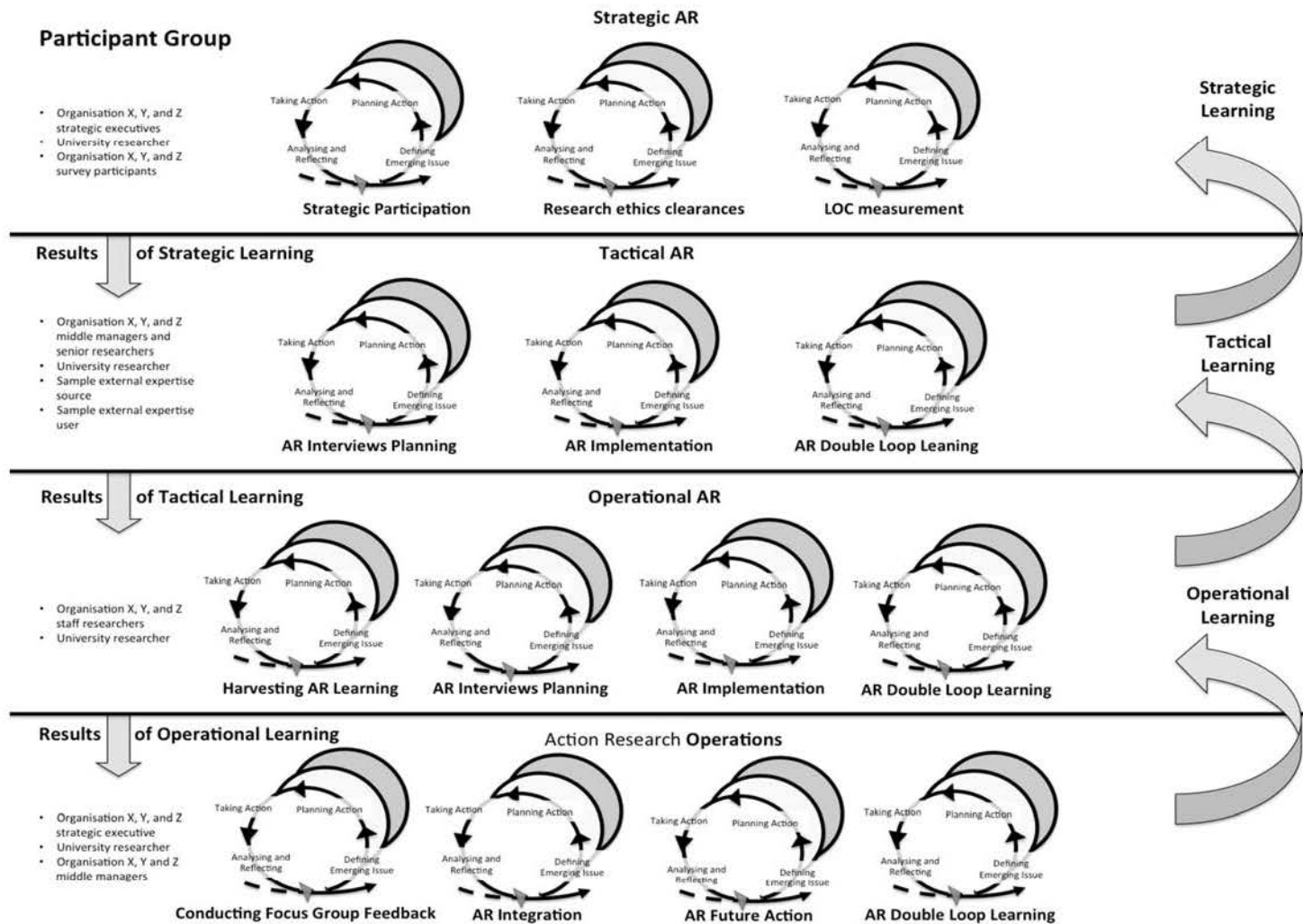


Figure 4-4: Alignment of management level learning with AR cycles (Shah *et al.*, 2007)

Figure (4-4) begins with Participant Groups (see top left hand corner). This refers to the functions which AR participants were sourced from. Looking from top-to-bottom in Figure (4-4), there are three dimensions: (1) strategic learning, (2) tactical learning, and (3) operational learning. As the participant group on the left side indicates, participants for each dimension were different according to their management level. In all groups, the university researcher (myself) was included. The AR cycles in each level (cycles flow from left to right) are defined in table (4-1).

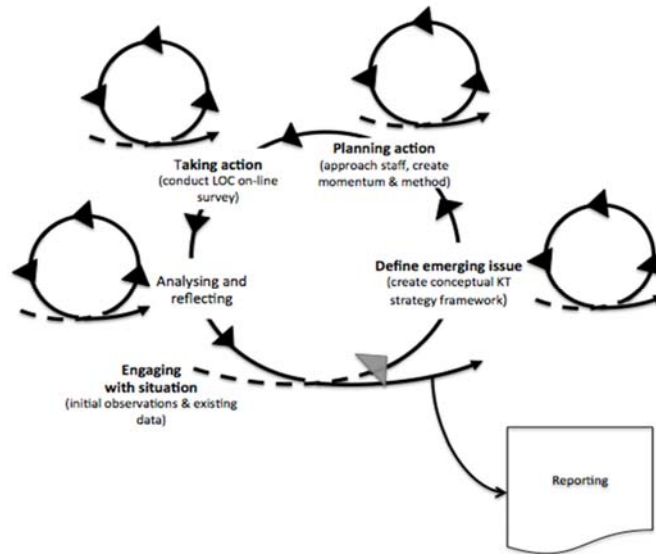
<b>Cycle Level</b>	<b>Sub-Cycle 1</b>	<b>Sub-Cycle 2</b>	<b>Sub-Cycle 3</b>	<b>Sub-Cycle 4</b>
<b>Strategic AR (AR cycle 1: Knowledge strategy)</b>	Participation: The cycle that served formalizing the participation of case study organisations.	Ethics: The cycle that served to completing UOW ethics form to commence research.	LOC: The cycle that served to conducting the online survey for AR cycle 1 (Ch. 5).	Reflection: The cycle that guided analysis and reflection.
<b>Tactical AR (AR cycle 2: KT process)</b>	Interviews planning: The cycle that served to recruit and formally enrol AR participants in the project.	Action: The cycle that served to conduct the face-to-face interviews in terms of time, space, and logistics (Ch. 6).	Reflection: The cycle that guided the process of preparing data for analysis and reflection.	N/A
<b>Operational AR (AR cycle 3: KT barriers)</b>	Contextualising: This cycle fed reflections of the tactical level into the learning of this cycle.	Interview planning: The cycle that served to recruit and formally enrol AR participants at the project for the operational level.	Action: The cycle that served to conduct the face-to-face interviews in terms of time, space, and logistics (Ch. 7).	Reflection: The cycle that guided the preparing data for analysis and reflection.
<b>AR outcomes (AR cycle 4: Proposed KT strategy)</b>	Contextualising: This cycle fed reflections of the tactical level into the learning of this cycle.	Focus group planning: The cycle that served to recruit and formally enrol AR participants in the project at the operational level.	Action: The cycle that served to conduct the face-to-face interviews in terms of time, space, and logistics (Ch. 8).	Final outcomes: The cycle that guided producing the final outcomes of the study based on reflections from all cycles (Ch. 9).

**Table 4-1: defining the micro-cycles of the study**

The design acknowledges the importance of high-level management in establishing AR (Shah *et al.*, 2007). This is due to the time and resources commitments by participating organisations as well as the invasive penetration of AR into core and strategic areas. Just as importantly, the proposed system recognises the importance of cyclic repetitions in each stage as a means to achieve sustained learning (Loh *et al.*, 2003). The suggested spiral of steps also preserves both (1) the essence of having research *in action*, rather than research *about* action, and (2) the strategic hierarchies that take on different perspectives of the AR project (Baskerville and Wood-Harper, 1996). These iterative *cycles* take place in ‘real time’ to rationalize the analogue movement through those strategic levels. This supports my *process* to implement change as opposed to isolated discrete ‘one off snap shots’ that neutrally reported in retrospect (Baskerville, 1999).

Each group of cycles in Figure (4-3) combines to form main cycles, thereby showing the

‘big picture’ (Shah *et al.*, 2007). The ‘bigger’ cycle is illustrated in Figure (4-5). This means that each strategic level can actually be seen in a single cycle (as in figure 4-5 below), but broken into smaller cycles as in the previous figure (4-4). My interpretation stems from the view that AR cycles can shrink and expand (i.e. micro-/macro-thinking) depending the level of scrutiny. The depth of AR cycles is infinite (as long as thinking depth is infinite as well). The researcher needs to draw a line to the level of idea disaggregation down the line of thinking. The aggregation (revers thinking), on the other, results in higher-level views.



**Figure 4-5: Infiniteness in AR cycles zooming (author’s original idea)**

The above discussion, to this point, explained different contextual levels that considered management level hierarchy, participating groups and change evolution at a strategic, tactical, and operational level. The zooming process was explained to illustrate that AR cyclic thinking is non-linear and can take different levels of complexity depending on the depth of thinking.

The above is more of an analytical approach to AR theory. It is time now to present the final AR design for this thesis, which will guide subsequent chapters in terms of laying out the journey of AR in a meaningful and practical way. Figure (4-6) shows four sets of AR cycles. Each set is composed of three cycles (behind each other as organisations X, Y and Z), which run in parallel. This means that I have conducted 12 AR cycles in total for this thesis (4 at each site). Each set of 4 cycles produced a single report, summarizing the learning outcomes of each cycle. The last report contained an overall solution to the thesis problem.

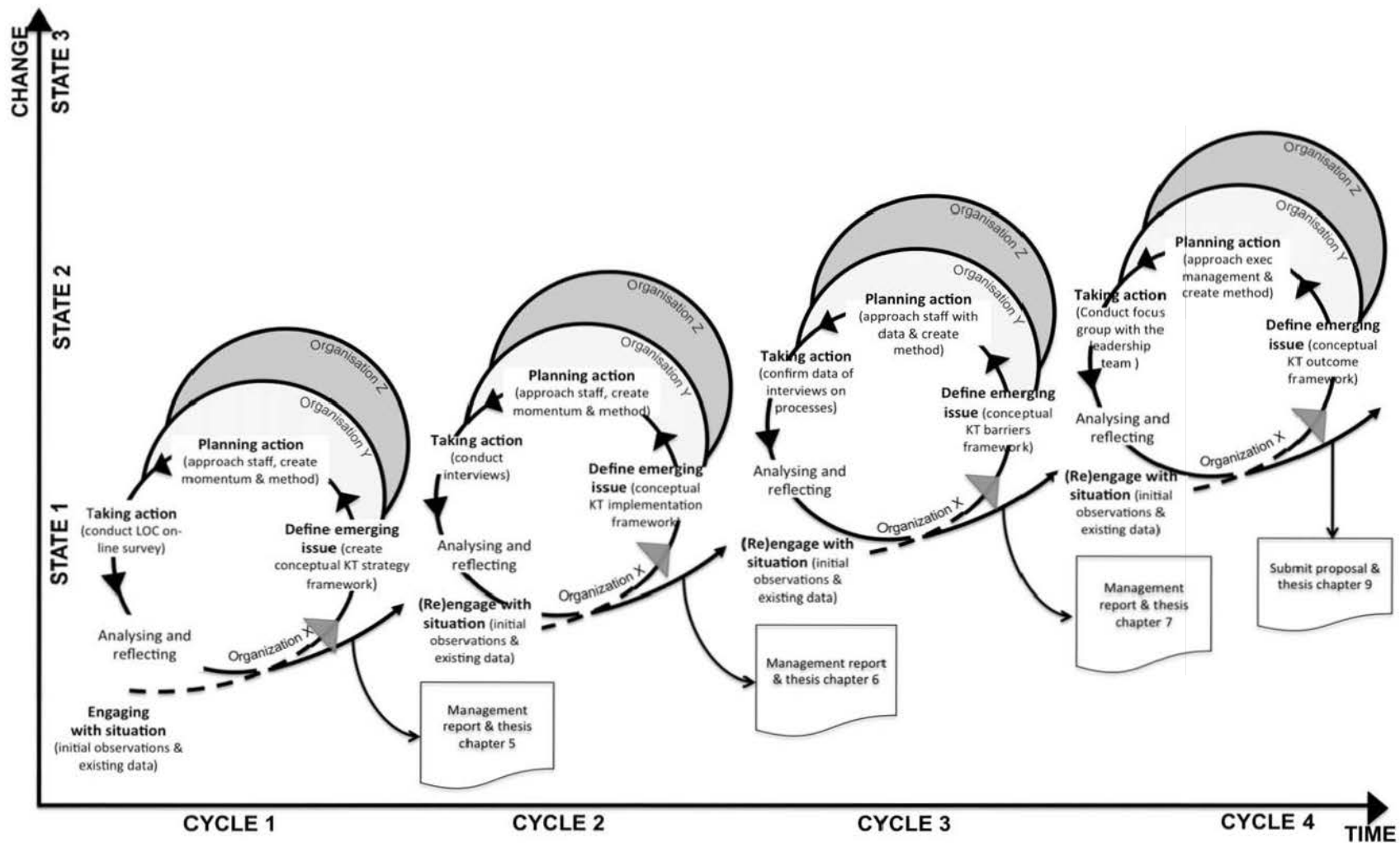


Figure 4-6: The AR framework for this thesis distributed over the time and change dimensions (author's interpretation compiled from the literature)

The vertical ‘change’ axis represents changes after each cycle. Change should occur while the AR study evolves. Evidence to change will be explained in detail in subsequent chapters. Each following chapter of this thesis explains a single cycle. The fourth AR cycle is explained in two chapters (chapters 8 and 9). Each phase of a cycle in figure (4-6) is described in further detail as below. Each AR cycle starts with ‘the emerging issue’ phase. In this phase, I needed to locate a strategic group to accept starting and participating in that AR cycle and agree on a shared vision for that cycle. This group (later on called AR participants) help me define the problem, plan for action, take action, and develop necessary understandings for reflections. Although the contribution of AR participants to analysis and reflection was limited, it was essential, as an AR study. This would ensure the *shared understanding* element being sustained (Newcombe and Hartley, 1952; Kemmis and McTaggart, 1988).

### 4.3 STARTING A CYCLE WITH “THE EMERGING ISSUE” PHASE

The rationale for having ‘the emerging issue’ phase is to emphasise reason for action. This phase is represents the process for identifying issues and problems to justify initiating an AR cycle. It is a ‘learning system’ that not only detects but also corrects errors, especially at the critical and strategic levels (Argyris and Schon, 1978). This view is operationalised by identifying issues and examining problems based on a set of ‘governing variables’ (Ragsdell, 2009) identified by concepts explained in chapter 3. The action strategy is aimed at controlling those variables within an acceptable range. For example, the key *emerging issue* for the first cycle in this thesis is having a better understanding to the knowledge strategy and associated strategy performance gaps, as explained in chapter 5.

### 4.4 THE “PLAN FOR ACTION” PHASE

The ‘plan for action’ phase is defined as a process of building on views and perceptions of AR participants to elicit evidence needed for understanding how to take action (Muir, 2007). Planning ensured that the conceptual design of chapter 3, the methodological design of chapter 4, and the emerging issues defined in the previous phase (section 2.1) were cohesively combined and agreed upon by the researchers (i.e. the academic supervisor and the Ph.D. student) and the AR participants (Dick, 2006). Developing a shared understanding requires careful planning (Senge, 2006). This is explained in each chapter separately because the context for each AR cycle was different (Zuber-Skerritt and Perry, 2002).



## 4.5 THE “TAKE ACTION” PHASE

Taking action refers to the process and events that took place to execute the AR plan developed in the previous phase (Gustavsen, 2008). The steps involved in the “take action” phase are numerous and overlapping, particularly since this research uses a four-cycle approach (Dick *et al.*, 2009). Actions include conducting work for the ethics approvals, online surveys, semi-structured interviews, focus group executive feedback meetings, and organizing meetings to discuss content of interviews.

A number of actions were planned as part of the research. These included interventions designed to elicit evidence needed from key stakeholders, especially the views and perceptions of mentees and mentors, to understand how to improve KT and ultimately the LOC online survey. In addition, it was necessary to ensure that AR participants took the results seriously. In order to increase the likelihood of taking the results seriously, proper reflection was required to produce the management reports at the end of the AR cycle so that it can have the highest possible impact on the AR participants.

## 4.6 THE “ANALYSE AND REFLECT ON ACTION” PHASE

This phase is defined as the evaluation and assessment of actions carried out through the reflections collected from various stakeholders. This phase is considered the main building block for learning. It encapsulates the essence of the research process to produce significant cognitive awareness and possible change. The action of reflecting on the data coming from a variety of stakeholders (i.e. via online surveys, interviews, focus groups) allowed data findings to be triangulated (Gibbs, 2007). The focus group meetings are considered sessions of collective reflection on the data findings of AR cycles 1, 2 and 3. Chapter 8 provides a detailed reporting activity to the collective reflections that took place with the executive management of the case study organisations.

In each new AR cycle, new theoretical models were introduced to model the theory in the respective AR cycle (i.e. knowledge strategy, KT process, KT problem, and KT strategy). The theoretical development through models introduced in this thesis added strength to methodology and confidence to conclusions in a way that illustrated how AR can combine with theoretical models to become a tool for action and reflection.

**4.7 THE “REPORTING” PHASE**

The hosting organisations made a significant time commitment on their part when they agreed to take executives, managers and research staff out of their day-to-day activities to participate in this AR project. Their participation in reflection, made it more likely that real change could be achieved. The documentation process followed reflection in each AR cycle. While change from reflection benefits the action part of the study, reporting benefited the theory development and contribution to the body of knowledge (Miskovic and Hoop, 2006).

Reporting was primarily through narrating qualitative reflections and presenting quantitative descriptors of findings about the Saudi engineering research organisations in a meaningful way (Gibbs, 2007). When referring to the three engineering organisations in this study, I shall use the term ‘case-study organisations’ or ‘host organisations’ interchangeably. While the first refers to the organisations as being put under research scrutiny, the latter refers to them as organisations that advocated the study and sponsored its activities. Hence, each term has a rightful meaning to be used in this thesis.

Reports on the research outcomes had two versions for each cycle: (1) a practitioner based report to address the executive management at each of the three host organisations and (2) an academic based chapter to be included in this thesis (see chapters 5 to 9). The two versions had fundamental differences because the audience for each version was also fundamentally different (i.e. business managers versus academic researchers). The business reports added up to a total of 570 pages.

## **4.8. DATA COLLECTION AND ANALYSIS TOOLS**

As the study will be applied at organisations X, Y and Z, it is appropriate to provide some background on these three case-study organisations. Organisation X is a major Saudi national research organisation focusing on science, engineering and technology projects. The organisation comprises many project groups, research centres and technology clusters. The major area of research is related to engineering projects. Organisation Y is a major education and research organisation in Saudi Arabia and hosts several specialised research centres. The major research focus of this organisation is applied engineering and commercialisation. Organisation Z is an advanced research organisation in Saudi Arabia specialising in cutting-edge engineering and technology research and focusing on engineering and scientific breakthroughs. They all have close ties to foreign research institutions with 11 digit budgets.

The practical aims for field-work data collection were threefold: (1) to make an assessment of the current efficacy of the knowledge flow environment in Saudi engineering research organisations; (2) to identify a set of key problematic factors that appear to work as vehicles towards ineffective KT; and (3) to produce a set of cause-effect relationships that may allow developing intervention actions in the form of a suggested KT strategy solution to be carried out ultimately by the organisation members themselves after this study is completed.

### **4.8.1 ON-LINE SURVEYS**

The LOC online survey was used in AR cycle 1 to examine the perceptions of staff on the performance of their organisational knowledge strategy. Three independent online surveys were conducted in three independent research organisations. The three organisations were part of a single industry. In this thesis, the online survey was the platform that provided a big picture ‘health audit’ on whether KM is required to fill a possible capability gap. Identifying possible defects in LOC was the main task for this cycle. With a best practice benchmark, the capability gap can be defined.

The survey was applied to a single industry (i.e. the Saudi engineering research industry). By unifying the industry, better control of variables and context was achieved (Pollalis, 2003). Also, a single industry study can be conducted with a smaller sample that satisfies the detection of reasonably substantial effects (Slater and Atuahene-Gima, 2004). The use of multiple industries however, would have had weaker relationships, required a larger sample

and resulted in contradictory findings (Slater and Atuahene-Gima, 2004). The single industry thus allowed the surveys to be more reliable with a sample of three organisations.

AR participants represent the source for building a cohesive understanding of the knowledge strategy at host organisations. They were the source for data. It was important to ensure sufficient information was available about stakeholders' occupations, age and years of service, among other demographics. This also includes work related information on roles, expertise, skills and their competency levels. Table (4-2) presents some demographic information about the participants in this research. Appendix A also provides further details on AR cycle 1 demographics.

AR Participant Information	AR Characteristic
<b>Organisations</b>	X, Y, and Z
<b>Knowledge domain</b>	Electrical, Chemical, Petroleum, Civil, Materials, Manufacturing, Nuclear, Electronics, Computer Engineering; Solar energy; Bio-informatics; Geophysics; Nano-technology
<b>Strategic position</b>	Executive, middle management, senior research director, senior researcher, researcher
<b>Years of service</b>	5 years – 35 years
<b>Age</b>	28 years – 57 years
<b>Gender</b>	Male - Female
<b>Nationality</b>	Saudi Arabia, USA, Ireland, China, India, Egypt, Jordan, Turkey, Pakistan, Bangladesh
<b>Pay range (pa)</b>	US\$36,000 – US\$150,000

**Table 4-2: Demographics of AR participants**

As the above table demonstrates, the online survey in AR cycle 1 is focused with the context of engineering research. Therefore, the AR participants in the survey were sourced from knowledge domains relating to fields of engineering and technology.

#### 4.8.2 INTERVIEWS

The second and third cycles comprised one-on-one semi-structured interviews. The sequence of interviews (i.e. who was interviewed in the second AR cycle and who was interviewed in the third) was based on whether an individual was from the strategic, tactical or operational group. To these participants, interviews were conducted with an overseas knowledge expert and a knowledge seeker (local industry). Appendix B presents the questions used for AR cycle 2. The third action cycle comprised the remaining one-on-one interviews from the tactical and operational level. Appendix D presents the questions used for this cycle.

As per Mengis and Eppler (2008), explicit conversational rules such as formal interviews

would add structure and purpose to face-to-face conversations in ways that bring about the means to convey organisational knowledge. The questions in the interviews were informed by the general enquiries in the following table:

Stage	Why	Who
<b>LOC survey</b>	1. What learning capability is actually needed? 2. What capabilities exist? 3. What capability is lacking?	All staff
<b>KT processes</b>	1. Who needs this capability within the organisation? 2. What KT processes can make use of these capabilities?	Managers
<b>KT barriers</b>	1. What are the barriers underlying KT process waste points? 2. What behavioural challenges are expected?	Engineers
<b>Proposing an initial KT strategy</b>	1. How can KT be made more effective? 2. How will staff use this KT strategy when provided?	Researcher

**Table 4-3: A guiding high-level enquiry list for designing interview questions**

The results of the LOC online survey also helped identify the strategic gap to formulate necessary interview questions. An important soft element of the interviews was that all participants receive an equal opportunity to contribute to the study questions regardless of their hierarchal position (Emery and Purser, 1996).

### 4.8.3 FOCUS GROUPS

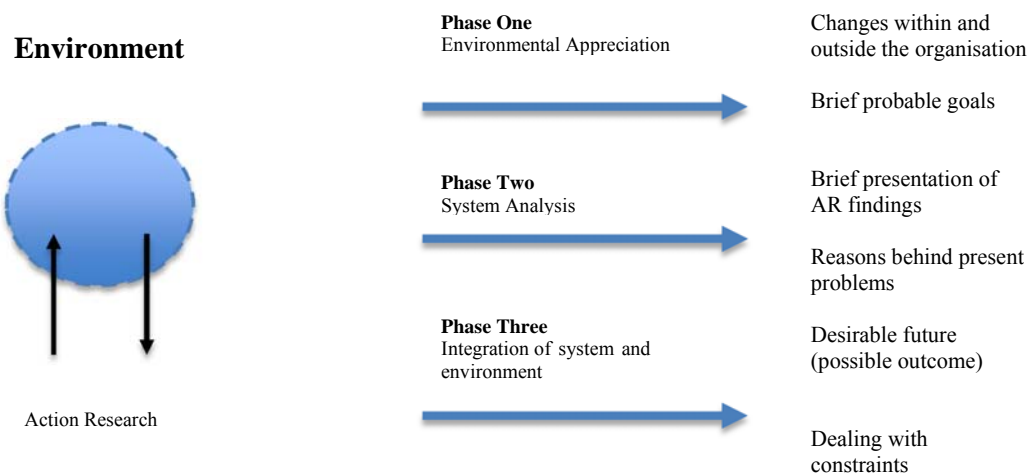
A focus group is defined as a qualitative research technique that “collects data through group interaction on a topic determined by the researcher” (Morgan, 1996, p. 138). Focus groups follow structured, semi-structured, or unstructured approaches (Bryson and Anderson, 2000). In this AR study, a semi-structured approach was used to preserve the planning element of the methodology while allowing new themes to emerge as needed during the course of the focus groups. Focus groups offer a level of convenience and economic advantage by putting a group of people in one room at the same time (Krueger, 1988). The use of social interaction distinguishes it from other qualitative approaches (Merton, 1990).

When a focus group is limited to a group of executives, it becomes a methodology for participatory action design that allows decision makers to receive informed feedback to trigger possible change (Martin, 2006). This way of collective planning and design of actions aims to remove the barriers to KT that are directly relevant to the people involved in the host organisations. Focus groups are supported by several participatory AR studies advocating their design (Grundy, 1982; Emery and Purser, 1996; Greenwood and Levin, 1998). Many action researchers agree on the importance of contextual sensitivity in designing group discussions (Emery and Purser, 1996; Greenwood and Levin, 1998).

Without examining the specific environment of the organisation under study, the researcher risks applying the wrong active variables and will likely mislead the focus group.

In this thesis, focus groups were used in the AR fourth cycle, which were initially, planned for durations of one full day each. These events were not possible and consequently were reduced to between one and a half hours and two and a half hours at each case study organisation. The setup of the meeting included voice recording. Once again, I transcribed the tapes immediately after the meetings to ensure understanding of context. This also helped in the coding process, which also immediately followed the transcription of the recordings. The process of analysing the different coded scripts and eliciting meaningful and useful knowledge was lengthy and is explained in chapter 8.

Sharing using feedback in the AR terminology refers to a specific kind of process where participants take part in co-generated learning (Greenwood and Levin, 1998). The idea of applying the feedback approach in this project is to create a situation where middle management and executive members of the organisation can engage in structured knowledge generation using a systematic AR approach illustrated in figure (4-3) and facilitated by the researcher. The phases of the management focus groups (MFG) are illustrated in figure (4-7).



**Figure 4-7: The phases of the MFG (Emery and Purser, 1996).**

The focus groups are aimed at the third phase of the above figure to build positive attributes in the participants and work as an enabler for the KT framework. With the help of focus groups outcomes, possible growth may emerge. The environment of the focus groups was constructed with behavioural contextual intentions to: (1) develop confidence in the

participants' ability to solve their own problems related to KT change and (2) enhance their willingness for change by carrying out agreed upon action, observing it and reflecting on it.

Emery and Purser (1996) opposed what Sampson (1989) suggested in holding private, self-contained feedback meetings with management members. Instead, Emery and Purser recommended approaching the management openly and as a group of staff and executives. In the MFG, there should be no workbooks, questionnaires, or other occasions for private writing; instead, it is the freedom of dialogue and exchange of findings and reflections that could bring about shift in thinking towards a shared understanding (Senge, 1990). The emphasis is therefore on creating a culture of mutual trust in the perceptions of staff (Ong, 1967). Table (4-4) summarises important risk factors for a focus group meeting.

Discourse	Methodological perspectives
<b>Inadequate participation</b>	The expectations of MFG participants as to the contribution that they are expected to make will be explained to them in advance to enhance the participation rate.
<b>Low commitment from executives</b>	Executives will be invited to accept the method and outcomes. They are expected to be very protective of their strategies and unwilling to expose themselves to criticism.
<b>Poor preparatory work</b>	Very little pre-thinking about the topics is expected from executives before the meeting. I planned to remind executives to attend and review the management reports before the meeting to discuss them.
<b>In-built conservatism</b>	The need to recognize existing business process designs to keep loyalty to the study. The risk of holding up the whole project if an idea went wrong is a serious constraint. The tendency to see things in terms of prior knowledge and experience is expected to be a major problem. The plan is always to seek feedback before moving forward.
<b>Dysfunctional meeting process</b>	Lack of clarity over evaluation criteria, inconsistent brainstorming approaches. MFG goals are not to be too abstract or too complex (too many issues to be addressed). Short time formats (e.g. half an hour per theme) may allow reflection and incubation.
<b>Political behaviour</b>	Some participants may attend solely to defend partisan interests or to advance tendentious causes, not to contribute positively. A case-based response will be used.

**Table 4-4: Pre-planning for possible adverse factors during focus group meetings**

The final output of the MFG should consider validation of findings (Emery and Purser, 1996). Sharing the ideas of different stakeholders and allowing them to discuss problems to develop a common vision for their future is important before suggesting solutions.

#### 4.8.4 TRANSCRIPTION AND DOCUMENTATION

The literature suggests 90 minutes as an optimum duration for a qualitative research interview (Seidman, 1998). Interviews with this length yield transcripts of about 30-40 pages or 15000-20000 words, which provide a wealth of material to examine (Elliott, 2005). In this project, the transcriptions were between 35 and 65 pages each. Digital voice recording is considered good practice in qualitative interviewing (Elliott, 2005), therefore, all interviews were voice taped and then transcribed into raw data. This helped verify any

unusual interview content in the transcriptions to ensure validation. Appendix B and D present the interview questions and the guiding process. For the purpose of immersing myself in the context of the interviews, I transcribed all interview recordings myself. This helped make better meaning from data during the coding process that followed transcription.

Raw data is the smallest element in research and requires significant analysis to make meaning and enhance the body of knowledge on a given topic (Strauss and Corbin, 1998). Data may be converted to different forms before reaching the analysis phase (Strauss and Corbin, 1998). The interviews were conducted in English but the participants were non-English native speakers. This made it necessary for all interviews to be transcribed and verified with the participants themselves to ensure accuracy of meaning. The process of transcription helps correcting grammar mistakes that alter the correct meaning of what was said (Gibbs, 2007).

## **CODING**

Thematic coding is defined as fundamental analytical categorisation or an indexing process that identifies passages of text and finds descriptive ideas to establish thematic frameworks (Gibbs, 2007; Ritchie *et al.*, 2003). Since the conceptual framework in chapter 3 introduced many KM themes/constructs, I began the coding process by searching for those themes (Gibbs, 2007). I then compared data findings with those codes and compared them back to literature findings (Ritchie *et al.*, 2003). Theoretical development may emerge from this approach with data to confirm, deny or establish theory (Strauss, 1987). It was important to examine the KM theory in relation to the empirical findings of this study in order to make conclusions (Probst *et al.*, 2000). If empirical findings opposed theoretical claims then this would be a substantive knowledge contribution because it would alert the academic community to gaps in existing theory (Schein, 1988).

The contextual factors discussed in the introduction of this chapter illustrate many issues being irregular, difficult to replicate and complex. Emergent themes may appear clearly in the data, which may result in modifications to the conceptual framework. Such modification utilises the grounded theory approach as themes emerge from data (Strauss and Corbin, 1994).



## 4.9 OBJECTIONS: ACTION RESEARCH DIFFICULTIES

The literature suggests the autonomous nature of KM research methods; however, there is growing momentum to suggest AR as the most appropriate approach due to its practicability and change elements (Shah *et al.*, 2007). Other research methods have taken the epistemological form of focusing on success factors and aspects of best practices (O'Dell, 2000). These methods have typically involved the elicitation of general reflections from senior KM practitioners through non-intensive methods, such as telephone interviews (Davenport, 1997) or questionnaire-based approaches, such as the Delphi study of Holsapple and Joshi (2000).

Despite its extensive time and energy demands, I perceive AR as the appropriate approach in capturing the thoroughness, cohesiveness, applicability and replicability that KT change initiatives require to be successful. The selection of AR as my KT research method fits appropriately with this argument since KT represents a transformation (aimed for positive increase) in the LOC. Increasing the LOC cannot be attained from a single attempt or through a passive approach; rather, it best fits within a dynamic change motion towards a target LOC benchmark. This is ideally approached through sets of *defining, planning, acting, reflecting* cycle phases.

AR is especially appropriate for testing KM research theories since innovation and change are continual, and processes and outcomes are usually dynamic, complex and often involve fuzzy and subjective human input that is inhomogeneous through time. Rich description, deduction and idiographic qualitative approaches will be used to support the framework in Figure (4-2) (Gibbs, 2007). This thesis represents a coordinated set of four AR cycles, each of which provides valuable learning and feedback to the organisation at different operational and strategic levels (Shah, 2007). This placement is explained in the next section.

### 4.9.1 PLACING ACTION RESEARCH IN THE SPECIFIC CONTEXT OF KT

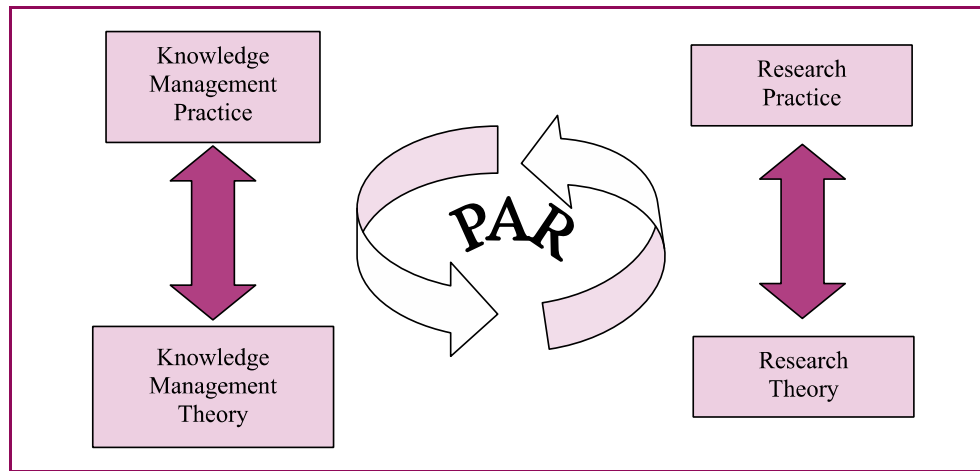
In organisation Y, purposive sampling was used and the number of interviews was dictated by the premise that researchers would be interviewed until there was data saturation and no new information was forthcoming. In both organisation X and organisation Z, the number of interviews was governed by the number of participants approved by their organisations,

consequently, all participants in both organisations were interviewed to validate findings coming from organisation Y. Interestingly, very few new codes were generated from organisations X and Z, as compared to organisation Y.

This study aspired to make two contributions: (1) theoretical (to the literature of KM, by providing insights into barriers and enablers), and (2) methodological (through the use of AR for KM studies). The research approach is applied in an Organisational context specific way, where members collaboratively question their practice, make changes, and assess the effects of those changes (Kemmis and McTaggart, 1982; Hollingsworth, 1997; McNiff and Whitehead, 2006). The study will describe and discuss underlying technical, cultural and organisational obstacles that limited the KT process in the past (see chapters 5, 6, 7 and 8) and suggest change that could attain desired effectiveness of a new transfer framework (see chapter 9).

Without taking *a priori* theoretical position with reference to KM constructs, and allowing the data to speak for itself, this study demonstrates the contribution to theory development. Theory is validated by continuously inspecting data while trying to build deepened understandings for new concepts to emerge (the process of open-coding, i.e. attaching labels to data). Categories are derived from this coding process and new data is constantly compared against existing categories (by asking: are the existing ones adequate, or are new ideas/themes emerging?). New categories are elaborated, generalised and internally consolidated with existing categories when matching is possible (axial coding). As the research process unfolds and an overall theoretical structure progressively takes shape, the research contribution to the existing body of KM theory will be evident.

In light of this epistemological stance, I argue that this study will add a substantive contribution in demonstrating the application of the AR approach to KT studies. At this stage, I argue that the contextual aspect of KM ties closely with the key characteristic of AR in being pragmatic and contextual based. This brings both disciplines to a converging praxis that should prove to be an ideal fit for the purpose of this study. The following model represents an attempt to establish this link.



**Figure 4-8: A model for connecting AR research with KM (Ragsdell, 2009)**

AR methodologies use different qualitative and quantitative methods (Greenwood and Levin 1998). Since the constructs explained in chapter 3 represent the theoretical foundation for this study, I aim to test them qualitatively following the listed elements in table (4-5):

<b>Qualitative research</b>	<b>Qualitative researcher</b>
Takes part in the natural world	Views social phenomena holistically
Utilizes multiple methods	Systematically reflects on who is in the inquiry
Focuses on context	Sensitive to personal biography and its effect on the shape of the study
Emergent rather than prefigured	Uses complex reasoning that is multifaceted and iterative

**Table 4-5: Attributes of qualitative research and researchers (Rossman and Rallis, 2003)**

AR follows repetitive planning for action by carrying action followed by reflection (Greenwood and Levin, 1998). The first step is to define the problem (Greenwood and Levin, 1998). This involves research questions formulation. The second step is to plan for action to solve the problem identified in step one. In order to formulate a valid definition and a plan of action, the research field requires a pretested guide for the plan of action that prepares rigorous theoretical grounding for carrying the ‘action’ as in ‘meta-action’. For this study, I began asking the important questions that were necessary to identify the AR participants, their characteristics, the rationale of the research itself and the expected outcomes.

## 4.10 METHODOLOGICAL CHALLENGES

In this section, I discuss different provisions taken into consideration to implement the methodology such as measurement issues, validity and reliability issues. Selecting the level of analysis (i.e. individual, group, organisation) as well as scale of analysis (i.e. cross-sectional surveys, in-depth longitudinal studies) are challenges from a methodological perspective. For any study, a philosophical choice about what is important must be thoroughly be weighed (Easterby-Smith *et al.*, 2004).

### 4.10.1 MEASUREMENT ISSUES

Major attention is usually given to organisational level processes because the knowledge strategy aims at reaching the LO status (Senge, 2006). To know if this target was achieved, measurement of performance becomes necessary. Neuman (2006, p. 112) states that “the researcher needs three things in order to measure: a construct, a measure, and an ability to recognize what one is looking for”. In doing so, it was essential to examine the individual and knowledge characteristics levels to enable an informed feed-in analysis to the organisational level. This was extended to national level for some constructs to visualise environmental KT forces on host organisations. This multi-level analysis impacted the measurement design of this thesis where each AR cycle had its own measurement criteria (Mingers and White, 2010).

Operationalization is dependent on measurable *ideas* (any mental image, belief, plan, or impression), *concepts* (a thought, a general notion, or a generalized idea about a class of objects) and *constructs* (thoughts that are systematically put together; or systematically arranged ideas, facts or impressions) (Neuman, 2006). Operationalization refers to the process of defining tangible measurements to a construct (Colton and Covert 2007). Operationalization is about putting constructs in a language that allows the researcher to observe and measure attributes that represent that construct. With the advancement of measurement and statistics, social sciences can lay scientific claims to methods as rigorous as the ones employed in the natural sciences arena (Porter, 1985). This is however hindered by vagueness, unclear concepts and misleading terminology (Neuman, 2006). As chapter 2

illustrates, the number of ideas, themes and constructs in this study is substantial and therefore complications in measurement were expected as a result. Therefore, my aim was to merge reflections emerging from KM theory presented in chapter 2 into a systemically operationalised set of measureable ideas, concepts and constructs (Gibbs, 2007).

KM empirical research is categorized in terms of how individual and organisational knowledge are operationalised (Spender and Grant 1996). The notion that knowledge is a firm's resource does not imply a simplistic ability to identify and measure knowledge resources (Spender and Grant 1996). Measurement of knowledge resources, the bandwidth of KT and absorptive capacity of the seeker are elements of the analysis and thus require standardisation both in philosophical representations as well as statistical partitioning.

### 4.10.2 VALIDITY ISSUES

Validity of qualitative research refers to the extent to which research findings and explanations are accurate and correctly capture what was actually happening (Gibbs, 2007). Qualitative research validity is different in approach from quantitative research validity because it requires a *realist* approach to validity rather than an *idealist* approach (Gibbs, 2007). AR is attributed however with the quality of reflexivity, which refers to the notion that the output of research “inevitably reflects some of the background, milieu, and predilections of the researcher” (Gibbs, 2007, p. 56). This concept is built upon an understanding in the social community that social phenomena cannot be objective (Brewer, 2000); rather it is better to declare the researcher's preconceptions, the underlying epistemologies of the research process, how the findings were represented, and how the researcher and respondents interacted (Denzin and Lincoln, 1998). Greenwood and Levin (1998) argued that in order for AR to result in useful knowledge, collective learning must promote change through the involvement of the researcher, thereby allowing informed inquiry to continue to evolve. They concluded that:

As action researchers, we believe that action is the only sensible way to generate and test new knowledge. We find the widespread belief that being a social scientist means not being engaged in social action so peculiar and counterintuitive ... We also have noticed a tendency for people to believe that action research must be qualitative research rather than quantitative research ... Because we see no merit in these assumptions, we reject the notion that action research is qualitative research only.... Formal quantitative, qualitative, and mixed methods all are appropriate to differing situations.... For us, AR aims to enable organisations to mobilize their diverse and complex internal resources as fully as possible. (p. 59)

In qualitative terms, it is important to measure reflective writing against validity measures.

To provide an auditable record of the research process, the use of reflective writing is a mechanism that can be applied (Guba and Lincoln, 1985; Sandelowski, 1986). This is the reason for the excessive details in this thesis. It is to provide *an auditable record of the research process*<sup>3</sup>. Trustworthiness is enhanced when researchers describe and interpret their experiences, and identify the events, influences and actions influencing their research - thus acknowledging their own centrality to the research process. Taken as another data source, reflective writing can provide this evidence, contributing to the legitimacy of the knowledge claims being asserted by the researcher.

Dependability incorporates the notion of ‘validity’, or how believable the study’s results can be judged to be. Thus validity can be judged by the presentation of an audit trail, and clear indications of procedural steps. This may be referred to external audit for verification (Koch, 1996). Hence, reflective writing’s strongest evidence of validity is the transparency of process in describing the subjective role of the researcher and how issues relating to this have been addressed. For those assessing the study, such transparency should empower them to judge the value of the findings. As Koch (1996, p. 188) says: “[T]he responsibility lies with the researcher to show the way in which a study attempts to address rigour. It is for the reader to decide if the study is believable.”

Gibbs (2007), supported by Denzin (1970) and Flick (2008), suggested four approaches to qualitative research validity: (1) triangulation (having different views on one subject such as interviews, observations and documents to prove consistency), (2) respondent validation (to ask respondents to review transcriptions, interpretations and findings if they agree with them), (3) constant comparisons (checking the consistency and accuracy as well as differences and variations of the coding process and the codes developed), and (4) evidence (generating reports with data quotes to support validity). All these approaches have been adapted to use in this thesis with varying degrees in each cycle.

In this thesis, I triangulated this research using individual interviews, field observations, and focus group meetings. The qualitative approach shall comprise empirical level theory that will develop an empirical basis for the proposed KT system and for KM studies in Saudi Arabia and hopefully for developing countries in general. The AR model will be developed

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<sup>3</sup> This point justifies the length of this thesis. In order to be auditable, research activities must be explained in detail. Given the qualitative nature of this thesis, providing evidence from data and detailed discussions of analysis can strengthen the objectivity of qualitative findings.

to realise a clear understanding of the status of knowledge in the surveyed organisations, the process by which knowledge is managed, in-depth longitudinal data about knowledge workers and the business process which knowledge management activities could be integrated into (Mertins *et al.*, 2003).

One of the weaknesses of AR is its limited replicability. AR follows a strongly fashioned localism. The bulk of AR takes place on a case-by-case basis, where it proves to be effectively beneficial in a local situation but then fails to extend beyond that local context (Colton and Covert, 2007). The degree to which an instrument was replicable to measure a construct was a challenge in itself. Assessing instrument validity approaches may be in the form of review of research literature to provide evidence that the instrument is correctly measuring and defining the addressed construct. Other forms of instrument validity include expert review of the instrument (Colton and Covert, 2007).

Although the need for standards or criteria of validity has been questioned in the case of AR for the same reason that some standards are bound to the ideals of positivism (Schwandt, 1996), this research advocates ensuring validity through *quality* and *good practices* offered by AR measures as supported by Lincoln (1995) and Gustavsen (1996). It must therefore rely on both the quality of theory as well as the holistic and lived experiences as illustrated by the researcher and participants (Reason and Bradbury, 2006). In order to improve such qualities in an AR approach, I aimed to develop congruence between qualities of participation (i.e. commitment, participation, understanding) and the actual output being accomplished (Reason and Bradbury, 2006). Evidence to these occurrences was provided through the use of actual quotes and datasets generated from the research activity.

#### **4.10.4 ISSUES OF RELIABILITY**

Reliability is defined as the consistency of research output across repeated investigations in different circumstances with different researchers for a specific case (Gibbs, 2007). Generalization extends this definition to ensure reliability for different cases as well (Gibbs, 2007). Despite the many differences from natural sciences research, results obtained from social research are often associated with the limitations of its situational and context bound nature (Colton and Covert, 2007). This causes reliability and generalisation difficulties when attempting to apply the results on the same case at a different time or other cases than the ones studied (Gibbs, 2007). Although this is an intrinsic issue of social sciences that cannot

be eliminated, the most effective method to address this task is to ensure higher level of reliability measures.

Much of the KM literature focuses on technologies for KM, which is relatively generalisable in principle (Davenport *et al.*, 1998). But as many others have pointed out, technology is not a sufficient condition for effective KM (Swan *et al.*, 1999; Storey and Barnett, 2000). Changes in attitudes and working practices are critical to encourage knowledge sharing and the re-use of knowledge assets, which is a highly contextual factor that resists generalisation. This is usually an idiosyncratic environment that is difficult to replicate.

The centrality of the role of the researcher to qualitative studies is paramount. Reflective writing within journals and research logs establishes this centrality and often contains clues to creativity within the work that discovers and describes new understandings of people's experiences (Neuman 2004). This provides evidence to intensify the use of data quotes. In support of this argument, Jasper (2005) states:

[R]esearchers' reflective writing is central to the research process and therefore needs to be incorporated into any study as a data source and to be considered as central to establishing the trustworthiness of a qualitative study. (p. 249)

The selection of data quotes can be challenging. However, this is an iterative process where the final document (i.e. thesis) should include the most impacting quotes that support the analysis and reflections of the study. In support to the non-linear approach to data selection, Jaspers (2005) suggests to:

[C]ontinue to engage collaborators in interpretive conversations about what your shared research is creating. Be prepared to live with a lot of uncertainty. Keep writing. Develop writing practices with your collaborators. Record insights. Be prepared to abandon them. Understand that there is no direct cause. Learn to appreciate detours. (p. 253)

The following section will present the platform for the fieldwork engagement with the host organisations in this study. In covering the three host organisations in this study, I will be examining the described sample of the engineering research industry in Saudi Arabia. Other governmental or private engineering research institutions in Saudi Arabia either lack national recognition or are too small to be considered for this study. Future research may validate the sample selection empirically by expanding the sample beyond the three host organisations in this study.



#### **4.11. THE BEGINNINGS OF THE JOURNEY AT HOST ORGANISATIONS**

The approach suggested by Creswell (2007) has led this thesis to apply many adjustments in research propositions and methodology as the research progressed. Creswell suggested starting with initial plans for qualitative studies that may evolve during research. The following quote by Creswell illustrates this approach:

The initial plan cannot be tightly prescribed, and that all phases of the process may change or shift after the researchers enter the field and begin to collect data. For example, the questions may change, the forms of data collection may shift, and the individuals studied and the sites visited may be modified. The key idea behind qualitative research is to learn about the problem or issue from participants and to address the research to obtain that information. (p. 29)

This meant that it was acceptable to apply modifications during the research activity. In the case of this study, the techniques to gather required data about host organisations were based on primary research. This was due to scarcity in the literature covering Saudi Arabian organisations in relation to the subject of engineering knowledge transfer. In order to produce empirical data for this thesis, two methods were applied: (1) field study in the form of surveys, interviews, focus groups and (2) personal observation in the form of structuring understanding the status quo and documenting experiential learning.

I advocate that research is only the starting point to understand reality. Revans (1980) asserts the need to consider management research as an open-ended problem, rather than ‘puzzles’ with identifiable solutions, and thus, he suggests special focus on change management. On a practical level, this section resembles a true start of the project in that I have actually engaged with the real world from this point onwards.

##### **4.11.1 NEGOTIATING PARTICIPATION TERMS**

The UOW ethics approval process started with consulting Saudi host organisations on the possibility of collaborating in an AR project to enhance their KT capability and gradually decreasing their dependence on external expertise. This required the host organisations’ management to provide an organisation level acceptance. Host organisations were also conscious of the sensitivity of this thesis in that it entailed exploitation of their internal affairs and activities that touch the heart of their strategic resources. Due to the political aspect of the study, the approval process consumed several months to materialise.

After approval, the project was to move forward by introducing AR cycle 1 of Figure (4-4). I focused on selecting research participants democratically so that participants were evenly selected from the three host organisations. The nominees signed written consents in the format illustrated in Appendix B. No nominee refused to participate in the AR except one manager from organisation X. He was a senior manager responsible for KT activities in organisation X in the past and seemed concerned about doing research on his subject.

The host organisations in Saudi Arabia have already collaborated, and still are collaborating, with external experts, mainly from the US, for the purpose of knowledge acquisition. I found it necessary to include external experts who worked with the host organisations in KT activities. A senior world-renowned chair professor from the US accepted the invitation to participate in this project as an external knowledge provider who is genuinely interested in the transfer of knowledge to the host organisations in Saudi Arabia. He has been working for more than 30 years at a US research institutions ranked in the top 5 in the world. This segment of the research with the US experts focuses on external-to-internal knowledge flows, which are illustrated in Figure (3-9) in chapter 3. He is part of AR cycle 3.

The local industry should also benefit from external-to-internal KT. As host organisations learn from overseas experts, they should transfer this knowledge to the local industry as an internal-to-external KT. In order to understand the local industry perspective in the internal-to-external KT process, I nominated an RandD research manager at a leading local industry organisation as a knowledge user to represent the local industry. The local organisation is ranked in the top 10 largest petrochemical companies in the world. This global position justifies placing such a local organisation under scrutiny from a knowledge perspective. In this way, the thesis comprises the following research stakeholders:

- (1) Three Saudi engineering research organisations
- (2) One US engineering research institution
- (3) One Saudi engineering local industry

Although the majority of individual participants are from the first stakeholder (96%), the inclusion of the second and third stakeholders validates exploring the internal-to-external KT system that will be discussed in chapter 6 and 7.

**4.11.2 ENTRY INTO AND EXIT FROM THE STUDY**

Since real-world situations continuously evolve, it was important to plan an exit from the AR project once useful findings were revealed. It was important to accept that at some point the research project would end while a lot more research was needed. The host organisations should be encouraged to continue change after this study exits to sustain growth, hence, allowing the cycles to continue under their staff. In order to set the correct exit stage, it was important to know which account of learning was targeted. Capturing the intended knowledge that allows sufficient evidence for defensible generalisations was the basic measure to decide when to exit after a given research cycle (Checkland, 1997). In eliciting lessons learned, the criterion of recoverability means those lessons are useful elsewhere than the site of the host organisation. I aim to provide sufficient detail on the project to help the critical reader accept justified generalizations and to facilitate the transferability of results for the purpose of replicating this project in other organisations. It is essential to point to the risks and likelihood of some results being particular, and uniquely applicable, only to the host organisations in the thesis.

In contrast with laboratory researchers in the natural sciences who can stop when replicable results show that their hypothesis has been refuted or has survived the tests to which it has been subjected, AR as a mode of inquiry is not homogenous through time, and thus ending research is inherently an arbitrary act. The thematic transformations of the research situation will continue to evolve through time no matter how much ‘more’ time is given to the research or how many cycles are executed. It has to be the researcher’s judgment that the chosen methodology (M) of Figure (4-1) and its framework (F) have contributed enough knowledge about the area of application (A) to justify a temporary stop, thus, waiting for future research cycles to be carried out by other researchers. When approaching the end of this thesis, I will discuss how the host organisations should continue the project. I will also provide a framework in chapter 9 to guide future researchers on how be consistent in approaching the KT solutions to deliver an effective KT strategy.

## 4.12 CONCLUSION

Research methodologies seek reliable, measurable and replicable understandings. The primary objective of social sciences, therefore, refers to knowing ultimately how the researcher will go about understanding the phenomenon or question of interest (Colton and Covert 2007). Such an understanding enables comprehending the world to a level deep enough to make phenomena predictable (Trochim 2001). This thesis thus focuses on examining current problems rather than searching for future solutions. Predicting solutions should then follow.

This KT project can be viewed as a coordinated set of four AR cycles. After measuring the knowledge strategy performance using LOC survey, the KT processes are examined from the perspective of BPR. The literature gap in understanding how knowledge actually flows is addressed by identifying capability issues in processes (chapter 6) and examining the problems -the barriers- surrounding those processes (chapter 7). This provided a source for reflection to draw the KT strategy in chapter 9.

As a modelling perspective to AR, the classification of first-, second-, and third-person was adopted (Bjørn and Boulus, 2011). First-person AR represents the researcher's ability to cultivate a critical approach to understanding research practice, and in general, to the way of being and acting (Heen, 2005; Kemmis and McTaggart, 2003). Second-person AR represents the act of bringing people together to discuss issues of mutual concern (i.e. interviews/focus groups). The third-person AR represents the inquiry being extended to groups too large to engage in face-to-face communication, hence, on-line surveys and questionnaires. All three types were adopted in this project in AR cycles 1, 2, 3 and 4.

In conclusion, AR is seen as a strategy that aims at solving a pertinent problem where problem stakeholders and the researcher learn and reflect within the same co-generative process (Greenwood and Levin, 1998). Because AR faces real-life problems, it is difficult to tailor research projects exactly the same way. For this reason, the methodology adopted in this thesis may be unique. Accordingly, the methodology evolves around the phenomena and how stakeholders can address it (Levin, 2012). The research focus here can be described as an undetermined real life situation that can be made determined Dewey (1938). What matters to stakeholders is what matters to this thesis. This is a genuine strength of AR.

# CHAPTER 5: EXAMINING THE KNOWLEDGE STRATEGY

## CYCLE 1

*“By seeing wholes we learn how to foster health”*

*Senge (1990)*

### 5.1 BACKGROUND ON STRATEGY AND LEARNING CAPABILITY

Strategy guides both the leadership and staff to make decisions to achieve their goals (Grant, 1996). In this thesis, the strategic focus is on knowledge. The focus on strategy was devoted to investigate the knowledge strategy. Knowledge intensive organisations focus on how to maintain or grow its OKB (Massingham, 2012). From a knowledge resource perspective, a knowledge strategy identifies the capability gap between what an organisation knows and what it needs to know, both now and in the future (Massingham, 2012). The knowledge strategy investigates how can an organisation grow its OKB while continuously measuring the gap. The goal of the knowledge strategy is thus to make the organisation become a LO.

By measuring the existing LO status at a particular organisation and comparing this measurement to an aspired benchmark, it is possible to reveal a clear capability gap that informs the knowledge strategy. The knowledge strategy translates this input into increasing the OKB to fill the designated gap. This requires processes that are implemented using KM strategies. One of those strategies that this thesis adopts is the KT strategy. A KT strategy is therefore one way to implement the knowledge strategy and achieve the LO status. In this

chapter, the focus is to measure the existing LO status at the host organisations and to establish a best practice benchmark that can define the capability gap. The next chapter, the KT process, examines the KT strategy that can examine how the implementation capability is performing. However, successful implementation is risky and entails a high failure rate (Zack, 2006). This will be discussed in the next chapter.

In this chapter, the process of defining the knowledge strategy will rely on (1) measuring the LOC construct using two performance models and (2) comparing the results with best practice benchmark organisations from Europe, the US and other countries. A low LOC measure or a large gap indicates that the organisation has a low capability to learn (i.e. does not provide frequent knowledge input to the system) and therefore risks both a failure to meet the knowledge strategy and a failure to adapt its capability to achieve a successful KT strategy implementation (Garratt, 1999). LOC is not only for the leadership but it is indeed to provide a genuine insight for organisational members at all levels to understand their current and aspired capabilities, thereby, triggering calculative growth (Richardson, 1995).

From a KBV perspective, strategy and LO capability are needed to construct a knowledge strategy with practical value (Coulson-Thomas, 1996; Lorange, 1996; Richardson, 1995; Sun and Scott, 2003). This thesis provides a new dimension in blending a knowledge strategy with LOC using the AR approach as a change vehicle. In practical terms, the knowledge strategy will look at two aspects of the situation: (1) organisation type as in conservative versus aggressive (exploit or explore), and (2) organisation process approach as in, what do we know, what do we need to know, and how do we address the gap? (competency mapping). The objective here is to use theoretical rationale to realise change in a real-life situation to address these two aspects at the host organisations (Greenwood and Levin, 1998). Zack (2007) described his journey with a firm that needed a knowledge strategy. He chose AR as the best approach. He explains in his words:

I performed a longitudinal case study ... to test and illustrate the framework ... The implementation served as an action research opportunity, in that the theoretical framework ... was used as the basis for making significant changes to the structure and process ... as part of the implementation. I observed the organisation for a period of approximately one year, conducting repeated interviews with the president, VP Operations, managers of customer service, production, distribution and inventory management, and several clerical personnel who were system users. The framework was used to categorize and analyze interview and observational content. The results of the study were used to derive several propositions for future testing. (p. 1665)

Zack's process of conducting observations, interviews, and eliciting meaning related to current structures and processes was actually a *learning schema* that informed the change process and reflected on the overall strategy. This thesis adds to the above approach the use of a validated LO tool (the LOC measure) and the comparison with best practice benchmarks that may help Saudi research organisations to aspire to.

### 5.1.1 BUT HOW DO WE OPERATIONALISE LEARNING ORGANISATION CAPACITY?

The operationalisation of LOC in this AR cycle encompasses desk and fieldwork research. The creation of a LOC measure is aimed at defining a knowledge gap and addressing it by using KT process activities. With a benchmark that resembles a realistic ideal for the LO and knowing where an organisation is at in terms of its learning capabilities, the gap becomes clear, thus leading the way for the KT strategy to target filling the gap. The benchmark was based on secondary data from the literature for similar types of industries (Moilanen, 2005; Kluge *et al.*, 2001).

The LOC activity was operationalised using an online survey constructed from the extant literature on the measurement of LOC (Phillips, 2003; Mertins *et al.*, 2003; Kluge *et al.*, 2001; Moilanen, 2005; Marsick and Watkins, 2003; Bontis, 1998) and from the work of my supervisor Dr. Peter Massingham in his ARC project. The survey was designed based on elicited, theoretical-based and empirical-based, LO factors and influential constructs as described in Table (3-2) in chapter 3. The survey action phase activity is explained in phase 4 of cycle 1 where I explain how the survey was converted to real-life action. In addition to its significant role in building the KT strategy, raising awareness was a primary objective at for the knowledge strategy.

In the following sections, I present the actual phases that this AR cycle evolved through. The concepts of change, double-loop learning, action learning and democracy were adopted.

## 5.2 CYCLE 1 – PHASE 1: SITUATION ENGAGEMENT

As figure (5-1) below illustrates, this section describes the first phase of AR cycle 1. In this phase, I will present the segment of the AR journey that explains how the situation engagement in this particular cycle took place.

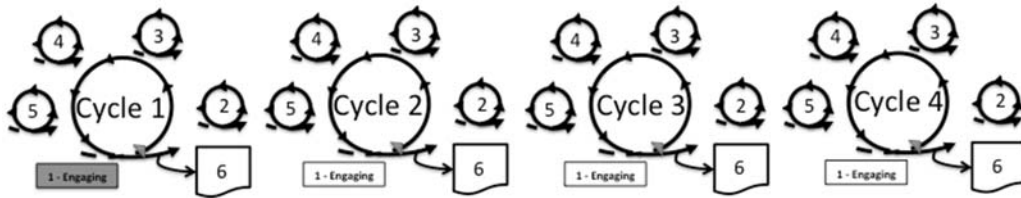


Figure 5-1: Cycle 1 – Phase 1: Situation Engagement

This section presents two events: (1) agreeing with staff that there was a problem, and (2) trusting me as an outsider to help solve the problem. In doing so, I needed to conduct an engagement phase. It was not simple as an outsider to engage with an internal problem because staff were required to apply new ways of thinking (Hamel and Prahalad, 1994). My motivation stemmed from how Forsythe (1999) profoundly stated, “[T]he most qualified field researcher is an outsider with considerable insider knowledge” (p. 127). My engagement effort was therefore focused on understanding the problem from inside.

During my experience with the ethics approval process, I engaged in multiple interactions, which turned into a positive opportunity to establish second-person reflections (Reason and Bradbury, 2001). In the pragmatic sense, selling my idea was by engaging with people (Bjørn and Boulus, 2011). From those interactions, there was no reported evidence from participants that a formally constructed publicly announced KT program have ever existed within any of the three case-study organisations. It was an opportunity to raise awareness to fill a capability gap that has never been addressed using KM. Strategic plans at the three organisations did mention KT to varying degrees as a generic goal but when staff was asked about any particular KT initiative, they did not report any. Their plans embedded KT notions focusing on international collaboration and research alliances but researchers did not comprehend what this entailed in the practical sense. These facts were appropriate justifications to engage with the host organisations’ members to conduct research on KT.



The case-study organisations are separate governmental bodies with different missions, but yet I had to engage myself with each organisation as if I was an insider at all three. After the approval process was completed, a comprehensive review of their publications on goals and objectives was conducted to gain a conception of their business strategies. Table 5-1 illustrates the information extracted. As can be seen, the host organisations are ambitious and want to become leading research and world-class institutions, thereby contributing to the national GDP. However, there was little evidence to suggest that these organisations were held accountable for such commitments and ambitious targets. They neither had progress indicators on meeting those targets nor operationalised reports that measured their commitment to their values. All three organisations admitted in informal discussions that they had not yet met their objectives but were working towards achieving them. The question became: how would they know if they were on the right track to do so?

	Organisation	Vision, Mission and Values
1	Organisation [anonymous]	<p><b>Vision:</b> To be a world-class science innovation knowledge-based organisation in the Kingdom.</p> <p><b>Mission:</b> Conducting applied research and technology development, providing support to scientific research and technology, investing in commercialization, fostering cooperation for technology transfer, localization, and investment in intellectual property, providing consultation and innovative solutions</p> <p><b>Values:</b> Integrity, loyalty, value and respect employees, serve society, excellence, team work, and transparency.</p>
2	Organisation [anonymous]	<p><b>Vision:</b> To be a preeminent institution known for its globally competitive graduates, cutting edge research, and leadership in energy fields.</p> <p><b>Mission:</b> To make a difference in the fields of sciences, and business by: graduating leaders who are knowledgeable, skilful, and productive members of society, creating new knowledge that makes a scholarly impact, provides innovative solutions, and contributes to the national economy, and engaging the society, alumni, and partners, in valuable endeavours.</p> <p><b>Values:</b> Creativity, excellence, integrity, fairness, diversity, responsiveness, teamwork, leadership, discipline</p>
3	Organisation [anonymous]	<p><b>Vision:</b> Becoming a cutting-edge, basic and goal-oriented research in science and technology comparable to that of the world's top science and technology universities, a source for highly trained and skilled graduates, a research and commercialization hub to strengthen the economy.</p> <p><b>Mission:</b> Advancing science and technology of regional and global impact. Energizing innovation and enterprise to support knowledge-based economic diversification. A catalyst for transforming people's lives.</p> <p><b>Values:</b> Achievement, passion, inspiration, diversity, openness.</p>

Table 5-1: Strategic positioning of the case-study organisations prior to the start of this research

The above table shows that host organisations were knowledge-intensive, required creativity to gain knowledge and needed social attributes to support meeting their strategic position. These attributes included openness, fairness, loyalty and integrity. However, their strategic targets underestimated their need to position themselves as knowledge seekers. This is the gap that needed to be addressed in terms of the way they think. To me, this meant more work was needed to align the above strategies to a KT strategy as will be shown in phase 2.

The informal acceptance of staff to be interviewed was extended to participation in a possible LOC online survey to provide an accurate assessment of the situation. This was the second important engagement with staff to establish momentum to start the project on the basis of shared understanding (Peters and Robinson, 1984). The main rationale for the proposed measurement model was important because it would provide staff and their leadership with an assessment of their organisation's performance against a best practice benchmark from other countries.

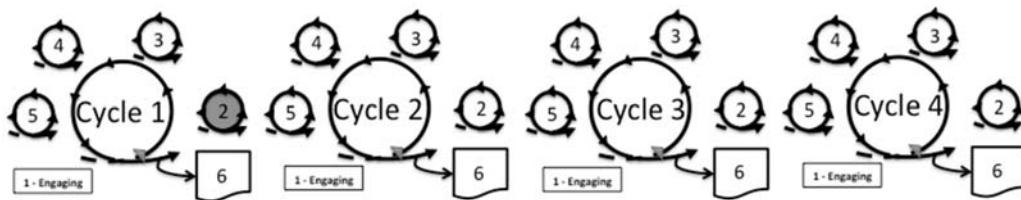
After finalising the formalities needed to enter the host organisations as explained in chapter 4 following the ethics approval of UOW, I attempted to explain to staff and executives how LOC was widely considered to function as the ideal business model for international organisations to sustain their strategic position as knowledge organisations (Massingham, 2010). It was made clear through oral discussions with the three organisations' staff that positive LOC status was normally attained by organisations that (1) respond to change, (2) learn from experience, and (3) grow their capability. An initial acceptance was acknowledged and a point for the importance of this field study in the context of the case study organisations was made. One advocate participant provided the following quote in support of a KT strategy that creates a LO:

In this particular subject, I believe that the management of the [organisation] should encourage institutionalising the practices that are being followed by world-class universities, and benchmark to what extent we have been following those practices. Encouraging that brings up a qualified research team, human resources, and manpower. This will be always extremely regarded and recognized. The university needs to revisit the subject. What we feel is a bottleneck, is that the university has not yet clearly identified the responsibilities.

In this sense, the KT strategy was to become a learning organisation, and a critical capability in achieving that goal was improving the KT capabilities of host organisations.

### 5.3 CYCLE 1 – PHASE 2: EMERGING DEFINITION

As figure (5-2) below illustrates, this section describes the second phase of AR cycle 1. In this phase, I will present the segment of the AR journey that explains how the emerging definition in this particular cycle took place. I will also present the result outcomes that emerged from this activity. Phase 2 of AR cycle 1 is shaded at which 5% of the project fieldwork was completed successfully.



**Figure 5-2: Cycle 1 – Phase 2: Emerging Definition**

The experience accumulated from the previous phase draws significant attention to the role of clarity and definition of activities (Coghlan and Brannick, 2007). The definition of a knowledge strategy with a KT capability focus represents the guiding approach, processes and infrastructure for transferring and sharing knowledge (Zack, 2002). KT operates within an overall knowledge strategy “to sense and respond to the changing knowledge habits of the organisation’s employees by monitoring knowledge transfer barriers along core business processes” (McLaughlin, 2010, p. 155). However, before KT, as a key capability, is assessed, the performance of the knowledge strategy must be examined in this chapter.

By obtaining staff perceptions and end-user input, an accurate alignment can be made between how to align the knowledge strategy and the core business strategy. As an approach to democracy and participation, using staff perceptions as a bottom-up approach usually supports employee engagement and buy-in throughout AR phases. This method of building the knowledge strategy provides an epistemology for how KM initiatives should take shape in its early steps. The collection of perceptions on people, systems, barriers, processes, feasibility, and prioritisation of change in KM practices should therefore precede formalising the KT strategy (Walters and Lancaster, 2000). The rationale behind this lies in the expected change in thinking that emerges from AR.

The above approach starts with exploring learning capability that once operationalised could mature into the sought knowledge strategy (Lehr and Rice, 2002). This approach is developed through longitudinal and detailed data collection activities. In doing so, I allow capability gaps, misaligned processes, and barriers to emerge early enough before a KT strategy is formalised in chapter 9 because the KT strategy should address the identified learning barriers as they appear along the core business strategy and relevant processes.

Theorists perceive high LOC as important for a knowledge strategy because it not only resembles the concept of OL, but also encompasses the elements of the ideal organisation (Örtenblad, 2001; Sicilia and Lytras, 2005; Phillips, 2003). Learning may be at the individual level (Wright and Belcourt, 1995) but others see the organisation as a whole undergoing the learning process (Garavan, 1997). The view adopted depends on whether we see knowledge as being owned by the individual or by the organisation. Many believe it is the individual because he or she is the one who actually learns. However, through their learning, the organisation's stock of knowledge (OKB) increases especially when they share their knowledge with other staff (Massingham and Diment, 2009). Location of knowledge therefore depends on one's view of how knowledge resides. I thus advocate a knowledge strategy with both individual and organisational learning perspectives.

The value in increasing the OKB is operationalised by OL. The increase in OL is also proportional to the increase in OKB. This means for both to increase, knowledge must be seen as a strategic resource that increases by investing in OL through staff training, on-the-job learning or through the process of KT. Setting a goal for host organisations to elevate their OL will eventually enable higher LOC results. This thesis therefore not only helps increasing OL and the OKB, but also provides measures that assesses how the organisation is performing to attain a LO status. It allows measurable outcomes to be explicit.

### **5.3.1 LINKING THE LEARNING ORGANISATION (LO) WITH KNOWLEDGE MANAGEMENT (KM) USING PERFORMANCE MEASUREMENT (PM)**

This section refers to the use of PM to support KM activities (Neely *et al.*, 1996; Crawford and Cox, 1990). One of the main KM activities related to PM is measuring the LO status (LOC). As the definitions to PM, LO and KM were presented in chapter 2, this section examines their application (Grant, 1996). This draws attention to a critical issue: KM (and

LOC) should be measured according to a knowledge strategy (Grant, 1996). By going back to Table 5-2, which describes the strategic positions of the case study organisations, PM can provide business indicators to describe how the organisation is performing in respect of meeting their strategies. KM is important for this task because it leverages the organisational resources (i.e. RBV) and its intellectual assets to meet defined business objectives (Sveiby, 1997). Hence, PM can support KM to provide well-structured templates that facilitate alignment with business objectives (del-Rey-Chamorro *et al.*, 2003). This chapter builds the LOC on this conception.

A well-referenced PM model is the Balanced Scorecard (BSC) of Kaplan and Norton (1996). The BSC measurement model integrates financial measures, customers, internal business processes, and learning and growth factors to form lag indicators or core outcomes for the strategic level and lead indicators or performance drivers for the operational level. This model fits with our measurement interest since it addresses intangible assets (i.e. knowledge and learning). Other attempts link KM with learning curves (Bohn, 1994; Hendriks, 1999). These frameworks allow organisations to determine factors at the operational level that should be measured to fulfill strategic objectives. They usually use Key Performance Indicators (KPIs).

Although learning is considered a very personal and individual process, it has a direct effect on the organisation as a vital element of all organisational structures and processes (Moilanen, 2001). As Moilanen (2001) states:

Diagnostic tools seem to be more often products of consultants than of thorough scientific development and testing. There seems to be a remarkable gap between practical and scientific work in diagnosing learning organisations. (p. 9)

Previous tools used to diagnose LOC are dispersed in methodology and scope. Some tools rely on interviews, observations, workshops and questionnaires (Pedler *et al.*, 1997); while others rely only on the questionnaire tool, which is the tool of choice for this AR cycle (Moilanen, 2001; Tannenbaum, 1997; Ojala, 1996; Watkins and Marsick, 1998). I find that a common drawback of these diagnostic tools is lack of feedback from the measuring process and the absence of a link back to theory once the measurement is made. This AR cycle attempts to fill this gap by providing the analysis with detailed reflections. By establishing a clear understanding to the performance of the knowledge strategy, further cycles may, in light of the results, build the KT strategy that aligns itself with an overall knowledge strategy that is clearly defined.

## 5.4 CYCLE 1 – PHASE 3: PLANNING FOR ACTION

As figure (5-3) below illustrates, this section describes the third phase of AR cycle 1. In this phase, I will present the segment of the AR journey that explains how the planning for action in this particular cycle took place.

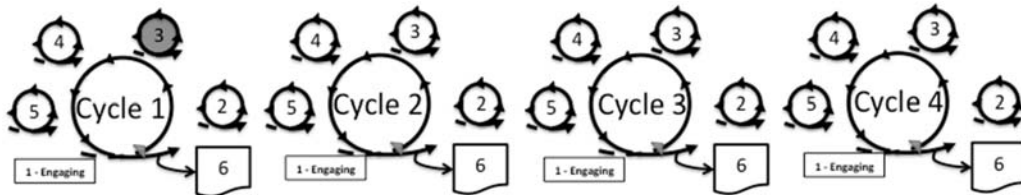


Figure 5-3: Cycle 1 – Phase 3: Planning For Action

The substantive importance of this AR cycle comes from the notion that the only sustainable strategic competitive advantage affecting the future of an organisation is its learning capability (Yang *et al.*, 2004). For this study, learning capability is needed to enhance KT to the host organisations and then to the local industry. With this in mind, the planning phase has a clear goal: to empower AR participants to know themselves better and allow their new knowledge to pave the way to a more profound understanding of how to respond (i.e. make change). This phase will focus on the LOC construct to measure strategic competitiveness.

Contemporary measures of LOC have not yet provided universally accepted assessment tools for application across different industries (Jennex *et al.*, 2009). Therefore, scholars and practitioners devote more attention to measurement tools that are tailored to specific industries for more focused results (Palte *et al.*, 2011). Thus, the specificity of PMS involves introducing industry specific tools that are far from generic. This AR cycle focuses on the measurement of LOC as a PM tool for engineering-based research organisations. Host organisations are all from Saudi Arabia, so there is specificity in the national environment and thus applying this tool elsewhere may require further testing in other countries.

### 5.4.1 HOW DO WE OPERATIONALISE LOC?

From a definitional perspective, the LOC construct can be operationalised by specifically displaying measurable learning and adaptive capability indicators for the organisation, then translating how these indicators apply to the organisation's body of knowledge (Yang *et al.*, 2004). Since most publications in this area refer to prescriptive advice and lack empirical

research, the majority of this AR cycle will focus on the practical lens of LOC characteristics via an empirical dataset that addresses the operationalisation of the LOC to fill this literature gap (Hao *et al.*, 2012). The breakdown of LOC performance into sub-construct behavioural indicators allows a better understanding of underlying phenomena and provides more accuracy in defining LOC status. In doing so, this chapter will test 23 indicators to operationalise the LOC of the host organisations.

Some scholars see a LO as one that learns from its members, external consultants, internal experts, good and bad experiences, successes and even mistakes at all organisational and hierarchal levels (Aizpurua *et al.*, 2011). Other scholars see it as the firm's capability to improve performance based on experience (Morales *et al.*, 2007). While some scholars interpret LO constructs by categorising them into different types such as single/double loop learning and cognitive/behavioural learning (Panayides, 2007), others prefer levels such as the individual, group, organisation, or community. A LO may also be interpreted through a processes architecture as in acquisition, conversion, application and protection (Panayides, 2007). However, the challenge is to convert those types into quantitatively measurable variables. By constructing accurate survey questions that group into cohesive measures, this chapter will find meaningful conclusions to operationalise LOC.

### **PARTICIPATING ORGANISATIONS**

AR cycle 1 was conducted in most divisions of organisation X using via the organisation's intranet and the executive management support memo. A consistent distribution of staff over different parts of the organisation was not possible due to individual response behaviour. Thus, some parts of the organisations participated more than others and this was difficult to control as a reliability measure. Only research sections of organisation Y participated in AR cycle 1. Academic and teaching sections of the organisation were not included in order to ensure consistency in the study demographics. The methods of communication to recruit participants were personal contact, email and memorandums from executive management. There were no interventions from the organisation on who could or could not participate.

AR cycle 1 was conducted in organisation Z research only divisions. Academic divisions were not involved to ensure consistency of the selected participating demographic

categories. The methods of communication to recruit participants in the survey were personal contact, peer recommendation and email. The coverage was not comprehensive, however it was at a satisfactory level for the purposes of the online survey. The management of this organisation was not supportive and was not willing to offer direct memos to staff to participate, which had a negative impact. Having the lowest participation from organisation Z was expected.

### **PARTICIPATING INDIVIDUALS**

The study involved four main classes of individual participants: (1) senior researchers who may be full professors, research centre directors or assistant research centre directors; (2) scientific researchers who may be post-doc researchers or research project managers; (3) assistant researchers who may be senior technicians, research coordinators or laboratory analysts; and (4) business analysts who may be research services administrators or statisticians. There were efforts to control the sample by controlling the invitation emails. The purpose was to ensure that the majority of participants were part of the general category of research staff, or at least staff who were close to research activities. Host organisations are large and it was important to control the sample.

The total number of invitations is unknown due to intranet announcements, which do not make it possible to know who viewed the invitation. The actual number of participants in the survey detected by the survey system was 463 (N=463). The majority of this sample was drawn from a non-random sample from organisations X, Y, and Z since most participant names matched the invitation list, which suggests that the intranet invitation was not effective. The majority of active participants were directly invited to participate in the LOC online survey, except for the case in organisation X where the intranet was used. Over an 18-week period, the final sample of 96 usable responses (a 20% response rate) was accepted as being representative of the population. The remaining 367 responses were either incomplete or invalid. All of the accepted responses were then processed in the Performance Measurement Model (PMM) and the LOC categories model for analysis, which will be explained in the analysis and reflection described in phase 5. Tables 5-2, 5-3 and 5-4 provide details on participants.



## CHAPTER 5: EXAMINING THE KNOWLEDGE STRATEGY

Sector/ Participant position	Specialty expertise of online survey participants						Participants by position type
	Electrical/ Mechanical/ Chemical Engineering	Space and Aeronautics	IT	Nuclear Science and Technology	Water and Energy	Materials and Nanotechnology	
Senior researcher	2	4	1	2	2	1	12
Scientific researcher	1	3	2	2	1	4	13
Assistant researchers	1	1	2	-	-	2	6
Senior analyst	-	-	-	-	-	1	1
Business analysts	-	-	3	-	-	-	3
Total by sector	4	8	8	4	3	8	35

**Table 5-2: Summary of AR cycle 1 participants in organisation X**

Sector/ Participant position	Specialty expertise of online survey participants						Participants by position type
	Electrical/ Mechanical/ Chemical Engineering	Space and Aeronautics	IT	Nuclear Science and Technology	Water and Energy	Materials and Nanotechnology	
Senior researcher	4	1	2	1	4	3	15
Scientific researcher	7	3	5	2	3	1	21
Assistant researchers	1	2	4	-	-	2	9
Senior analyst	1	-	-	-	-	1	2
Business analysts	-	-	1	-	-	-	1
Total by sector	13	6	11	3	7	7	48

**Table 5-3: Summary of AR cycle 1 participants in organisation Y**

Sector/ Participant position	Specialty expertise of online survey participants						Participants by position type
	Electrical/ Mechanical/ Chemical Engineering	Space and Aeronautics	IT	Nuclear Science and Technology	Water and Energy	Materials and Nanotechnology	
Senior researcher	-	-	-	3	-	1	4
Scientific researcher	-	-	2	1	-	3	6
Assistant researchers	-	-	-	-	-	1	1
Senior analyst	-	-	1	-	-	-	1
Business analysts	1	-	-	-	-	-	1
Total by sector	1	-	3	4	-	5	13

**Table 5-4: Summary of AR cycle 1 participants in organisation Z**

As shown in the above tables and table 5-5, nearly all (approx. 90 per cent) of the participants were researchers in the engineering and technology fields of varying rank. The respondents were predominantly male (99 per cent). One-tenth (10 per cent) were from

research support services working as technicians or business analysts who were deeply engaged with researchers. The ratio of 9:1 between researchers and technicians/analysts is justified by my qualitative perception that the majority of knowledge flow and learning activity that directly affect the competitiveness of the organisations rely on research science engineers who generate and assimilate advanced knowledge.

	ORGANISATION X	ORGANISATION Y	ORGANISATION Z
Senior researchers	12	15	4
Scientific researchers	13	21	6
Assistant researchers	6	9	1
Senior technicians	1	2	1
Business analysts	3	1	1
<b>TOTAL</b>	<b>35</b>	<b>48</b>	<b>13</b>

Table 5-5: Overall summary of AR cycle 1 participants in organisation X, Y and Z

## INSTRUMENT DESCRIPTION

The instrument used to survey perceptions categorised them into operationalised constructs covering a range of characteristics commonly used to define LOC (Lorange, 1996; Phillips, 2003; Sun and Scott, 2003; Örténblad, 2001; Schulz, 2001; Ikehara, 1999; Richardson, 1995; Dymock and McCarthy, 2006; Wright and Belcourt, 1995; McHugh *et al.*, 1998; Sicilia and Lytras, 2005; Armstrong and Foley, 2003). The extensive literature review identified a substantive range of scale items for this instrument. These constructs were defined and explained in the relevant literature (see chapter 2 and chapter 3). The categories in the LOC survey aim to measure different dimensions of the LO (Yang *et al.*, 2004).

The biggest challenge in this phase was to ‘operationalise’ the high-level constructs of pioneers such as Peter Senge (1990) who talks in broad terms of things such as ‘shared mental models’. Operationalisation of such constructs was challenging in terms of presenting them in the survey to respondents in a sensible and understandable way. As mentioned in chapter 3, the instrument was adapted from a previous Engineering Research Project (2007–2011) conducted by Dr Peter Massingham (ARC Linkage Project). The adaptation included adding questions and re-designing the survey using an online technology system. The Likert-scale items were preserved to maintain their tested validity and reliability from the ARC project (Massingham, 2012).

## POSITIONING THE SURVEY IN ACTION

Online survey instruments have become a common practice used by organisations to improve their understandings of their workforces (Wiley, 2010). Although in the US it has been reported that 75% of large organisations survey their employees (Kraut, 2006), it has been reported that staff surveys are not yet common in Saudi Arabia (Wiley, 2010). The issue of the popularity of surveys, however, does not affect their impact or benefit but could affect the cooperation of unfamiliar staff since it is not a common practice (Kraut, 2006).

As the survey was an unusual practice for some participants, especially that it takes two hours to complete, some employees refused to complete it. To address this, the survey started with a clear message explaining benefits of participating on the individual, organisational and industry levels. This introduction is in line with the participatory approach of AR. Figure 5-1 shows the main screen of the survey to trigger interest.

University of Wollongong

KNOWLEDGE TRANSFER STUDY RESPONDENT QUESTIONNAIRE

هذا البحث يهتم في تحليل كيفية نقل المعرفة الهندسية من مراكز البحث في الدول المتقدمة الى مراكز البحث في المملكة. انه جدير باهتمامك نظراً لاهماسة يعمل كافة الباحثين حيث ان محور الرابح هو تحديد اسباب بطء انتقال المعرفة الى مراكز البحث العلمية والهندسية في المملكة. وحيث انك باحث علمي او هندسي في المملكة فإن رأيك هام وموثر لتطوير نظام فعال لانتقال المعرفة الى متشائكن. نأمل ان تولي اهتمامك لإرسال معلومات دقيقة عن طبيعة عملك واسلوبك البحثي ليكون لك دور مساعد في هذا المشروع

Engineering and technology knowledge transfer is an important asset in engineering based research institutions. This is especially true for organisations like yours, where you need to import knowledge from outside the borders of your research institute and try to develop beneficial research output from it. Research is your most important service in order to support the Saudi economy to become successful in global markets.

But how is knowledge best created and shared between international researchers? How does knowledge flow and what is its best methods for Saudi researchers? That's what we want to find out with this online survey.

This project is undertaken as part of a PhD program at the University of Wollongong, New South Wales, Australia. The purpose of this project is to develop, through action learning, a practical framework for knowledge sharing between international networks especially between industrial and developing nations, i.e. USA and KSA.

**What action is required?**

This invitation is personal and not intended for circulation. You have been selected based on your qualifications, experience and potential to contribute to this action research. You are expected to advocate the cause of this research and support it by filling out the online questionnaire (approximately 120 minutes).

**Your benefits?**

Every participating researcher, director or executive will receive a thank you letter and with it, your institute will be able to implement a knowledge transfer framework, hence, you would be supporting your organisation to improve and compete globally. If you have any queries about this project, please do not hesitate to contact me or Dr Peter Massingham. We would be delighted to hear from you.

Thank you for your valuable time.

Yours sincerely,

Moshary A. Al-Holaibi, Researcher,  
Email: [mah500@uowmail.edu.au](mailto:mah500@uowmail.edu.au)  
Phone: +966505926191

Dr Peter Massingham, Project Supervisor  
Email: [peterm@uow.edu.au](mailto:peterm@uow.edu.au)  
Phone: +61242 213 642

Exit and clear survey Load unfinished survey

Figure 5-4: Introductory page to the online survey with a description of its benefits

The introductory message clearly illustrates the benefits for participants, their organisation and professions. Some clarifications and technical support on how the survey works was requested. This proved the existence of motivated individuals to participate in the survey as well as the existence of illiteracy of some participants in completing online surveys.

## 5.5 CYCLE 1 – PHASE 4: TAKING ACTION

As figure (5-5) below illustrates, this section describes the fourth phase of AR cycle 1. In this phase, I will present the segment of the AR journey that explains how action took place in this particular cycle.

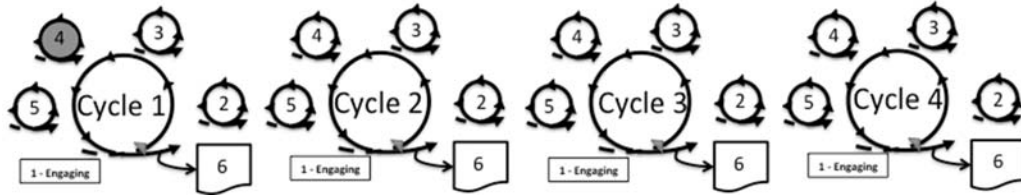


Figure 5-5: Cycle 1 – Phase 4: Taking Action

From the start, the LOC online survey engaged internal staff in exploring themselves epistemologically and ontologically. The LOC questions drew attention to matters that had not been noticed before by them, indicating a gap in strategic thinking. While explaining the LOC tool and its application to participants and stakeholders, a lack of comprehension of underlying constructs and of the cause-effect aspects of learning and change was detected.

To answer the question: *how well do the organisations in this AR cycle embrace and live the LO concept?* It was necessary to audit – measure – the present state of the organisation as perceived by its members (Moilanen, 2001). To do so, a quantitative self-administered online LOC survey tool was suggested with 187 statements that characterise LOC attributes on a six-point Likert-type scale. In addition to the given statements, participants' demographics and daily work responsibilities were captured through other questions posed in the system survey. The tool provided quantitative results in analytical and graphical formats to allow for the operationalisation and theoretical discussion to identify bottlenecks in the learning and knowledge flow processes, which will be discussed in the next AR cycle phase. In this sense, the LOC survey was a 'health audit' of each organisation's performance according to staff, which feeds into knowledge strategy by identifying capability gaps; specifically KT capability. The LOC survey, therefore, plays a critical role in the AR cycle by establishing a baseline for the change program. It establishes the need for change from the participants' perspective, and also identifies the specific changes needed, for example through poorly performing LOC indicators.

The online survey technology system to upload the question statements was sourced from an open source code application that is widely used by researchers at UOW and worldwide. Respondents were requested to click the rating they agreed to as shown in Figure 5-6. Respondents were allowed not to provide a rating for a statement they are not willing to rate to avoid events where the respondent would exit the survey if forced to input information. The level of detail in responses was reviewed and poorly answered surveys (i.e. many missing values) were not included in the analysis phase. Some respondents left out very few statements and therefore, the optional feature allowed them to continue the survey.

**KNOWLEDGE TRANSFER STUDY RESPONDENT QUESTIONNAIRE**

0% 100%

**Learning Organisation capacity**

Please look at the following statements and indicate how you rate your University/Research Institute, as a whole, using the following scale:

1 : Strongly disagree  
 2 : Disagree  
 3 : Slightly disagree  
 4 : Slightly agree  
 5 : Agree  
 6 : Strongly agree

(This is a long question. Please complete as many as you can. Click next at the end of the page to move to the next question).

	1	2	3	4	5	6	No answer
Building a learning organisation (e.g. learn from experience, respond to change, invest in staff) is a priority and has many	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>

**Figure 5-6: Online survey first screen for the 187 LOC statements section**

In addition, there were questions related to demographics, academic background and work responsibilities. Respondents were asked to list their daily tasks, to prioritise them and then provide the percentage of their time allocated to each task. They were also asked questions of qualifications, experience and specialisation skills. Respondents answered most of these questions although they were optional which showed some motivation on their side. Other questions related to their position within their organisation were also captured. Data from these questions validated the attributes of participants and confirmed the applicability of responses to similar work groups. Despite some missing entries, most accepted responses were fully completed.

## 5.6 CYCLE 1 – PHASE 5: ANALYSIS AND REFLECTION

As figure (5-7) below illustrates, this section describes the fifth phase of AR cycle 1. In this phase, I will present results and the segment of the AR journey that explains how the analysis and reflection in this particular cycle took place.

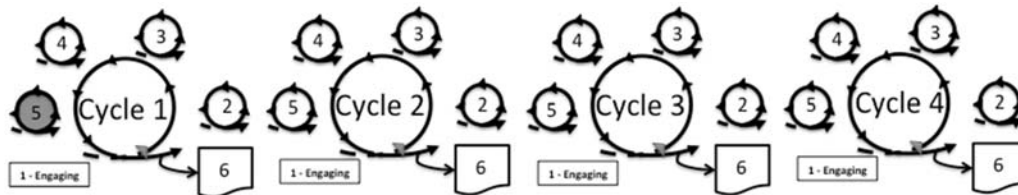


Figure 5-7: Cycle 1 – Phase 5: Analysis And Reflection

This phase is considered the most important phase of any AR cycle because it includes contemplating on what can be learned from experience (Lau *et al.*, 1997; Bjørn and Boulus, 2011). Explaining how analysis and reflection occur is seldom discussed in AR publications (i.e. how do I reflect?) (Marshall and Mead, 2005). My approach to reflection was to question the taken-for-granted assumptions, feelings, beliefs and actions in each particular situation and explain how I came about reflecting (Ross and Hannay, 1986). Given the uncertainties in AR, I do not contend that reflections are coincidental thoughts; rather, reflection is critical considerations of a situation that enables possible improvement but not final solutions. With the support of contextual explanations and situated qualitative discussions, the online survey operationalised a considerable number of constructs from the literature mentioned earlier in this thesis to facilitate a snapshot diagnostic measure of how the host organisations' members perceived their organisations.

A LO is one that has an enhanced capacity to both learn and change from the inside (Watkins, 2005). The learning factor requires some sort of incremental change. Therefore, knowing about how to respond to change is an important learning element (Senge, 1990). This AR cycle measures the 'insider's' attitude to learning rather than employing an 'outsider' type analytical approach. It is necessary to focus on 'insider change', having adopted the AR approach as the governing research guide. The capture of LOC perceptions was suggested by the literature to be both *quantitative* and *qualitative* (Marsick and Watkins, 2003). This phase presents the qualitative reflections on the online survey results in the form of staff experiences, which is in line with AR approach.

Given the extant literature on LOC, a low LOC indicates ‘knowledge management is ineffective’ (Lorange, 1996), or in knowledge strategy terms, that there is a capability gap. In the case of a low LOC, it is incorrect to claim that KT is weak because what is claimed weak was actually the overall KM practices. Indeed, a low LOC implies that some – or all – KM activities may prove to be weak, which requires scrutinising each KM element to find out which needs improvement. On the other hand, if the outcome of the LOC measurement was high then this indicates *healthy* management of knowledge activities (Phillips, 2003). Once again, with a high LOC score, it is incorrect to claim that KT is efficient because what we claim as strong is actually overall KM practices.

### 5.6.1 HOW TO USE THE LOC SURVEY RESULTS?

The LOC survey provides an important tool to implement strategic alignment of knowledge activities with organisational goals. Ideally, knowledge is efficiently shared within a research organisation for the purpose of *combining* with existing knowledge to improve organisational performance in meeting its strategic goals and objectives (Schulz, 2001; Phillips, 2003). Sustaining this ideal situation implies that OL, including KT, is correctly aligned with the organisation business strategy, which may also close the identified capability gap that hinders the knowledge strategy (i.e. LOC status).

However, the results of the LOC survey showed that the reality in the case of the host organisations was far from the ideal situation. The current situation indicated a number of knowledge flow defects that were affecting learning processes (del-Rey-Chamorro *et al.*, 2003). In chapter 3, Figure 3-7 demonstrated a group of organisations with low LOC. This example illustrated that there was no deductive method to reveal those process-learning issues and that it is essential to inductively explore the situation for each process separately. This also implies that once we know that there is a capability gap, as this cycle will prove, knowledge processes need first to be identified before altering the knowledge strategy. For this reason, the findings of this cycle suggest a new cycle, which will take place in chapter 6.

Based on the results from host organisations, knowledge flow was found to be *sticky* (Szulanski, 1996; 2000). The results coming from the host organisations indicate the existence of knowledge blockages. The analysis of the LOC results will list the potential issues for further investigation in the following cycles to (1) locate them on the process map

for each host organisation (i.e. AR Cycle 2), and (2) explain these blockages further (i.e. AR Cycle 3) (Brown and Duguid, 2002; Hansen *et al.*, 1999; Wenger, 2000). The main difference, therefore, between AR cycle 3 and this cycle is that the LOC survey was designed based on theoretical measurements (i.e. identified by the LOC literature); while AR cycle 3 was designed based on the empirical results from AR cycle 1 and 2. Therefore, it is essential for the leadership and staff to use the LOC results as an *initial* diagnostic tool in the learning process and that further details on the exact source of impediment for knowledge flow are obtained from the following cycles to validate the LOC results. The case-study organisations may use the *analysis and reflection* phase results of this LOC audit in three ways:

- (1) At a strategic level: to inform the leadership to determine whether their research organisation is performing satisfactorily against a set benchmark as an LO. If not, the audit will identify areas to focus on (i.e. the strategic learning gap). The results of the LOC online survey for the three host organisations were merged to represent the research industry sector in Saudi Arabia. The objective is to focus on the research industry learning problems rather than on a given organisation. The advantage of having three leading research organisations in Saudi Arabia in one study is that it provides an opportunity to establish a LOC industry standard for Saudi Arabian research organisations. The ability to embrace this standard as a benchmark for research organisations in Saudi Arabia can help individual organisations to compare their performances with an industry standard. The case-study organisations will be guided to tailor its own strategy in chapter 9 based on its distance from the established benchmark.
- (2) At a tactical level, to inform middle management about whether there are significant differences between internal groups in perception of their organisation as a LO.
- (3) At an operations front-line level, it enables group leaders and senior researchers to: (a) determine who feels most negatively about his/her research organisation as a LO and why. These employees would represent barriers to change if the research organisation decided to improve its performance as a LO and (b) determine who feels most positively about their research organisation as a LO. Positive staff represent potential change agents who could support the change transformation process, which is discussed in chapter 6.



### 5.6.2 THEORETICAL FOUNDATIONS: DATA ANALYSIS MODELS

It has been difficult to measure high-level constructs of the LO described by theorists such as Senge (1990), Pedler *et al.* (1997) and Argyris and Schon (1978; 1996). Their descriptions of the LO were holistic and idealistic. To overcome this challenge, researchers such as Moilanen (1999) tried to add specific dimensions to the LOC construct that ease the measurement of LOC. Moilanen (2001) builds on this approach by defining the LO as:

[A] consciously managed organisation with 'learning' as a vital component in its values, visions and goals, as well as in its everyday operations and their assessment. The learning organisation eliminates structural obstacles of learning, creates enabling structures and takes care of assessing its learning and development. It invests in leadership to assist individuals in finding the purpose, in eliminating personal obstacles and in facilitating structures for personal learning and getting feedback and benefits from learning outcomes. (p. 11)

This definition was a starting point for him to provide a platform for specific metrics that measure where an organisation is positioned from being described as a LO. His LO diamond was a product of this work that provided a basis for our LOC instrument (Moilanen, 2001). The LOC survey was a validated tool of Dr. Massingham adapted to apply in this study. Therefore, there was little justification to include quantitative validation to this part of the thesis' measurement given that it was tested elsewhere. A comprehensive review was made of the theoretical source of the instrument in order to support my effort to explain the results and to offer underpinning reflections on the analysis of the results. All survey statements revised to appropriately apply to the context of this study. Three theoretical models were adopted to analyse the data emerging from the online survey in this chapter:

- (1) Performance Measurement Model (PMM) – section 6.3
- (2) Conceptual Categories Model (CCM) – section 6.4
- (3) Best practice benchmarks – section 6.5

The first and second models are analysis tools to reflect on the results. The third model is a comparison model to define the capability gap between the existing performance of the knowledge strategy and the aspired knowledge strategy. The PMM was presented and discussed in chapter 3 as part of the knowledge strategy (see Figure 3-4). It explores important 'attributes' influencing the LO (Massingham and Diment, 2009). The CCM, is a useful model that has been tested and validated by previous research and explores important 'behaviours' influencing the LO (Massingham and Diment, 2009). These two models will number descriptors using the following formats:

**(1) Mean Score**

This descriptor provides an indication of the average staff perception for a given LOC sub-construct. The results are helpful in benchmarking against studies conducted by other organisations against the same set of LOC sub-constructs. The mean scores can be calculated to provide an overall picture or can be scrutinised to provide *subtotal* means for group categories, which represent familiar constructs. Each relevant scaled statement, when grouped into a mean score, represents a construct category. The categories are helpful because they isolate the problem and lead to opportunities to discuss solutions. However, mean scores need to be treated with caution. Mean score ratings tend to pull towards the middle of a rating scale because a group of negative ratings offset a group of positive ratings. The scores tend, therefore, to dilute the real message without explicating it with further attributes, unlike the second point to below. This justifies introducing the next descriptor.

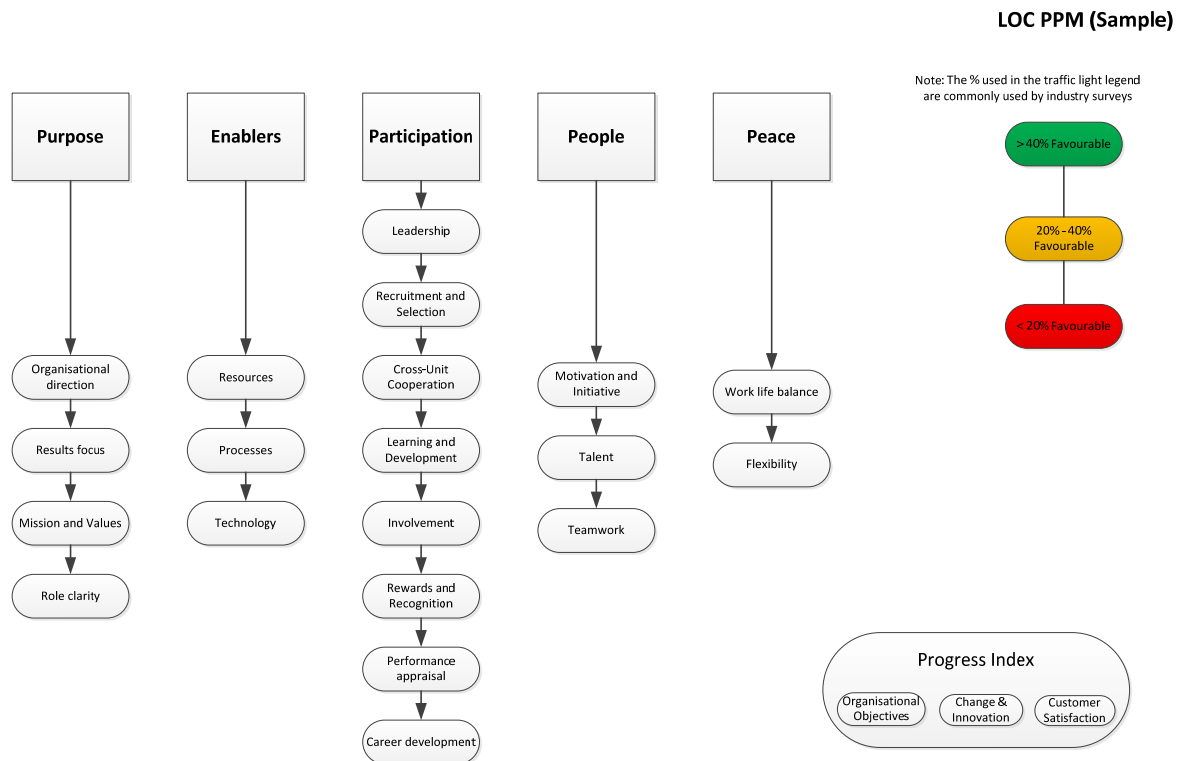
**(2) Percentage Favourable**

This descriptor represents the staff who felt very positively about the LOC item by strongly agreeing (score 6) or agreeing (score 5) in the online survey Likert-scale (1–6). The weakness in mean scores is therefore addressed by including this ‘agreement index’ (represented by % favourable). This indicator shows the percentage of people who responded favourably (i.e. with either an agree or strongly agree) to the survey items. This indicator is commonly used in consulting industry *health audits* and better represents the ‘ideal scenario’, compared with mean scores that simply summarise the average response.

## **5.7 THE PERFORMANCE MEASUREMENT MODEL (PMM)**

This section will present the data. This section presents one model to operationalise the LOC construct and provides a practical solution to converting theory into practical measures. The PMM was used to classify the survey statements into categories amenable to management understanding and action. The PMM classified 187 survey statements into 23 Performance Measurement Model Indicators (PMMIs) distributed over five strategic areas: *purpose*, *enablers*, *participation*, *people*, and *peace*. Each PMMI comprised a sub-set of statements that was considered a strategic area. In chapter 3, a definition for each PMMI was presented in Table 3-2. Further theoretical underpinnings on what these constructs mean and how the literature understands them is discussed below. A representation of the model is presented in

Figure 5-9. The model was designed by Dr Peter Massingham for his ARC project and was adopted by me to establish the baseline for my thesis.



**Figure 5-8: Colour coded representation of the PMM**

The PMM model includes a colour-coded index for each performance indicator to ease interpretation. The colour codes are *red*, *orange* and *green*. Code ‘Red’ means less than 20% of respondents felt favourably about the indicator. Code ‘Orange’ means 20-40% felt favourably. Code ‘Green’ means more than 40% felt favourably. The higher the favourable percentage for an indicator, the more aligned the organisation is with its members and learning objectives. It is a sign of danger when low favourable percentages appear for a given organisation. It is also a sign of danger for the overall research industry in Saudi Arabia when low favourable percentages appear repeatedly for the overall PMMIs at an industry level. The results for the three case-study organisations will be presented and discussed in detail to provide a solid basis for understanding the problem situation of KT.

### 5.7.1 ANALYSIS AND REFLECTIONS ON RESULTS USING THE PMM

The highest and lowest results are presented in sections 6.3.2 and 6.3.3. All data findings are then discussed in section 6.3.4. In section 6.3.5, an overall summary is presented with conclusions and colour coded diagrams following the architecture of figure (5-9) above.

### 5.7.2 REFLECTION: IN WHAT AREAS ARE WE DOING WELL?

The most positive overall PMM indicators for the three case-study organisations based on the highest % favourable indicators were:

- (1) Resources (48.5% favourable)
- (2) Career development (41.9% favourable)
- (3) Cross-Unit Cooperation (43.5% favourable)
- (4) Recruitment and selection (42.4% favourable)

Three of the above PMMI's are *Participation* measures and one is an *Enabler* measure. The results for participation suggest that the host organisations are perceived, generally, as investing in staff and empowering them to feel cared for and supported in achieving their work and career goals. This indicates that the organisations are trying to establish a positive culture, at least from the perspective of nearly half of the staff. This fits with some aspects of Senge's (1990) characteristics of a LO; namely, personal mastery. The cross-unit cooperation finding is important because it is evidence of positive KT behaviour. These results show an opportunity to attain the knowledge strategy goal (i.e. becoming a LO).

The results suggest that staff feel quite positively about the resources aspect of LOC, i.e. that the organisation invests in providing them with necessary work-place resources, e.g. equipment. These findings are important for identifying strengths in the knowledge strategy, (i.e. becoming a LO) and to uncover hidden LOC gaps that could serve as a scientific measure for establishing a clear KT strategy. The positives here are evidence of a capability growth. However, the results do not provide evidence on 'respond to change' and 'learn from experience', which are important KT capabilities. This identifies a capability gap that directly relates to KT, despite the result on cross-unit cooperation, which is an excellent result here – 43.5%.

The most positive individual statements with the highest % favourable results for the three host organisations were related to:

- (1) Applying learning to develop research work (62.6% favourable)
- (2) Being trained to do the job (60.7% favourable)
- (3) Organisational encouragement of knowledge sharing (60.3% favourable).

However, there are significant differences in results across the host organisations. For example, while knowledge sharing gets a high overall rating (60.3% - see above), it was 35% at organisation X. It will be interesting to examine whether there are differences as well in the KT processes, as the thesis evolves. The overall knowledge sharing finding shows those participants perceive that their organisation encourages positive KT behaviour. Therefore, KT is seen as part of the knowledge strategy. However, as we shall see in chapters 6 and 7, the knowledge strategy is not being effectively implemented, at least in terms of KT, because there are blockages in knowledge flows and barriers to sharing.

### **5.7.3 REFLECTION: IN WHAT AREAS DO WE NEED TO IMPROVE?**

The lowest overall PMM indicator was Flexibility (13.8% favourable). This is a Peace PMM indicator and influences job satisfaction and psychological contract (organisational commitment). From a strategy perspective, flexibility is a very important influence on professional staff willingness to stay at an organisation. From a capability perspective, organisations that are capable of providing their staff with a sense of control over decisions about their work are better able to retain their human capital (Massingham, 2012).

The most negative individual statements with the lowest % favourable results were:

- (1) Lessons learned made available by the organisation to all employees (10.1% favourable).
- (2) Organisational roles and responsibilities for knowledge management activities (10.7%).
- (3) Organisational members involvement in generating non-traditional ideas (11.1%).

This shows that KM is not formally conducted, experience is not shared and used, and creativity is constrained. For example, while ‘lessons learned’ has low ratings, it is the most critical for addressing the knowledge capability gap. These ratings substantiate the qualitative dimension and imply that I should not focus exclusively on quantitative ratings. I should assess the weight of each element in terms of its variable influence to the LO status.

### **5.7.4 DETAILED DISCUSSION OF RESULTS**

Analytical tables and graphical representations are presented to reflect on the data coming from the PMM. The tables and graphs present a visual summary of the data and highlight areas for each research organisation to focus on in order to improve their LOC. The tables provide the mean scores for ‘% favourable’ for the whole sample and then for each

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organisation. This allows comparison by organisation. It also helps identify key success elements and problem areas. The overall summary table and graph are presented:

Institute	PMM Driver by % Favourable					
	Purpose	Enablers	Participation	People	Peace	Mean
Organisation X	32.8	37.9	35.9	29.7	33.4	33.9
Organisation Y	29.5	42.8	46.2	33.1	22.8	34.9
Organisation Z	13.3	26.0	29.7	15.2	10.0	18.8
Overall Average	25.2	35.5	37.2	26.0	22.1	29.2

Table 5-6: Overall comparison by PMM driver for the host Organisations

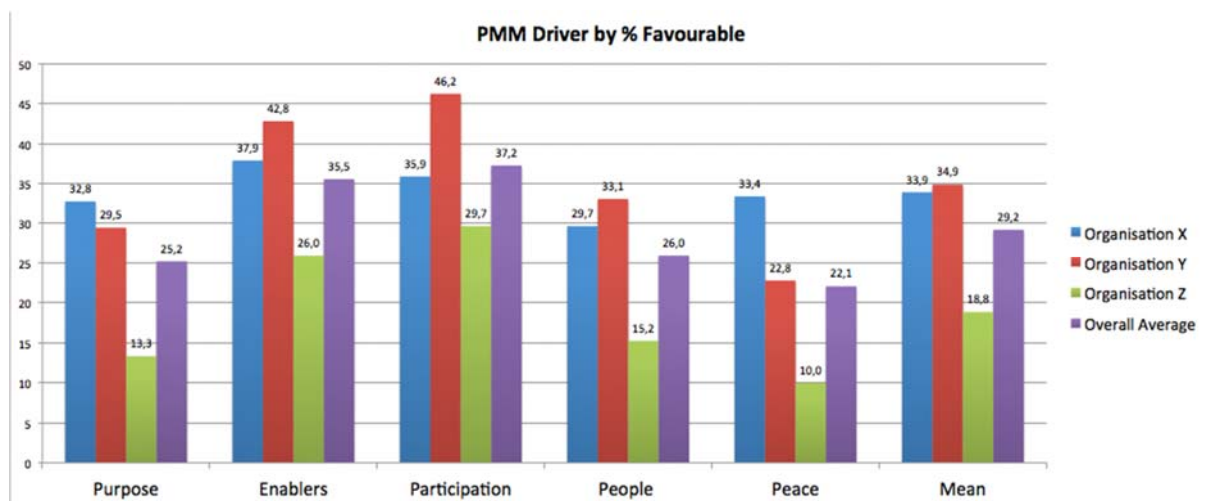


Figure 5-9: Column representation by PMM driver

The above table and graph present a high-level summary of the results obtained from the LOC online survey using the PMM. The results highlight the differences in performance across the three host organisations in relation to the five strategic areas discussed earlier in Figure 5-4. The following tables and graphs present detailed results for each PMM indicator.

**(1) L1F1: PURPOSE**

Institute	Purpose				
	Organisational direction	Results focus	Mission and values	Role clarity	Mean
Organisation X	28.2	39.1	25.1	38.6	32.8
Organisation Y	28.4	26.0	26.1	37.4	29.5
Organisation Z	12.1	18.9	8.7	13.6	13.3
Overall Average	22.9	28.0	20.0	29.9	25.2

Table 5-7: Result for the PMM Purpose definition construct

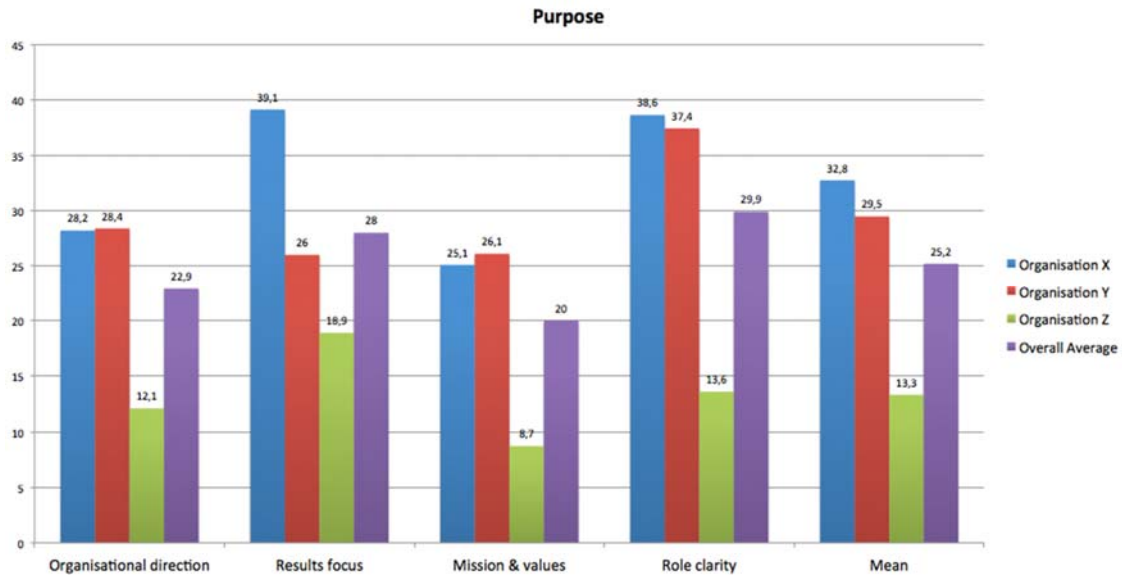


Figure (5-10): Column representation by PMM driver construct

**REFLECTION**

The first PMM driver for the host organisations in the *purpose* area of the LOC is ‘organisational direction’. In terms of the knowledge strategy goal of attaining LOC status, this translates to Peter Senge’s (1990) dimension of having a shared vision. However, in Massingham’s (2012) model, the focus is mainly on KM. In other words, organisational direction means: do workers have a shared vision about KM that aligns with their organisation’s goals? Employees tend to naturally base their decisions on self-interest (Kluge *et al.*, 2001). Instead of trying to alter or work against this behaviour, organisations should try to align it with organisational direction by designing a win-win scenario that makes both the employee and the organisation have the same goals. For example, host organisations could manage their organisational knowledge in a way that is useful to staff as well as central to their work activity. Rules, responsibilities and common values become practically part of staff daily activity and they become aligned with organisational strategy direction. With an average of only one quarter of respondents in the case-study organisations feeling that this is

the case at their organisations, it is clear that there is a lack of a homogenous (i.e. aligned) direction between the case-study organisations and their staff. This surfaces and brings about possible conflicts and political internal issues that confuses and fails the KM vision.

The second PMM driver for the host organisations in the *purpose* area of the LOC is having a ‘results focus’ in business activities. This means the host organisations should have set targets and performance gap measures aiming to achieve world-class benchmarks. Although the result is higher than for the first driver, it is still relatively low. This suggests that overall, staff feel unclear about how their organisations stand in comparison with the competition. This requires case-study organisations to rethink their strategies. In some of my discussions with an executive at organisation Y, he mentioned that they have a list of Key Performance Indicators (KPIs) reviewed each year. It seems from the results of this indicator, therefore, that either these KPIs are not results focused, or that they are not well communicated to organisational staff. The staff perception is yet to be further examined in future AR cycles.

The third PMM driver for the host organisations in the *purpose* area of the LOC is ‘mission and values’. The mission and values of host organisations were presented in the introduction of this chapter. The results showed similar approaches with little variation. Staff should recognise knowledge as a key resource from the organisation’s mission and values. The ‘mission and values’ indicator marked the lowest (20%) in the *purpose* area of the LOC survey. It is alarming that staff lack the understanding that KM is a major part of their organisational objective. Unclear alignment between what they do and what is strategically announced by the organisation could add to confusion about what KM is about and what KM is supposed to do. This finding also represents a barrier to the change program to become a LO. This demonstrates a lack of awareness about the proposed change.

The fourth PMM driver for the host organisations in the *purpose* area of the LOC is ‘role clarity’. Staff responded negatively to the question about whether their job descriptions reflected accurately their actual work. The involvement of staff in building their organisation’s vision was low and this resulted in the ambiguity of their roles. They were not sure why they were placed in their positions and what was expected from them. Although this indicator was the highest in this strategic area (29.9%), it is essential to improve this situation through better communication on what is expected from staff and whether their jobs are comprehensively described and aligned with the organisational vision and mission.



**(2) L1F2: ENABLERS**

Institute	Enablers			
	Resources	Processes	Technology	Mean
Organisation X	53.0	31.0	29.6	37.9
Organisation Y	55.0	30.3	43.1	42.8
Organisation Z	37.7	13.6	26.6	26.0
Overall Average	48.5	25.0	33.1	35.5

Table 5-8: Result for the PMM Enablers defining construct

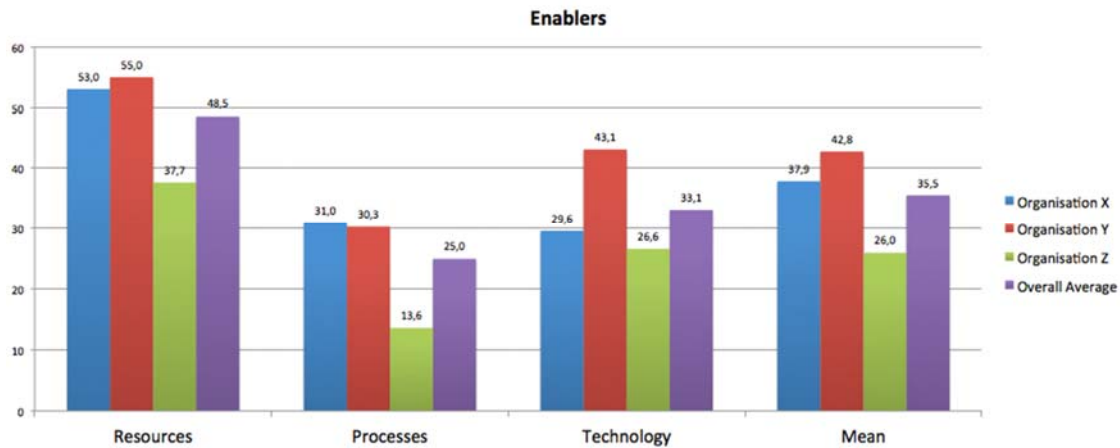


Figure 5-11: Column representation for the PMM Enablers defining construct

**REFLECTION**

The first PMM driver for the host organisations in the *enablers* area of the LOC is 'organisational resources'. In terms of the aim of attaining LOC status, this translates to obtaining and combining resources to enable a LO. Resources are about equipment, tools and facilities to support staff to share knowledge. When the organisation allocates resources towards efforts that measurably increase its knowledge base, then this organisation is seen as performing well in this indicator. Similarly, when the organisation enables people to get needed information at any time quickly and easily then this means that the resources needed for knowledge sharing are provided. Staff needs to find knowledgeable individuals quickly to seek advice, especially in the host organisations of this study where staff are distributed over different buildings and even different campuses. It is essential to provide appropriate resources to enable knowledge seekers to find appropriate advice.

A further layer of analysis may investigate the use of resources to create an environment for knowledge sharing, called the 'ba' (Nonaka and Takeuchi, 1995). The 'ba' in this case is relevant because it is concerned with how the resources are put together to create a

supporting environment for KT. The literature suggests a link between KT and workspace design (Takeuchi and Nonaka, 2004). This implies the physical space has an influence on how people interact. However, in this indicator, it is not the main focus.

The second PMM driver for the host organisations in the *enablers* area of the LOC is 'organisational processes'. In terms of attaining LOC status, this translates to efficient and economic use of knowledge resources. Business processes are core to the competitiveness of organisations. The assessment of guided workflows is an essential part of understanding how well processes are managed within the organisation. The availability of standard operating systems and technical standards that govern workflow processes to ensure all staff have a common platform to operate efficiently is a significant attribute of the LO. Such standardised operating systems align people and build a sense of shared understanding on how to work. It eliminates confusion and increases productivity. This creates more time to share knowledge and increases the tacit-to-explicit conversion of knowledge through the continuous development and updating of standard operating systems and manuals. Staff at the three organisations showed a deficiency in this indicator as an enabler to becoming a LO (25%), especially at organisation Z (13.6%). This requires attention from the host organisations to increase their efforts towards (a) standardisation of how work is done and (b) improving existing procedures to cope with organisational strategic goals to meet LO objectives.

The third PMM driver for the host organisations in the *enablers* area of the LOC is 'technology'. This indicator produced a moderate result with an average of (33.1%) for the host organisations. The role of technology should be to link organisational staff to each other and provide a smart institutional memory that is accessible to the entire enterprise. The result shows that there is room for improvement in this area and this should be addressed through the commissioning of real-time knowledge-based systems that integrate the host organisations' internal staff. Also, a national-level integration might also be useful.

### **(3) L1F3: PARTICIPATION**

The *participation* average for the case-study organisations produced the highest average favourable percentage (37.2%) among the five strategic areas of the PMM. This is promising as it is considered a major element of the LOC construct that measures KT performance. *Participation* involves the largest number of performance measurement indicators due to its complexity. Table 5-9 and Figure 5-12 below provide operationalised measures of this PMM area.

Institute	Participation							
	Leadership	Recruitment and Selection	Cross Unit Cooperation	Learning and Development	Involvement	Organisational culture	Performance appraisal	Career Development
Organisation X	37.3	41.7	35.7	32.5	33.4	31.2	34.4	40.9
Organisation Y	33.0	46.7	58.9	44.4	49.9	44.2	37.7	54.8
Organisation Z	21.2	38.9	35.7	34.5	24.2	27.1	25.6	30.0
Overall Average	30.5	42.4	43.5	37.1	35.9	34.2	32.6	41.9

Table 5-9: Result for the PMM Participation defining construct

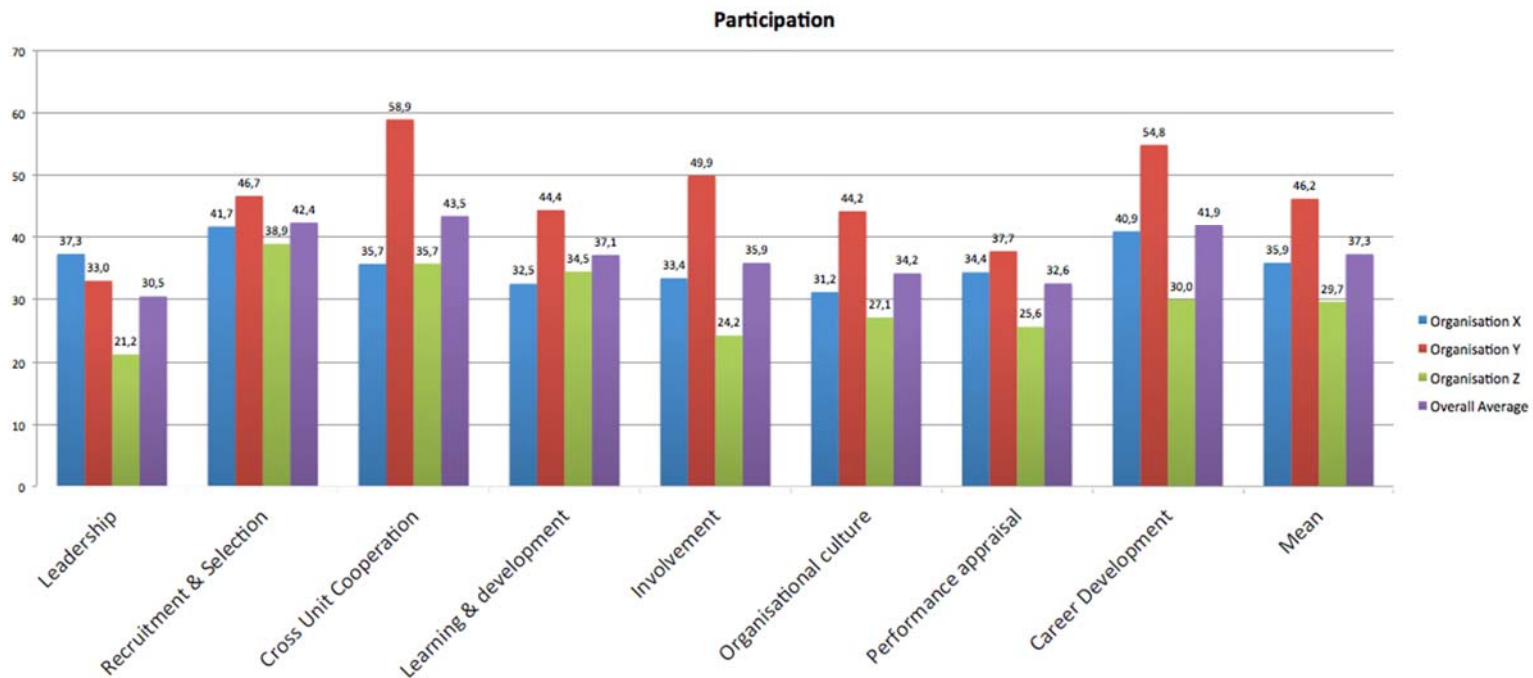


Figure 5-12: Column representation for the PMM Participation defining construct

### REFLECTION

The first PMM driver for the host organisations in the *participation* area of the LOC is 'leadership'. This indicator result provided the lowest among all participation factors (30.5%). This indicates that the knowledge strategy is not well supported by the leadership. Staff feel that the leadership is not guiding workers to make sense the organisational strategy in relation to KM activities. The reasons for this to happen are explained in chapter 7.

The second PMM driver for the host organisations in the *participation* area of the LOC is recruitment and selection. This is the second-highest indicator (42.4%), which implies a high rating for hiring the best candidates at the host organisations. There was little variation (2.8%) in the results for the three host organisations. This is a sign that a significant proportion of employees in the engineering research industry in Saudi Arabia as a whole believe that people are comprehensively assessed for their abilities before being hired at research institutions. The validation process of the qualitative interviews conducted in AR cycle 3 supported this result. This is important because it ensures that the right people are there. However, the problem, as will be evident, is that these qualified individuals are not utilised to their full capacity to collectively achieve the LO status in their organisations.

The third PMM driver in the *participation* area is 'cross-unit cooperation'. It refers to the economic use of knowledge resources across the organisation. One important aspect is the cooperation of human resources across business units. Cooperation means flexibility in sharing resources between individuals, teams and internal departments. Lack of cooperation hinders the filling of capability gaps since no department can acquire all capabilities. That is why departments are part of organisations – to complement each other. When cooperation is absent, this complementary aspect is diminished.

The 'cross unit cooperation' indicator stands out with the highest score (43.5%) in *participation* area. It directly relates to staff (a) being rewarded for team achievements, (b) being encouraged to share knowledge, (c) establishing tools to transfer tacit knowledge across organisational units and departments and (d) supporting a cooperative environment for all the above to happen. Interestingly, as will be discussed in chapter 7, the validation of this indicator through qualitative coding revealed a reverse outcome because the individuals interviewed rated the elements of this indicator as weak in their organisations. The high score

in the PMM for this area highlights the difference between the knowledge strategy and its implementation. In this online survey, the knowledge strategy is tested. In chapter 7, the implementation was tested. Since the LOC is an organisational-level construct, it asks participants to evaluate their organisation (not themselves or other individuals). The high rating here seems because participants feel the organisation encourages this area of LOC behaviour. However, the score should not assume that this encouragement is actually translated in reality (i.e. this is implementation). The participants seem to imply that their organisations desire cross-unit cooperation but the reality, as per chapter 7, is that there are many barriers to this happening.

The fourth PMM driver for the host organisations in the *participation* area of the LOC is 'learning and development'. This driver registered a relatively acceptable measure (37.1%) with a variation among host organisations of (11.9%). This indicator measures the ability of staff to (a) apply their learning at their workplace, (b) receive necessary training to do their jobs correctly and efficiently, (c) have a well-defined career path, and (d) encourage best practice distribution. However, given that the case study organisations represent the largest engineering research establishments in Saudi Arabia, the ratings were expected to be higher.

The fifth PMM driver for the host organisations in the *participation* area of the LOC is 'involvement'. The empowerment of staff to become involved in decision-making processes in an open and transparent environment is an important *participation* indicator. This indicator measured relatively well (35.9%). This means that some staff were given control to the extent that they influenced the organisation through their opinions and open feedback. This also indicates that the organisations were relatively considerate of the impact of decisions on staff morale. On the positive side, I see these attributes as contributing towards a conversion to LO. However, caution needs to be applied. The results show that there are bureaucratic practices that oppose the involvement of staff. The involvement process requires a culture of reduced bureaucracy and more democratic activities. This becomes part of an overall cultural attribute, which is measured in the organisational culture indicator.

The sixth PMM driver for the host organisations in the *participation* area of the LOC is 'organisational culture'. Culture at the host organisations is quite unique because of the influence national culture has on the internal culture of the host organisations. The aspect of control surfaces due to national culture influences which may affect openness, trust, and

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desire for learning. The internal culture must support the desire to innovate and share knowledge and experience. This culture should create an atmosphere of respect and comfort for people to speak and express their honest opinions. Although the three host organisations are from the same industry and nation, the variance in their internal organisational cultures was high (17.1%). The overall result for this indicator (34.2%) should be higher compared to other *participation* PMM indicators. Further effort is needed to improve this measure.

The seventh PMM driver for the host organisations in the *participation* area of the LOC is ‘performance appraisal’. It is an essential tool for gauging how staff contribute to the development of organisational knowledge. This indicator assesses how organisational members manage knowledge. The perception of staff (32.6%) regarding performance appraisal indicates the need to apply measurement tools that help staff know more about their performance and the performance of their organisations as a whole. These metrics could contribute to strategic-level planning and add more useful input to explore possible gaps located in blind spots that are not trivially observed. The organisation must remunerate staff for their contributions to increase the organisational OKB. The organisation must identify those individuals who contribute most and measure their skills to keep them up-to-date with cutting-edge knowledge.

The eighth PMM driver for the host organisations in the *participation* area of the LOC is ‘career development’. This is the ability of the organisation to map competencies and identify skills that staff need for doing future tasks. This process should be aligned with the knowledge strategy and the overall business objectives. This indicator yielded a good favourable result (41.9%) among survey participants but there was a large variation between host organisations (24.8%), which indicates more problems in organisation Z. Identifying the competency gaps within an organisation is a first step. However, that step needs to be followed by action to fill the gaps. Otherwise, possessing this kind of information becomes useless. This indicator assesses if the organisation acts upon its competency gaps.

On reviewing and comparing the previous drivers, the least favourably perceived indicator was related to leadership (30.5%), with a variance of (16.1%) between organisation X (highest score) and organisation Z (lowest score). This indicates there are differences in the way the host organisations are managed as perceived by their staff. However, the staff in all three organisations seem to be dissatisfied with the way the leadership runs the business.

Staff seem to feel that their leadership does not listen to them enough. They also find it difficult to approach their management and ask *why* questions. The leadership is falling behind in establishing feedback systems to facilitate two-way communication. These issues reflect negatively on the psychological contract of staff and results in below average trust levels. These issues have implications when the leadership suggest change, decides to implement new systems, policies, or learning programs because staff loyalty becomes low.

#### (4) L1F4: PEOPLE

Institute	People			
	Motivation and initiative	Talent	Teamwork	Mean
Organisation X	24.4	28.8	35.8	29.7
Organisation Y	30.8	29.1	39.3	33.1
Organisation Z	12.5	15.1	18.1	15.2
Overall Average	22.6	24.4	31.1	26.0

Table 5-10: Result for the PMM People defining construct

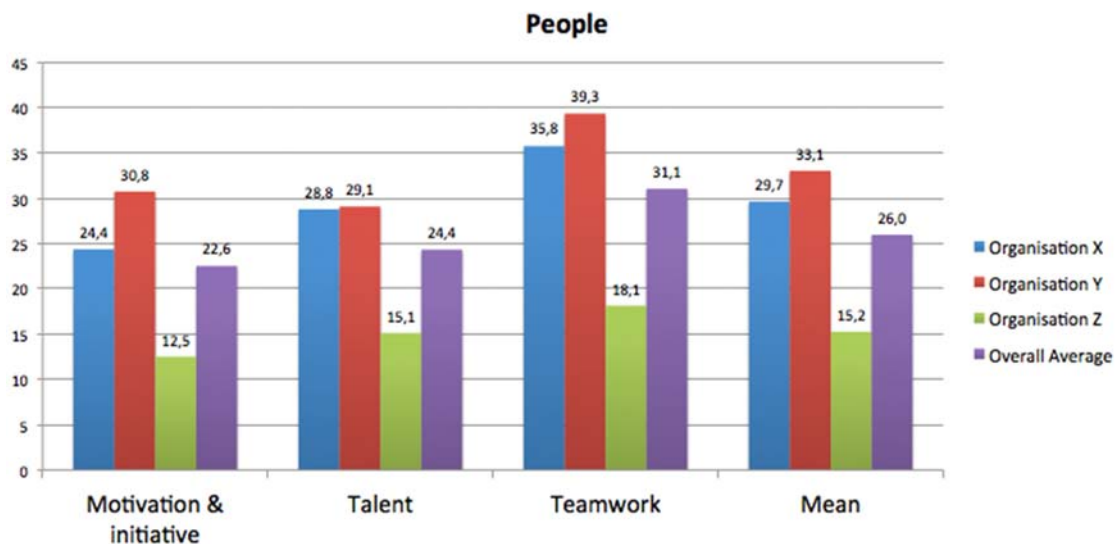


Figure 5-13: Result for the PMM People defining construct

## REFLECTION

The first PMM driver for the host organisations in the *people* area of the LOC is ‘motivation and initiative’. In terms of the knowledge strategy (i.e. attaining LOC status), this translates to whether people are willing to share knowledge. People represent the most valuable asset for organisations in a knowledge economy. To derive competitive value from people, they must be motivated and they must show initiative. Attaining these attributes translates into a

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significant impact on LOC measurement. Participants perceived the PMM indicator for motivation and initiative unfavourably (22.6%). The results show that individuals lack desire to work hard and do more than asked. This suggests passivity in the workforce, in terms of some individuals going through the motions at work, rather than being motivated to work harder without direction (i.e. initiative).

The second PMM driver for the host organisations in the *people* area of the LOC is ‘talent’. Staff showed little confidence in the skills and performance of their peers (24.4%). Talent is a measure of respect for colleagues. If respect is low, as seen with these results, then both knowers and seekers will be reluctant to engage in knowledge sharing. From a capability point of view, this is a cornerstone issue that needs to be addressed in order to attain a higher LOC status to meet the knowledge strategy objectives. This PMM driver will also be discussed in the knowledge barriers chapter (chapter 7) under the individual skills barriers to explore further how AR participants expressed their views on this matter. It is also discussed in the executive focus group meeting to seek the views from top management on how they perceive the talent of their staff.

The third PMM driver for the host organisations in the *people* area of the LOC is ‘teamwork’. Although the results were higher (31.1%), it is still considered a low outcome. From a KT perspective, this driver is about social connectivity, i.e. people working together cooperatively to create and share knowledge. It is a crucial indicator of KT from a LOC view. Therefore, the results show that social connectivity is relatively weak. The host organisations need to improve their current collective practices by constructing better systems that encourage synergy between people to become more able to share and exchange knowledge. People should be allowed collectively to rethink their decisions in an environment of equality and openness. Teams need to be empowered to become self-directed so that they work effectively, and innovatively. This requires that staff feel confident that they are viewed equally within the organisation when they join a team regardless of their position or rank. Forming teams should be an opportunity to help staff free themselves from administrative hierarchies and engage with each other to create a new set of ideas that direct their organisation in a democratic manner.



**(5) L1F5: PEACE**

Institute	Peace		
	Work life balance	Flexibility	Mean
Organisation X	35.6	31.2	33.4
Organisation Y	35.5	10.1	22.8
Organisation Z	20.0	0.0	10.0
Overall Average	30.4	13.8	22.1

Table 5-11: Result for the PMM Peace defining construct

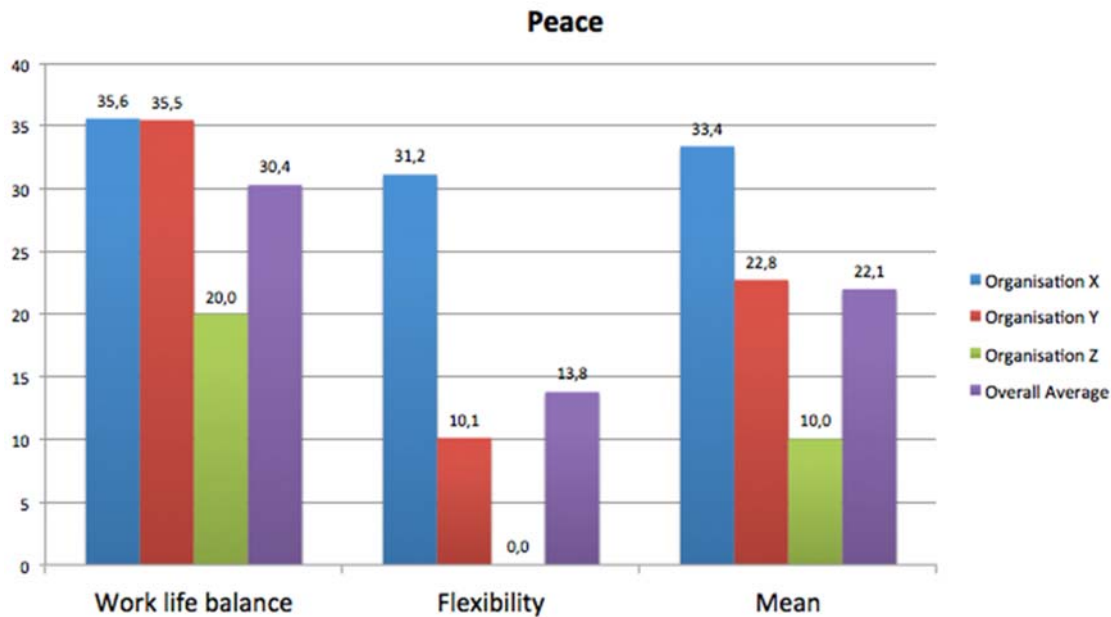


Figure 5-14: Column representation for the PMM Peace defining construct

**REFLECTION**

The first PMM driver for the host organisations in the *peace* area of the LOC is ‘work-life balance’. In terms of the knowledge strategy (i.e. attaining LOC status), this translates once again into a psychological contract that helps staff to become committed and emotionally stable. Building capability takes time, and without a long-term commitment, the capability gap cannot be addressed. The Arabian social context, known to be very interconnected and family-based, has possible implications for work. Maintaining a balance between work and family is essential for creating a productive workforce especially in a social national culture such as the Saudi culture, which prides itself as being family oriented. This is a significant matter for Saudi workers. In a recent study conducted by Alesina and Giuliano (2010) on family ties in 81 different countries, Saudi Arabia was among the highest 15 in the world in maintaining family ties. The support provided by host organisations to staff on maintaining a balance between work and family was perceived by staff as moderate (30.4%). From a KT

perspective, this finding suggests an important deficit in work-life balance, which may manifest in individuals being reluctant to give to the organisation, i.e. share their knowledge. This indicates that more work needs to be done to enhance this indicator given the importance Saudi staff give to family.

The second PMM driver for the host organisations in the *peace* area of the LOC is 'flexibility'. As mentioned earlier in this chapter, the lowest score indicator in the LOC online survey was for flexibility (13.8%). In order to understand how does this affect the knowledge strategy and KT capabilities, we must see flexibility as related to employee job satisfaction. Professional staff desire flexibility and if it is lacking, they are less likely to commit to change programs and the types of attitudes and behaviours necessary for KT. This result is alarming since it means that staff feel too controlled in their work, that they have little freedom to adapt their goals as their work requires from their point of view, and that they have little control over the resources they need to accomplish their research assignments efficiently. This aligns with the issues of bureaucracy and lack of distributed decision-making. For the host organisations to achieve a LO status, these interrelated critical issues must first be resolved.

## (6) L1F6: PROGRESS INDEX

Institute	Progress Index			
	Organisational objectives	Change and innovation	Customer satisfaction	Mean
Organisation X	34.1	30.6	29.7	31.4
Organisation Y	20.3	25.9	42.5	29.6
Organisation Z	5.6	11.0	17.2	11.2
Overall Average	20.0	22.5	29.8	24.1

Table 5-12: Result for the PMM Progress Index



Figure 5-15: Result for the PMM progress index construct

### REFLECTION

A low percentage of staff perceptions at the host organisations were favourable in regard to the overall progress index. This index is critical because it measures the overall performance of the organisation as perceived by its staff. This index has three main elements: meeting 'organisational objectives', achieving best practice in 'innovation and change' and achieving 'customer satisfaction'. The first PMM driver for the host organisations in the *progress index* area of the LOC is 'organisational objectives'. In terms of the knowledge strategy (i.e. attaining LOC status), this translates once again into clarity in strategy on all organisational levels. The results show dissatisfaction from staff for this driver (20%). Bureaucratic practices may justify this result. It implies that capability gaps exist in the structure and policies of the organisations, which prevents communicating organisational objectives.

The second PMM driver for the host organisations in the progress index area of the LOC is 'change and innovation'. A similar result of (22.5%) was obtained. This indicates that staff see their organisations being not sufficiently adaptive to new circumstances and unproductive in their innovation processes. Staff perceive themselves as working in an environment that is not open to discussing mistakes in order to learn from them and does not have the ability to generate lessons learned for possible change. This also indicates that the host organisations do not encourage employees who take calculated risks and look for non-traditional ideas. As a result, the knowledge strategy suffers, and so does the LO target, because the transformation of capabilities requires this driver to be high.

The third PMM driver for the host organisations in the progress index area of the LOC is 'customer satisfaction'. Although this indicator scored the highest (29.8%), it seems that staff found that their ideas were rarely implemented and that decisions taken were not market-based (the customer was not the central focus). Staff felt that the relationship they have with their customers (i.e. local industry) is not strong. This made them hesitate to expect their customers to continue to do business with them. Staff indicated that it is not likely that external partners would engage with them in a teamwork approach. These issues require further investigation to uncover where and why these occurrences take place within the host organisations. These results highlight the capability gap and the need for change. For example, customer problems link to external knowledge flows, which is a critical part of this thesis. If the relationship with knowledge users in the local industry is weak then social

interaction and the resulting KT will be weak as well. This works against the knowledge strategy that aims to build the knowledge capability of the local industry.

### RESULTS SUMMARY

The overall mean score for the 187 statements of this survey for all three organisations was (3.74 out of 6) with a percentage favourable of (29.2%). This suggests that overall, respondents tend to 'slightly agree' (score of 4 out of 6) with the statements defining LOC. A mean score of 4.5 or higher represents the benchmark for LOC best practice (Massingham, 2012), which means that the reported result is unsatisfactory. This result suggest a significant opportunity for possible improvement using this AR thesis. This result also calls for further research to identify possible underlying problems in the area of KT that could provide a link to the thesis problem (i.e. why knowledge transfer at the case study organisations is not flowing well). The PMM results provides evidence therefore to justify inaugurating AR cycle 2 to identify where exactly are the indicators affecting the core business processes at the case-study organisations.

Finally, the PMM provides an overall 'big picture' result for organisations X, Y and Z by defining them as 'orange organisations' (see Figure 5-16 to Figure 5-19). The overall results for the 23 PMM indicators reveal that: 4 were green (17.4% of PMM indicators), 18 were orange (78.3% of PMM indicators) and only 1 was red (4.3% of PMM indicators). This indicates that only (17.4%) of staff rated survey statements a 5 or 6 on Likert-scale of 1-6. The remaining (82.6%) of staff see their organisations as performing weakly as a LO.

However, there were significant differences overall between the three host organisations. Organisation Y was mainly 'Green' (see Figure 5-17), organisation X was mainly 'Orange' (see Figure 5-18), and organisation Z was mainly 'Red' (see Figure 5-19). This indicates that possible major variances exist among them in terms of reaching LO status. The overall result for all three organisations, which concerns this study most as an industry metric, represents the mean favourable for each PMM indicator. This is presented in Figure 5-10. By focusing on the overall result, an industry-based perception is revealed to guide Saudi engineering research organisations assess their individual knowledge strategies. In the next section, the CCM will provide further validation to the results of the PMM.

## CHAPTER 5: EXAMINING THE KNOWLEDGE STRATEGY

### LOC PPM (All)

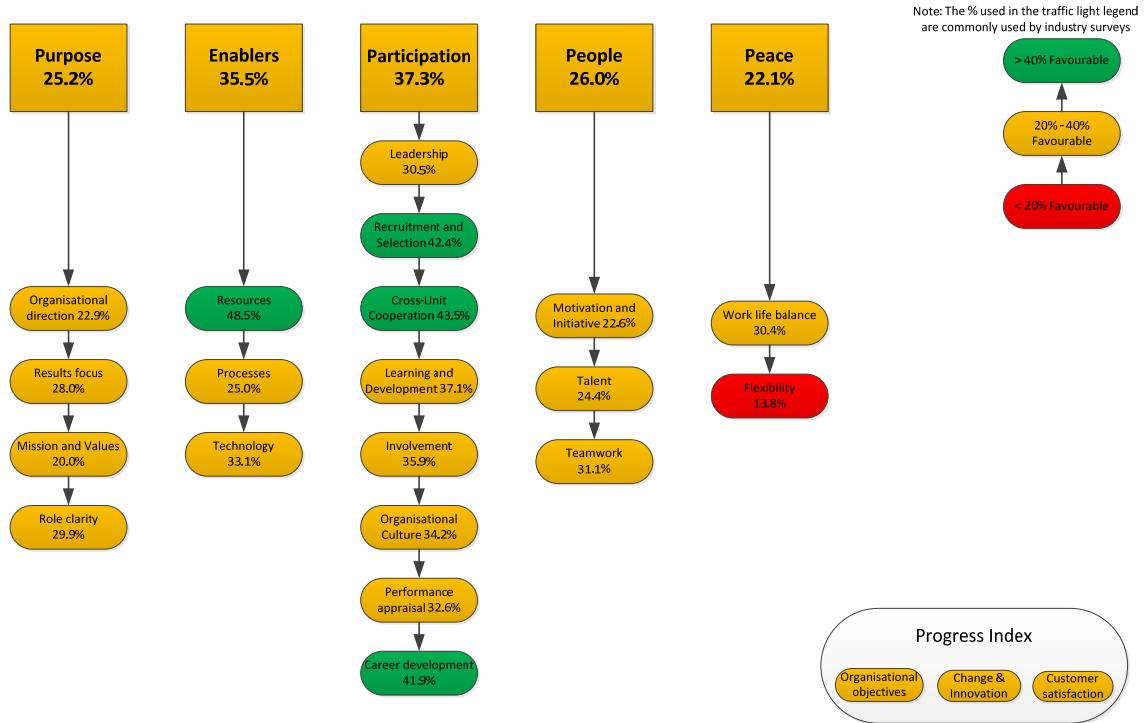


Figure 5-16: Overall PMM results using the colour-coded diagram

### LOC PPM - 1

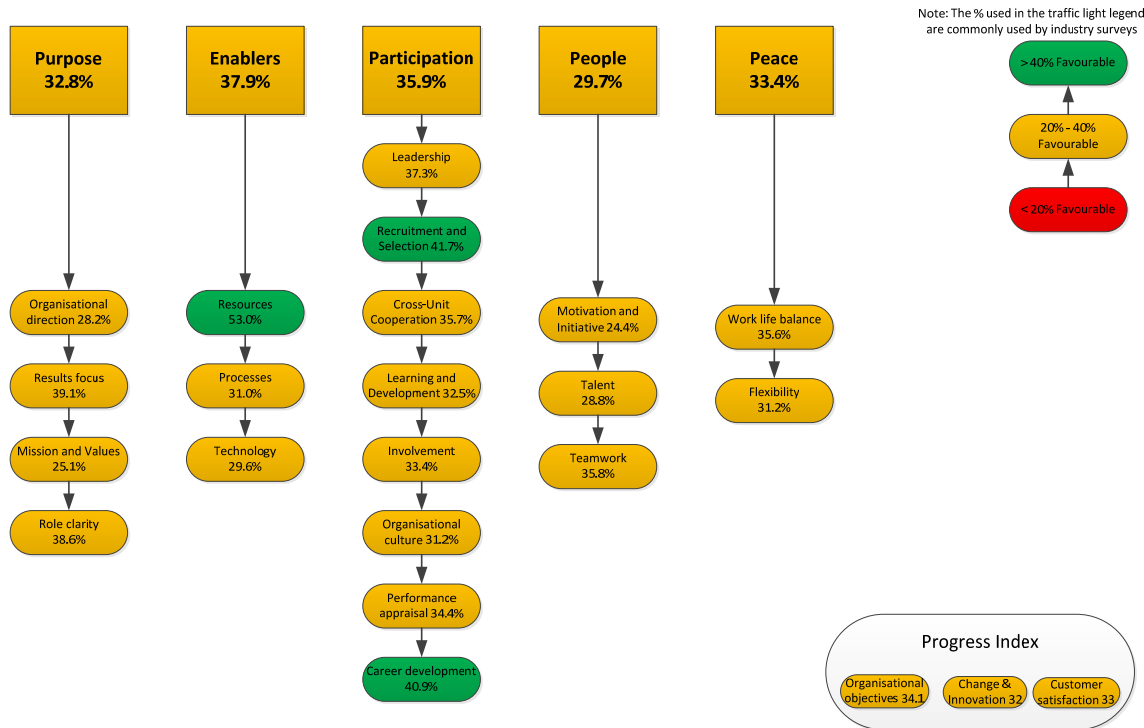


Figure 5-17: Organisation X PMM results using the colour-coded diagram

## CHAPTER 5: EXAMINING THE KNOWLEDGE STRATEGY

### LOC PMM - 2

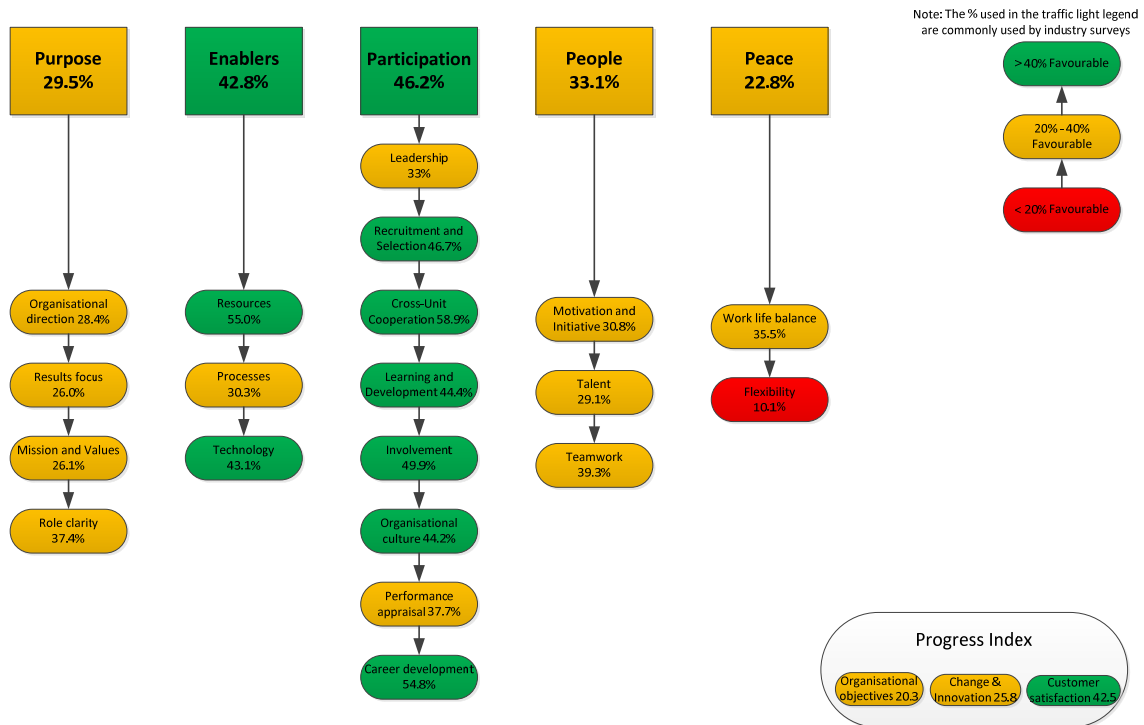


Figure 5-18: Organisation Y PMM results using the colour-coded diagram

### LOC – PMM - 3

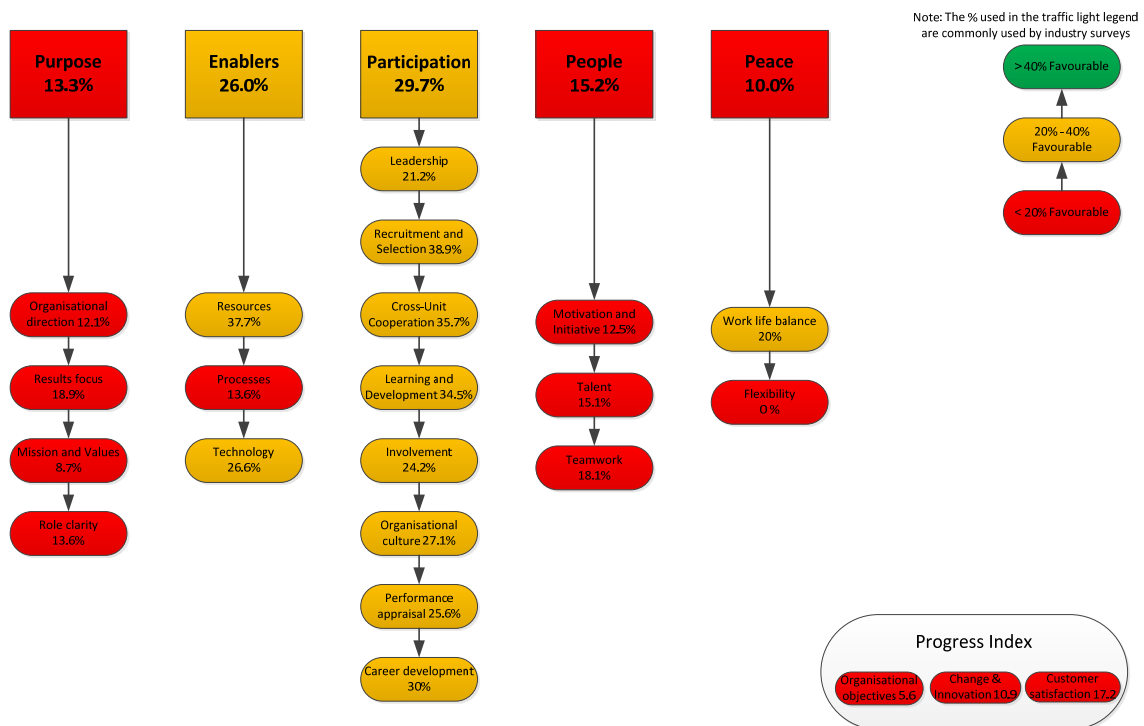


Figure 5-19: Organisation Z PMM results using the colour-coded diagram

## 5.8 THE CONCEPTUAL CATEGORIES MODEL (CCM)

To further analyse LOC results, I explore them using the LOC conceptual categories model (CCM). This will allow AR participants to visualise the results from a practical perspective and therefore may produce additional reflections that did not emerge from the PMM. The LOC CCM may also confirm the PMM results by categorising LOC constructs in a different way to produce similar findings. It summarises the wide range of LOC indicators in ways that host organisation management can further relate to and take action upon.

From an AR point of view, this cycle phase is the most important to yield change (Bjørn and Boulus, 2011). The CCM model classifies LOC statements into a series of *conceptual categories* used in previous LOC studies. These LOC categories are different to the PMM indicators in section 6.3 above. The LOC categories illustrate how to operationalise LOC status. There are 17 LOC categories in the CCM as shown in Table 5-13 below.

### 5.8.1 ANALYSIS AND REFLECTIONS ON RESULTS USING THE CCM

The highest and lowest results are presented in sections 6.4.2 and 6.4.3. All data findings are then discussed in section 6.4.4. In section 6.4.5, an overall summary is presented with conclusions and colour coded diagrams as per figure (5-14) below.

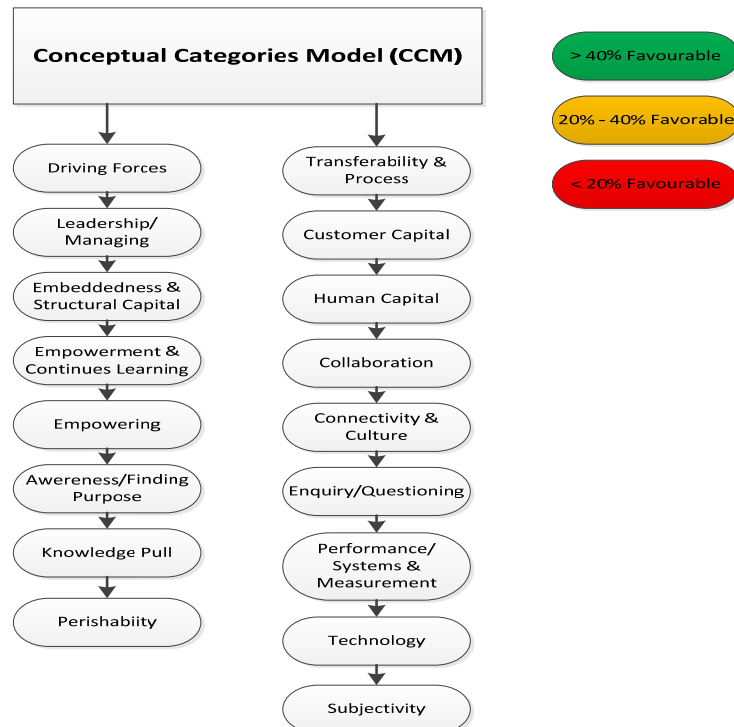


Figure (5-20): Colour coded representation of the CCM

## CHAPTER 5: EXAMINING THE KNOWLEDGE STRATEGY

Code	Model Factor/Dimension	Definition	Literature references
L3F1	Driving Forces	Organisation-wide systems, processes and structures which enable learning, and lead individuals and groups to become better learners or masters of learning processes.	Moilanen (2005)
L3F2	Leadership/Managing	Leaders support to learning as well as whether they use learning strategically for organisational results.	Mertins <i>et al.</i> (2003)
L3F3	Embeddedness and Structural Capital	The degree to which the organisations' knowledge lies hidden in the minds of its staff.	Kluge <i>et al.</i> (2001); Bontis (1998)
L3F4	Empowerment + Continuous Learning	The degree to which staff feel they can influence their work and their organisation.	Marsick and Watkins (2003)
L3F5	Empowering	Providing employees with sufficient and proper skills, knowledge and other tools for learning enhancement.	Moilanen (2005)
L3F6	Awareness/Finding Purpose	Finding 'the meaning' of learning in the vision or strategy of an organisation.	Moilanen (2005)
L3F7	Knowledge Pull	An organisational culture element that utilises a down-top approach to effective KM.	Kluge <i>et al.</i> (2001)
L3F8	Perishability	The currency of knowledge that decides whether the organisation keeps its knowledge up-to-date.	Kluge <i>et al.</i> (2001)
L3F9	Transferability + Process	The extent to which knowledge is being shared and diffused using non-obvious processes.	Kluge <i>et al.</i> (2001); Mertins <i>et al.</i> (2003)
L3F10	Customer Capital	Market knowledge and processes that exist to capture, share, and act on customer feedback.	Bontis (1998)
L3F11	Human Capital	Staff perception of the quality of colleagues as a measure of growth in the organisation's capability.	Bontis (1998)
L3F12	Collaboration	The extent to which staff share knowledge while working in groups.	Marsick and Watkins (2003)
L3F13	Connectivity + Culture	The extent to which organisational culture supports knowledge sharing and is linked to its communities.	Marsick and Watkins (2003); Mertins <i>et al.</i> (2003)
L3F14	Enquiry/Questioning	The extent to which organisational culture supports knowledge creation, double-loop learning and whether the culture supports continuous improvement and experimentation.	Marsick and Watkins (2003); Moilanen (2005)
L3F15	Performance + Systems + Measurement	The degree of satisfaction of staff in seeing practical outcomes from an LOC change management program and the extent to which performance metrics have been established in terms of both financial and non-financial indicators.	Marsick and Watkins (2003); Mertins <i>et al.</i> (2003)
L3F16	Technology	The extent to which staff feel they have the technology tools to be connected and be able to improve performance for end results.	Mertins <i>et al.</i> (2003)
L3F17	Subjectivity	The degree of common ground between the organisation and its customers.	Kluge <i>et al.</i> (2001)

**Table 5-13: Conceptual Categories Model (CCM) constructs with definitions and references**



The table above provides brief definitions for each category as well as literature references for further reading. The remainder of this section will discuss some of the categories in more detail. This method for measuring LOC was adopted from Dr Peter Massingham's work with his ARC project and, in this way; the constructs and the method have been validated.

### **5.8.2 REFLECTION: IN WHAT AREAS ARE WE DOING WELL?**

The categories with the highest overall mean for the three research organisations were:

- 1) Driving Forces (mean score: 4.34). This is about the organisation investing in systems and process, which are related to organisational learning.
- 2) Embeddedness and Structural Capital (mean score: 4.28). This is about the degree to which the organisation has been able to separate knowledge from the knower, and codify it for sharing with others (e.g. in reports, papers, policies etc.).
- 3) Knowledge Pull (mean score: 4.18). This is about involving staff in finding solutions to problems, rather than pushing management decisions onto them.

### **5.8.3 REFLECTION: IN WHAT AREAS DO WE NEED TO IMPROVE?**

In terms of the LOC categories, the lowest overall means for the case-study organisations were:

- (1) Customer capital (mean score: 3.37). This is about market knowledge and whether processes exist to capture, share, and act on customer feedback. This result suggests that staff may be somewhat isolated from external organisations and lack external relationships.
- (2) Empowerment, continuous learning and networking (mean score: 3.49). This is about the degree staff feel they can influence their work and their organisation
- (3) Performance, measurement and systems (mean score: 3.5). about whether staff see practical outcomes from the LOC change management program and whether performance metrics have been established
- (4) Transferability (mean score: 3.52). This is about how well knowledge is being shared
- (5) Finding purpose/awareness (mean score: 3.59). This is about the leadership actively engaging in sharing its strategies with staff to raise awareness and group consensus regarding organisational strategy.

These five bottom-rating LOC categories are directly related to the impetus for our KT study and justify its importance. In this sense, the results from the LOC survey indicate that staff believe there is a need for change. The results show that they believe external knowledge flows need to be improved in order to better connect with external customers and to update local staff knowledge. AR participants, surveyed over a period of 18 weeks, produced the results listed in Table 5-14.

Code	Level of analysis	ORGANISATION X (% Favourable)	ORGANISATION Y (% Favourable)	ORGANISATION Z (% Favourable)
L3F1-17	Overall % favourable per case organisation	35.22 %	40.15 %	24.26 %
	Overall % favourable for all organisations	33.21 %		

Table 5-14: Overall result for the host Organisations

The above table shows that the overall CCM rating placed the case-study organisations as ‘Orange’, as suggested by the PMM. Also, organisation Y was once again a ‘Green’ organisation, as suggested previously by the PMM. However, both organisation X and Z were ‘Orange’ organisations as per the CCM. The PMM suggested that organisation Z was a ‘Red’ organisation.

#### 5.8.4 DETAILED DISCUSSION OF RESULTS

The results obtained from AR participants (survey respondents) have been reconstructed to fit in the CCM to show the behavioural aspects of LOC under measurement. This was carried out after generating the reflections from PMM, which focused on the LOC attribute indicators. Each LOC category is discussed and reflected upon in this section to provide a grassroots cause analysis.

The first objective of this AR cycle is to *understand* how the host organisations are performing as LOs. The second objective is to become *aware* of the need for improvement and change. The following sections are therefore intended to provide insights and deeper understandings of the challenges and possible consequences if negative issues persist at host organisations. It is important to understand the implications of *not* solving the problem before a solution is suggested. This AR cycle therefore will not discuss solutions. The interaction between AR participants is essential to reach to a democratic solution that is collectively created as the study evolves.

**(7) L3F1: DRIVING FORCE**

Overall	Overall	Case Organisations		
Mean Score	% Favourable	ORGANISATION X % Favourable	ORGANISATION Y % Favourable	ORGANISATION Z % Favourable
<b>4.34</b>	<b>51.76</b>	<b>57.29</b>	<b>52.53</b>	<b>45.45</b>

**Table 5-15: Result for the Driving Force category****REFLECTION**

Driving forces (L3F1) is about the performance of leadership in driving change. It indicates that staff recognise that the strategic objectives associated with becoming an LO and the AR change agenda are important to their organisations. Driving forces are essential for the LO because the conscious attention of organisational staff in “taking care of organisation-wide systems, processes and structures which could enable or hinder learning” is critical for the organisation’s LOC status (Moilanen, 2001, p. 12). Individual driving forces that cause the organisation to work in teams, develop learning patterns and increase the knowledge base of the organisation to improve outcomes is the most influential to this indicator. Such a driving force cannot be obtained by a few staff but rather through collective efforts (Moilanen, 2001).

This category shows a favourable result. However, there is variance between the three organisations. This might be because they are independent from each other or have different leadership strategies. Organisation Z has the lowest score, which might be because its priority, at this stage, is to establish its infrastructure. The management in organisation Z could be too busy with establishing equipment and laboratories while the personnel side is not yet settled.

The majority of respondents reported that their organisations made innovation and learning their priorities. The LO status therefore may be achieved based on the perceptions and understandings of respondents to convert the strategy into reality. In other words, the LOC is a perception of the organisations (i.e. its knowledge strategy). However, the remaining chapters of this thesis focus on the KT capability (i.e. how well the knowledge strategy is implemented). In summary, the result above is considered a good result, which shows strategic intent to become best practice learning organisations, however, the face-to-face interviews revealed problems associated with implementing this strategy and this is discussed in the following chapters 6 and 7.

**(8) L3F2 : LEADERSHIP/MANAGING**

Overall	Overall	Case Organisations		
Mean Score	% Favourable	ORGANISATION X % Favourable	ORGANISATION Y % Favourable	ORGANISATION Z % Favourable
3.82	37.14	32.92	46.20	32.29

Table 5-16: Result for the Leadership category

**REFLECTION**

Leadership/managing (L3F2) resembles the notion that *Leaders support and encourage my learning*. This is an important indicator of what Senge (1990) calls *personal mastery* and is a positive antecedent of psychological contracts or organisational commitment because it shows that staff feel their organisation cares about their development. In general, leaders have some understanding of the importance of KM to their organisational strategy but this is not translated for staff in terms of being rewarded or recognised for their knowledge. This factor represents an important disconnect between strategy and implementation, which needs to be addressed. The results showed there was some satisfaction among organisation Y respondents; however, results for organisations X and Z were less favourable.

In summary, this construct lies at the heart of motivation, cultural change, and action. If staff do not feel rewarded and recognised for KM behaviours, improved LOC performance will be difficult to attain. Organisations X and Z remain a problem. Although, staff are well paid in both organisations, improved reward systems might be needed to address the differences in performance among staff.

**(9) L3F3 - EMBEDDEDNESS AND STRUCTURAL CAPITAL**

Overall	Overall	Case Organisations		
Mean Score	% Favourable	ORGANISATION X % Favourable	ORGANISATION Y % Favourable	ORGANISATION Z % Favourable
4.28	48.74	49.96	57.13	39.14

Table 5-17: Result for the Embeddedness category

**REFLECTION**

Embeddedness (L3F3) is about non-codified knowledge that is hard to find explicitly within the organisation in the form of documents, databases, knowledge repositories and standards operating

manuals. It represents the degree to which an organisation's knowledge resides in the minds of its staff (Kluge *et al.*, 2001). Embeddedness is also a characteristic of knowledge (Cummings and Teng, 2003). Although some embeddedness is fine, high embeddedness resembles a KT barrier because it suggests that knowledge is personal and inaccessible. Best practice companies try to balance between storing knowledge in their IT systems or people (Kluge *et. al.*, 2001). More fluid and short-term knowledge need not be captured in IT systems; rather that should be managed through people, e.g. communities of practice (Kluge *et. al.*, 2001). However, too much embeddedness means that the knowledge resource is too tacit and more difficult to manage and share. The solution to the problem of embeddedness is to capture some of what people know to add to the organisational *structural capital* (e.g. databases) or even *social capital* (Bontis, 1998).

Approximately half of respondents rate their organisation favourably in this category. It means that the host organisations are managing embeddedness relatively well, and capturing tacit knowledge to some degree. It supports other evidence that the host organisations have allocated the resources (e.g. physical space) needed to capture knowledge from internal or external experts. The result is favourable at organisation X and organisation Y but less so at organisation Z with a significant variance between them that indicates differences in business patterns between host organisations. The physical environment seems to encourage knowledge exchange, which suggests that resources and physical space are found to be strengths in this study.

## (10) L3F4 – EMPOWERMENT AND CONTINUOUS LEARNING

Overall	Overall	Case Organisations		
Mean Score	% Favourable	ORGANISATION X % Favourable	ORGANISATION Y % Favourable	ORGANISATION Z % Favourable
3.49	20.37	29.76	25.28	6.07

Table 5-18: Result for the Empowerment and Continuous Learning category

## REFLECTION

Empowerment, continuous learning and networking (L3F4) focuses on the degree staff feel they can influence their work and their organisation (Marsick and Watkins, 2003). This category includes aspects of *locus of control* as well as *personal mastery*. Although the *locus of control* is influenced by organisational behaviour, it is primarily seen as a personality trait that correlates

with the individual's cognitive perception to himself (Lefcourt, 1992). It represents the extent to which individuals believe that they have control over their environments (Rotter, 1966). Individuals with a high *locus of control* is confident, alert, and direct when attempting to control their work environments. *Personal mastery* captures how staff feel about being able to learn and develop within their organisations. Therefore, this is an important factor defining psychological contract and job satisfaction. In the initial observation phase, issues of bureaucracy and high-level control were observed to negatively affect these traits.

Previous studies have revealed that employees with a high *locus of control* are significantly more likely to possess idiosyncratic traits and to develop more social networks (Ng and Feldman, 2011). This is an important point that links knowledge sharing through social networks with staff feeling some sort of control over their work environment. This suggests there is a need to raise the locus of control of employees in order to enhance KT. Underlying influences which can be used to raise *locus of control* were suggested by Ng and Feldman (2011). Locus of control is affected by both internal and external factors (Rousseau *et al.*, 2006). This suggests that social relationships may strengthen by the existence of individuals with a high locus of control since they will be able to have access to information, and in some cases resources (Hobfoll, 1989). I therefore support the notion that the existence of individuals with a high locus of control motivates others to engage in social networking (Forret and Dougherty, 2004; Zanzi *et al.*, 1991).

The results indicate that staff feel disempowered and do not have a sense of control over their workplace and work activities. This may be caused by the fact the host organisations are part of a government system with strong bureaucratic controls. There are serious impacts from obtaining low ratings in this category. Of most concern are the indications that cultural barriers are obstacles to effective creativity and double-loop learning (i.e. the culture does not allow enough freedom to challenge underlying assumptions). Of most concern is the statement, '*Research institute gives people choices in their work assignments*', which evidence has shown is an important influence on job satisfaction and employee sustainability for professional staff (i.e. it is a major influence on whether staff will stay) (Massingham, 2012). In summary, psychological contract and satisfaction of staff need to be addressed by involving staff in decision-making and work process design.

**(11) L3F5 – EMPOWERING**

Overall	Overall	Case Organisations		
Mean Score	% Favourable	ORGANISATION X % Favourable	ORGANISATION Y % Favourable	ORGANISATION Z % Favourable
<b>3.91</b>	<b>34.32</b>	<b>38.72</b>	<b>40.61</b>	<b>23.64</b>

Table 5-19: Result for the Empowering category

**REFLECTION**

Empowering (L3F5) is about providing employees with sufficient and proper skills, knowledge and other tools for learning enhancement (Moilanen, 2005). This is about whether staff feel the organisation has systems and resources that help them do their job well and to continue to improve their job performance. It is a measure of whether staff members feel the organisation invests in them. Carter (2009) suggested a model for empowering employees by developing an improved and practical empowerment model that applies systems theory and socialisation theory (Katz and Kahn, 1978). The key goal for managers is to trust their employees by empowering them to help the organisation (Heskett *et al.*, 1990), and to allow them to freely use appropriate personal approaches to realise this (Ou *et al.*, 2010). Once staff are aware that their organisations are empowering them in this way, a vital starting point for LO improvement occurs – by finding ‘the meaning’ of learning in the vision or strategy of an organisation (Moilanen, 2005). This is akin to Senge’s (1990) concept of having a shared vision. It is also a key performance indicator for this AR cycle in terms of raising awareness of the importance of knowledge and KM.

Staff feel they are learning by doing (i.e. on the job) but the organisation is perhaps not doing enough to help them do their job well via systems (SOPs and work flow) or training. Both organisation X and organisation Y do invest in their researchers to a level that is acknowledged by many but not all staff. Organisation Z performs less satisfactorily in this area. In summary, this category is of direct importance to the perceptions of participants to KM. Without clear investments in staff skills, it is difficult to convince organisation members that KM is a serious program. Further improvement is therefore necessary.

**(12) L3F6 – FINDING PURPOSE/AWARENESS**

Overall	Overall	Case Organisations		
Mean Score	% Favourable	ORGANISATION X % Favourable	ORGANISATION Y % Favourable	ORGANISATION Z % Favourable
<b>3.59</b>	<b>22.48</b>	<b>28.59</b>	<b>27.26</b>	<b>11.57</b>

Table 5-20: Result for the Purpose/Awareness category

**REFLECTION**

When the leadership actively engages in sharing its strategies, staff awareness and group consensus regarding organisational strategy improves (Bourgeois, 1980; Floyd and Wooldridge, 1992; Rapert *et al.*, 2002). Effective dissemination of strategies should bring top executives' views closer to the views of lower-level organisational participants, thereby making the strategy more likely to achieve its objectives. Lack of awareness of host organisation's researchers about the views held by top executives on strategy may inhibit the implementation of the strategy (Nobel, 1999). Drawing upon *sense giving* theory (Weick, 1995; Gioia and Chittipeddi, 1991), I contend that the strategy pursued by top management and the information-processing structure being used directly impacts the understanding, interpretation and subsequent activities of employees at case-study organisations (Fiss and Zajac, 2006; Gioia and Thomas, 1996). Consistent with the concepts of *sense giving* theory (Weick, 1995; Gioia and Chittipeddi, 1991), I intend to examine in AR cycle 2 (chapter 6) the effects of intra-organisational messages from top and middle managers and how these messages interact in influencing the development of strategic awareness among boundary personnel responsible for the implementation of strategy.

One way in which the literature suggests organisations can ensure the dissemination of strategy vertically and horizontally across the organisation is by applying *sense giving* and *sense making* theories (Weick, 1995; Gioia and Chittipeddi, 1991). *Sense giving* is the KT process by which managers provide staff with explanations to difficult issues (Gioia and Thomas, 1996). The KT process that managers use to deliver sense-invoking information concerning an ambiguous phenomenon should be more emphasised than the KT process by which that information is translated into an interpretation of the phenomenon (Fiss and Zajac, 2006). Sense making, on the other hand, is the KT process by which employees can continually, retrospectively, interpretively process ambiguity, adjust to changing environments, and impose understanding on misunderstood



issues (Weick, 1995). It is therefore essential that managers learn sense giving while staff learn sense making.

Staff in this study felt their organisations recognised the importance of knowledge (to a degree), but this organisational resource is not formally managed (i.e. via knowledge management). The situation here requires more transparency in strategies and more awareness programs. The basic step related to this category is management action to ensure all staff at all levels have an understanding of the importance of KM and the means to manage and disseminate their knowledge to propagate it within their groups, sections and institutes.

### (13) L3F7 – KNOWLEDGE PULL

Overall	Overall	Case Organisations		
Mean Score	% Favourable	ORGANISATION X % Favourable	ORGANISATION Y % Favourable	ORGANISATION Z % Favourable
4.18	48.33	51.06	57.58	36.36

Table 5-21: Result for the Knowledge Pull category

## REFLECTION

Knowledge pull (L3F7) is a key element of the organisational culture required for an effective knowledge strategy (Kluge *et al.*, 2001). Many organisations begin (and end) their knowledge strategy by trying to disseminate knowledge using a top-down approach and infrastructure (e.g. IT). This usually fails despite the vast amounts of money often invested. This does not mean that push is bad and pull is good. A balance of both is needed. However, push is much easier than pull, so it is suggested that organisations focus more on implementing pull strategies.

From a strategic perspective, organisations use mechanisms that bring them closer to knowledge sources to learn and transfer knowledge. These mechanisms that connect an organisation with the external environment allow a learning process to take place “so that instead of an organisation responding reactively to knowledge-push it can pull that knowledge into itself, adapt it and effectively use it” (Maqsood *et al.*, 2007, p. 97). This category emphasises the tangible benefits that can accrue through being able to pull knowledge from an external source, or even an internal one. Because knowledge flows in nature are seen as highly recursive rather than sequential and

mechanistic. A pull strategy must sustain the recursive rhythm and resist losing momentum over time.

In this category staff seem to support the claim that a knowledge-pull strategy is taking place. This is a good attribute towards the ideal LO. Staff may seek better performance metrics for their organisation to reveal detailed performance, which will help them find more meaning and purpose in their work using a knowledge-pull approach. Performance benchmarks should also be established as a feedback measure. This will be presented in the benchmark section 6.5.

#### (14) L3F8 – PERISHABILITY

Overall	Overall	Case Organisations		
Mean Score	% Favourable	ORGANISATION X % Favourable	ORGANISATION Y % Favourable	ORGANISATION Z % Favourable
<b>3.67</b>	<b>28.72</b>	<b>31.32</b>	<b>34.40</b>	<b>20.45</b>

Table 5-22: Result for the Perishability category

#### REFLECTION

Perishability (L3F8) is about currency of knowledge and whether the organisation keeps up-to-date (Kluge *et al.*, 2001). Speed is increasingly important in today's business environments. For example, developing patents quicker than competitors can create a stronger likelihood of successful patent applications as well as faster cycles of innovative commercialisation. If insufficient attention is given to the importance of the time factor and to maintaining up-to-date knowledge, its value generally decreases over time. The value of knowledge is difficult to predict and the only way to keep its value tangible is to grow it in order to produce tangible performance.

This category indicates that the organisations are not investing in keeping knowledge up-to-date via knowledge sharing, process mapping and efficient creativity. It is a serious situation when staff feel that their knowledge related to their work is out-dated. It is as equally serious when staff feel that they are working with no structure. Rules, procedures and policies seem to be absent from the research staff, hence, they are working autonomously. The score for organisation Z is the lowest

again. In summary, there is a lack of sharing of experience (e.g. lessons learned) and investment in keeping staff up-to-date.

### (15) L3F9 – TRANSFERABILITY AND PROCESS

Overall	Overall	Case Organisations		
Mean Score	% Favourable	ORGANISATION X % Favourable	ORGANISATION Y % Favourable	ORGANISATION Z % Favourable
3.52	23.15	25.82	27.46	16.16

Table 5-23: Result for the Transferability and Process category

## REFLECTION

Transferability (L3F9) is about how well knowledge is being shared. Therefore, it is a critical construct for this thesis because it measures. It is about more than communication. Value can be created by transferring knowledge into new contexts (Kluge *et al.*, 2001). Therefore, transferability is about diffusing knowledge in ways that can help the business in non-obvious ways (Kluge *et al.*, 2001; Mertins *et al.*, 2003). Transferability processes are needed to build customer capital and human capital. Transferability is aligned with the *Talent* indicator in the PMM. It measures growth in the organisation's capability. This results for this category indicates that knowledge sharing across organisational contexts is unsatisfactory. The overall mean score is on of the five categories that were highlighted in section (6.4.3) as needing improvement. Most respondents are in the neutral area or in the negative area. A culture of independence and isolation seems to govern the organisations. Knowledge sharing seems to be absent. A clear action plan needs to be devised to overcome this situation.

Jay Liebowitz (2001) argues that the focal paradigm shift of KM strategies must ensure the migration from an individualist, competitive attitude to a collaborative attitude. The knowledge-sharing attitude is what makes KM difficult, which implies that improving this category may be cumbersome. In summary, the situation needs to be addressed in terms of leadership practices, and then individual attitudes. For the former, leadership must begin the initiative for KT and social capital building within the organisation. For the latter, individuals need to share with colleagues without feeling of fear of losing power or status.

**(16) L3F10 – CUSTOMER CAPITAL**

Overall	Overall	Case Organisations		
Mean Score	% Favourable	ORGANISATION X % Favourable	ORGANISATION Y % Favourable	ORGANISATION Z % Favourable
<b>3.37</b>	<b>23.01</b>	<b>22.91</b>	<b>35.02</b>	<b>11.11</b>

**Table 5-24: Result for the Customer Capital category****REFLECTION**

Customer capital is about acquiring critical knowledge and whether processes exist to capture, share, and act upon customer feedback (Bontis, 1998). The host organisations, classified as knowledge organisations, naturally rely heavily on their customer capital to win confidence and be able to compete in a competitive market. The competitive advantage the host organisations possess seems low because staff perceive their customer capital in the ‘orange’ code in organisation X and Y and in the ‘red’ code in organisation Z.

The results suggest that knowledge from customer interactions is not formally captured. The statements for this category in the CCM model focuses on customer satisfaction and whether the host organisations respond to feedback from their customers. The low score on the favourable measure indicates an ineffective internal-to-external knowledge flow, i.e. KT between host organisation staff and local Saudi industry. Since organisation Y is the most advanced among the three in terms of client-funded projects, it showed better results, perhaps due to more experience and more exposure to clients and research-based customers. In summary, organisations X and Z need to expose themselves more to client-related activities rather than internal development and basic research is necessary to allow better market knowledge to penetrate their organisations. More interaction is necessary to address this category correctly.

**(17) L3F11 – HUMAN CAPITAL**

Overall	Overall	Case Organisations		
Mean Score	% Favourable	ORGANISATION X % Favourable	ORGANISATION Y % Favourable	ORGANISATION Z % Favourable
<b>3.66</b>	<b>31.21</b>	<b>33.36</b>	<b>35.99</b>	<b>24.29</b>

**Table 5-25: Result for the Human Capital category**

## REFLECTION

Human capital is about staff perceptions of the quality of their colleagues (Bontis, 1998). It is a critical measure to obtain information about how staff assess themselves in terms of being good thinkers, performing competitively and creatively, working hard and dedicating themselves to produce results. This category is considered a self-assessment measure. It adds balance to the survey to ask questions about each organisation, its leadership and how its members are doing their jobs. The results show a recurring correlation between organisations X and Y. Organisation Z continuously remain the lowest in the majority of the categories measured in the CCM.

The overall results show a relatively low rating for colleagues' capability (31.2%). More interaction and better communication between colleagues could enhance the results. The results may be explained by a large variance in the quality and expertise of staff in the same category of the same department, which justifies the low interaction between them. The normal consequence of such a situation is that less cooperation will occur and hence, less knowledge sharing. In such situations, staff are likely to perceive their colleagues negatively since they do not expose themselves to each others' knowledge. It is important that professionals are placed with other professionals at the same level in the organisational hierarchy to allow better communication and more efficient sharing of knowledge. In summary, the results here indicate a capability gap.

### (18) L3F12 – COLLABORATION

Overall	Overall	Case Organisations		
Mean Score	% Favourable	ORGANISATION X % Favourable	ORGANISATION Y % Favourable	ORGANISATION Z % Favourable
3.75	28.46	35.25	35.91	14.22

Table 5-26: Result for the Collaboration category

## REFLECTION

Collaboration (L3F12) is about how well staff share knowledge while working in groups (Marsick and Watkins, 2003). It is another crucial construct for the thesis, given it measures KT from a group perspective. Work should be designed to use groups to access different modes of thinking

since groups are expected to learn together and work together. Collaboration should be valued by the culture and rewarded to enhance LOC status.

The results show that group socialisation and creativity is satisfactory to some extent. This means there is a disconnection between the group outputs and management; that is, they don't feel management will act on their recommendations. This suggests problems with democracy of decision-making and workplace flexibility (i.e. locus of control), which is a barrier to effective collaboration because groups lack a sense of purpose in their knowledge exchanges.

The results for this category are quite similar for organisations X and Y. The results for both indicate that teamwork at these organisations is effective to some extent. An important issue is whether knowledge sharing is consistent across different groups and whether it follows an organisational-level process or is ad hoc and depends on the members' efforts to cultivate knowledge sharing in their particular groups. We say this because the percentage favourable is only 28.46% and this suggests some inconsistency between different groups. The result for organisation Z is low and needs to be addressed. In summary, groups are sharing knowledge relatively well, but lack purpose due to lack of confidence in management acting on outcomes.

### (19) L3F13 – CONNECTIVITY AND CULTURE

Overall	Overall	Case Organisations		
Mean Score	% Favourable	ORGANISATION X % Favourable	ORGANISATION Y % Favourable	ORGANISATION Z % Favourable
<b>3.81</b>	<b>35.87</b>	<b>35.78</b>	<b>44.21</b>	<b>27.62</b>

Table 5-27: Result for the Connectivity and Culture category

## REFLECTION

Connectivity (L3F13) is about whether the organisation has a culture that supports knowledge sharing (Marsick and Watkins, 2003; Mertins *et al.*, 2003). As KT is a process of mobilising knowledge from a knower (sender) to a seeker, knowledge sharing is to fill the gap between the two. Knowledge sharing occurs at multiple levels, i.e. between two individuals, between an individual and a group and vice versa, between groups and between organisations. The aim of knowledge sharing is therefore higher connectivity. People need to be informed to know the effect of their work on the entire enterprise. People need to scan the environment and use information to

adjust their work practices. The organisation needs to be linked to its communities in ways that ensure knowledge is shared between people. Since knowledge is the only resource that can be shared with others without decreasing, the power of connectivity as an LOC measure becomes evident. The goal of connectivity is therefore to get the right knowledge to the right people at the right time.

This category indicates that the promotion of a KT culture could encourage better LOC. This process seems to be going fairly well with organisation Y. We see that there is a relatively low rating on the part of organisation X participants. This may be due to many cultural issues that will be identified in the KT barriers (see chapter 7). Organisation Z is struggling in this category and needs immediate attention to align its culture with KT. In summary, there is fairly weak readiness for change, and this suggests some scepticism about the LO strategies being achieved.

## (20) L3F14 – ENQUIRY / QUESTIONING

Overall	Overall	Case Organisations		
Mean Score	% Favourable	ORGANISATION X % Favourable	ORGANISATION Y % Favourable	ORGANISATION Z % Favourable
3.69	32.97	31.79	42.04	25.08

Table 5-28: Result for the Enquiry/Questioning category

## REFLECTION

Enquiry (L3F14) is about whether the organisational culture supports knowledge creation (Marsick and Watkins, 2003). It is really about double-loop learning and whether the culture supports continuous improvement (Moilanen, 2005). People need to gain productive reasoning skills to express their views and they need to be offered the capacity to listen and inquire into the views of others. This requires that the culture be changed to support questioning, feedback, and experimentation.

The results suggest a cautious, conservative organisational culture. While personal respect for others is satisfactory, there is insufficient open dialogue and questioning to really explore creativity and knowledge sharing. Although the case-study organisations are government based and this has a significant effect on their bureaucracies, this category also examines how the organisation deals with the ‘why?’ questions. It reflects how the organisation deals with the

visionary aspect of work. In engineering research workplaces, it is essential that best-practice procedures are applied. The results here show that many participants feel they are not in a creative environment. This issue needs to be addressed. In summary, executive management needs to assure staff that the organisation does encourage openness, questioning and relationships.

## (21) L3F15 – PERFORMANCE, SYSTEMS AND MEASUREMENT

Overall	Overall	Case Organisations		
Mean Score	% Favourable	ORGANISATION X % Favourable	ORGANISATION Y % Favourable	ORGANISATION Z % Favourable
3.50	21.64	30.55	22.72	11.65

Table 5-29: Result for the Performance, System, and Measurement category

## REFLECTION

Performance, measurement and systems categories (L3F15) are about whether staff see practical outcomes from the LOC change management program and whether performance metrics have been established (Marsick and Watkins, 2003; Mertins *et al.*, 2003). Scores for this category depend on the degree of satisfaction with LOC progress and the meaningful evaluation of LOC performance in terms of both financial and non-financial indicators.

The measures in this category gauge the situation at the case-study organisations in terms of how close they are to LOC status. The results show that the three organisations are far from an acceptable LOC level (only 21.6%). The measure also shows variation between the three host organisations and therefore, suggests that different strategies may be needed for each. In summary, this result provides strong evidence of the need for KM performance metrics to align desired behaviours and activities with an accountable KM system.

## (22) L3F16 – TECHNOLOGY

Overall	Overall	Case Organisations		
Mean Score	% Favourable	ORGANISATION X % Favourable	ORGANISATION Y % Favourable	ORGANISATION Z % Favourable
3.90	36.22	32.52	45.11	31.02

Table 5-30: Result for the technology category



## REFLECTION

The technology category (L3F16) measures whether staff feel they have the tools to be connected. It also indicates whether technology helps performance (Mertins *et al.*, 2003). Today, companies adopt technology solutions by connecting members of the organisation electronically so that they can communicate freely and work together on projects. Yet benefits are not always forthcoming. For example, while organisations may be linked to customers, they are not necessarily using technology to capture and share critical customer information. Likewise, they do not always analyse and store information in ways that enable others in the enterprise to use it efficiently.

Although the results are quite good, the challenge here is that each organisation must tailor its technology to its staff requirements, processes and systems. As the Saudi organisations have strong financial resources, still, technology requirements are numerous and thus needs to be carefully designed to optimise the use of resources. In summary, the issue of technology is overwhelming because technology usually overestimates what it can do. It definitely can do a lot for an organisation but the problem is staff discipline and dedication to a technological solution. It requires embracing the concept with all its tedious tasks such as documenting, registering and logging. It also needs to deal with technology problems and troubleshooting. In many cases, it is faster for someone to do a job without going through the official technology-based solution.

### (23) L3F17 – SUBJECTIVITY

Overall	Overall	Case Organisations		
Mean Score	% Favourable	ORGANISATION X % Favourable	ORGANISATION Y % Favourable	ORGANISATION Z % Favourable
<b>3.91</b>	<b>40.20</b>	<b>31.11</b>	<b>53.13</b>	<b>36.36</b>

Table 5-31: Result for the subjectivity category

## REFLECTION

Subjectivity (L3F17) is a measure of the degree of common ground between the organisation and its customers, such as local industry knowledge users (Kluge *et al.*, 2001). It is an indicator of customer relationships. There are always different interpretations, viewpoints, and multiple context-based variations on knowledge. Overcoming subjective interpretations of knowledge becomes increasingly important as the organisation grows in the number and diversity of its

customers and in the types of work it does. Differences in understanding lead to mistakes, confusion, and probably failure.

This category shows that staff assessments of dealings with external customers are at an acceptable level. This helps smoothen the process of deciding on priorities and creating task plans. Organisations X and Z, however, still need to address this issue with their staff. Organisation Y is the only organisation that has a heavy traffic of customers and a client-based research institute. Hence, it has a high level of alignment between the organisation and its clients.

In the interviews of the next cycle, organisations X and Z reported low interaction with customers and admitted having a very low numbers of client-funded projects. This was discussed in detail in the main report of the KT barriers submitted to the management of the host organisations at the end of AR cycle 3. In summary, the management at organisations X and Z need to address the issue of how to align the understandings of staff and external customers as a preparatory step to engage with the industry with a clear mission.

### **RESULTS SUMMARY**

The CCM provides a similar ‘big picture’ to the PMM for organisations X, Y and Z by confirming them as ‘orange organisations’ (see Figure 5-16). The overall results for the 17 CCM indicators reveal that: 3 were green (17.4% of CCM indicators) and 14 were orange (78.3% of CCM indicators). This indicates that only (17.4%) of staff rated survey statements a 5 or 6 on the Likert-scale of 1-6. This means that the remaining (82.6%) of staff see their organisations as performing weakly as a LO. The perception on knowledge activities in is thus currently low.

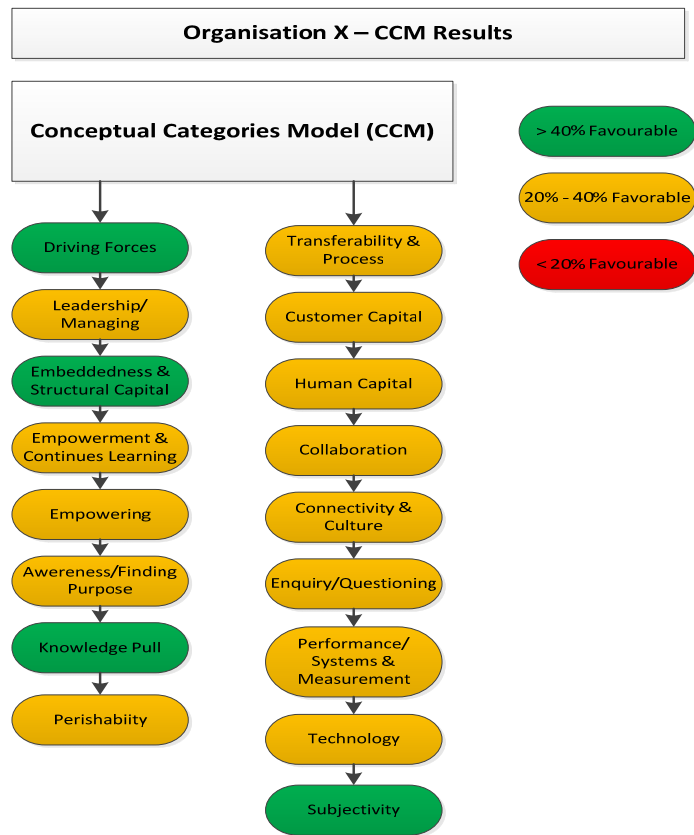


Figure 5-21: Organisation X CCM results using the colour-coded diagram

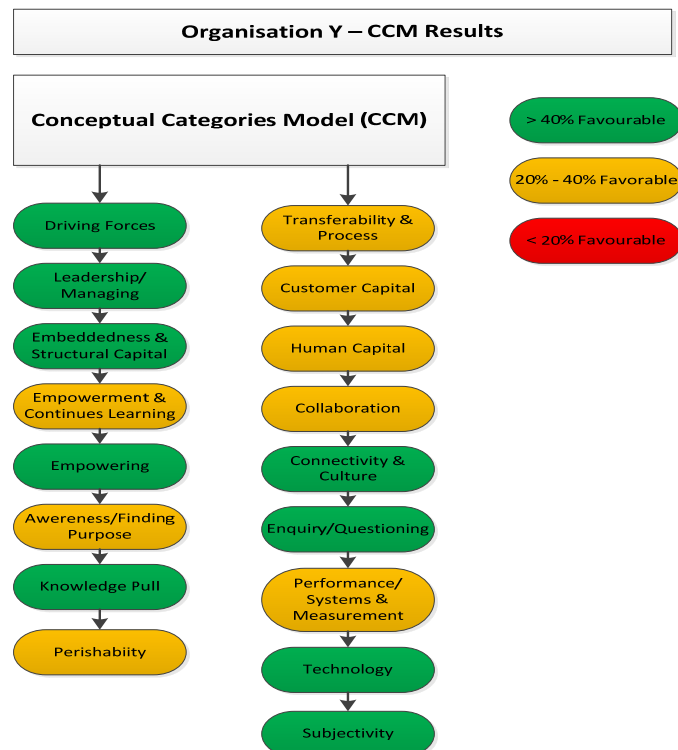


Figure 5-22: Organisation Y CCM results using the colour-coded diagram

## CHAPTER 5: EXAMINING THE KNOWLEDGE STRATEGY

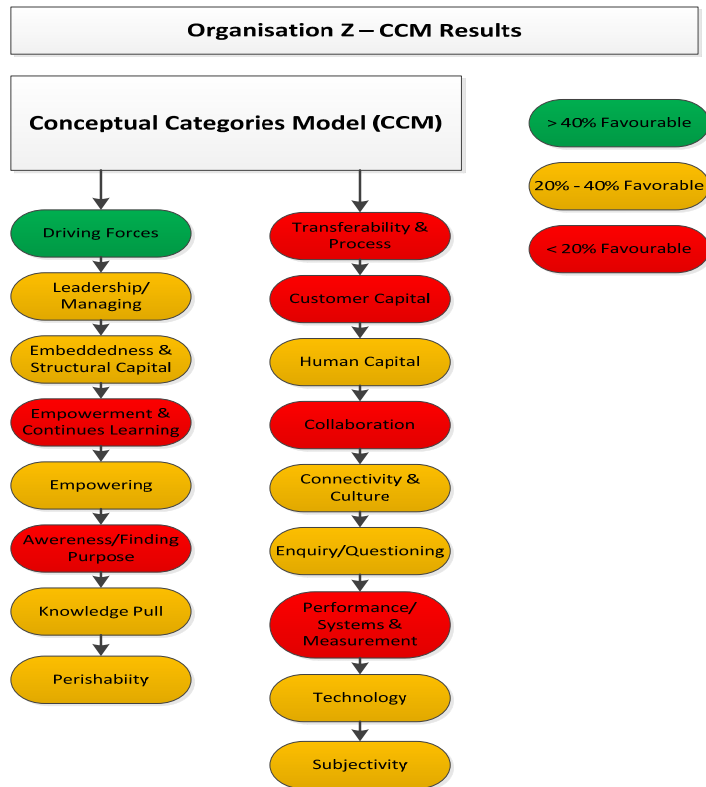


Figure 5-23: Organisation Z CCM results using the colour-coded diagram

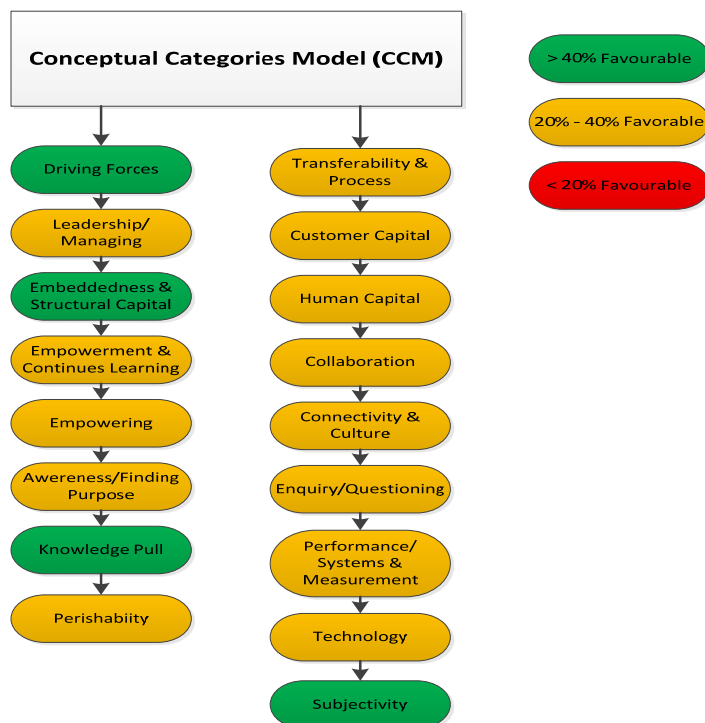


Figure 5-24: Overall CCM results using the colour-coded diagram

## 5.9 THE BENCHMARK INDICATORS FOR LOC

Benchmarking is the process that requires data from the organisation being assessed to be compared with another set of data from a best-practice organisation (Massingham, 2012). This section will explore how well the case-study organisations scored in the LOC measure against other organisations in developed countries. In this way, a better understanding can be attained after presenting the PMM and the CCM. The underlying concepts and sub-elements of these models explained the results of the LOC survey. In this section, I offer to (1) link the two models back with the knowledge strategy and capability gap, (2) combine the data and analyses that emerged from the models, and (3) present a benchmark based on similar studies conducted in other countries.

The PMM represented an essential managerial framework for action. The results of the LOC survey was submitted to the management of each case-study organisation based on the PMM. The CCM, on the other hand, will mainly be used in this section to compare key constructs with the nominated benchmarks. The CCM constructs allow comparison because its constructs are similar to the benchmarks' constructs. The benchmark comparison will provide a knowledge strategy context for a 'health audit' in terms of how far away the organisations are from the ideal LO. Exploring the size and nature of the strategic capability gap requires the benchmarking activity. Three benchmarks will be presented: (1) Moilanen's (2005) diamond model, (2) Kluge *et al.*'s (2001) best practice model and (3) The KM assessment tool (KMAT).

### 5.9.1 MOILANEN'S (2005) DIAMOND MODEL

The core of this measurement tool was the creation of a holistic picture of an organisation. This LO benchmark used the portrayal of five elements; namely, driving forces, finding purpose, questioning, empowering, and evaluating (Moilanen, 2005). Since the 'evaluating' construct was not considered in this chapter, it was eliminated from the comparison. The size of the diamond in the figures below demonstrates the score achieved. In other words, when AR participants provided highest scores, the diamond was in its largest form and when they provided the lowest scores, it was in its smallest form. Table 5-32 provides the definitions of the dimensions used in the first

benchmark. These dimensions have already been defined and discussed in the PMM and CCM. The results for these dimensions that have been presented earlier will be compared here.

Dimension	Definition
Driving forces	Managing all organisation-wide systems, processes and structures which help or hinder individuals and groups in their efforts to become better learners or masters of learning processes.
Finding purpose	The vital starting point of a learning organisation, i.e. ‘the meaning’ of learning in the vision or strategy of an organisation.
Questioning	Inquiring, doubting and asking for the value of knowledge at the present state, what factors might prevent the learning process.
Empowering	Providing employees with appropriate skills, knowledge and other tools for learning enhancement.

**Table 5-32: Definitions of Constructs for LOC Diamond Model**

In Moilanen’s research, data was gathered from a group of 691 respondents (686 accepted) across 25 Finnish organisations and six major industry sectors in 1998. This study used the data of these 686 respondents as if they were all from one large organisation to determine if the Finnish organisations were performing worse or better over the assessment elements. Due to the measurement tool in Moilanen’s study, which was allocated scores between 1 and 4, all scores of Saudi organisations were adjusted accordingly from the original 6-point Likert scale to a 4-point scale. Table 5-33 shows the means of each factor constituting the LOC diamond model in comparison between the Saudi organisations and (1) all 686 Finnish respondents as one large organisation, (2) the best Finnish LO, and (3) the less performing Finnish LO.

LOC Level 3 Factor/Dimension	Driving Forces	Finding Purpose	Questioning	Empowering
<b>SAUDI organisation X</b>	2.99	2.92	2.81	3.05
<b>SAUDI organisation Y</b>	2.87	2.49	2.48	2.71
<b>SAUDI organisation Z</b>	2.59	2.19	2.11	2.41
<b>SAUDI Organisations (mean)</b>	<b>2.82</b>	<b>2.53</b>	<b>2.47</b>	<b>2.72</b>
<b>FINNISH organisations (B) (all 686 respondents)</b>	2.31	2.66	2.31	2.64
<b>FINNISH organisations (C) (the best learning organisation)</b>	3.13	3.5	3.05	3.3
<b>FINNISH Organisations (D) (a less learning organisation)</b>	1.96	1.75	1.33	1.67

**Table 5-33: LOC mean scores of Host organisation and Finnish organisations**

The above data is presented in the three portrayals in Figure (5-22), (5-23), and (5-24) respectively. Figure (5-22) illustrates the organisational diamonds of 118 respondents from Saudi organisations X, Y and Z against 686 respondents from the overall 25 Finnish organisations (B). The Saudi organisations scored higher mean values than Finnish respondents for three measures: ‘driving forces’, ‘questioning’ and ‘empowering’. This means that Saudi organisations were

managing the industry and leading their organisations' learning better than the overall Finnish industry. In addition, the Saudi organisations were spending more efforts in identifying what factors might prevent their learning process. In terms of the remaining dimension, i.e. finding purpose (the connection between learning and strategy), the Saudi organisations were doing less than the 25 Finnish organisations. The gap in this case was (0.13). This identified an improvement area for Saudi organisations. The significance of this area to Saudi organisations is that it suggests a strategic gap because a lower score on finding purpose may imply an unclear vision, which may have negative effects on many operational level processes and motivational factors for staff. It therefore may be appropriate to consider this measure as specifically significant.

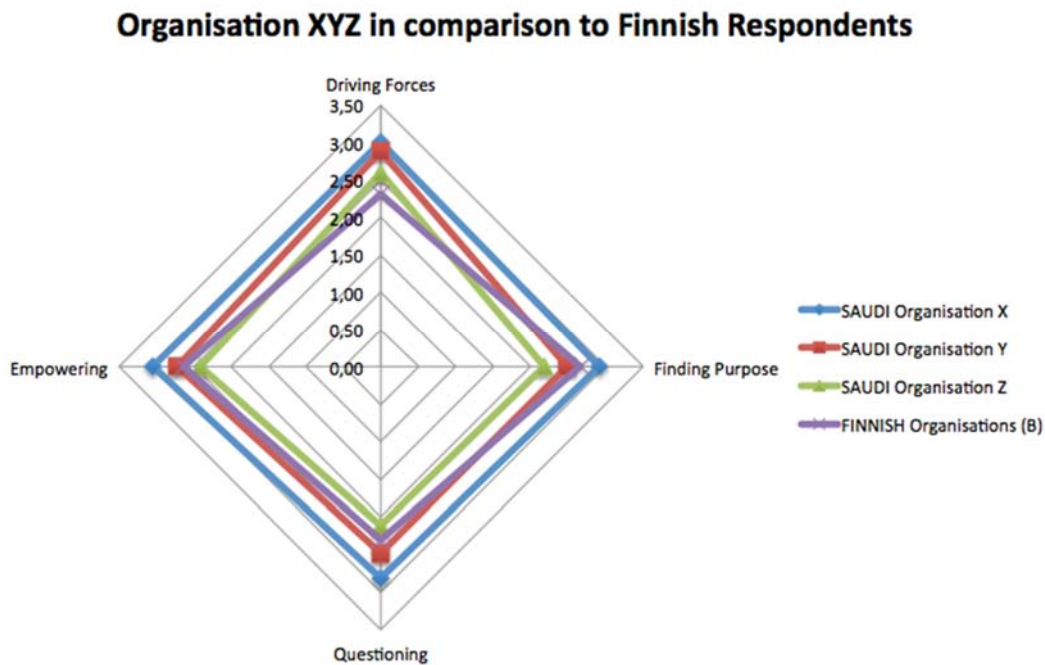
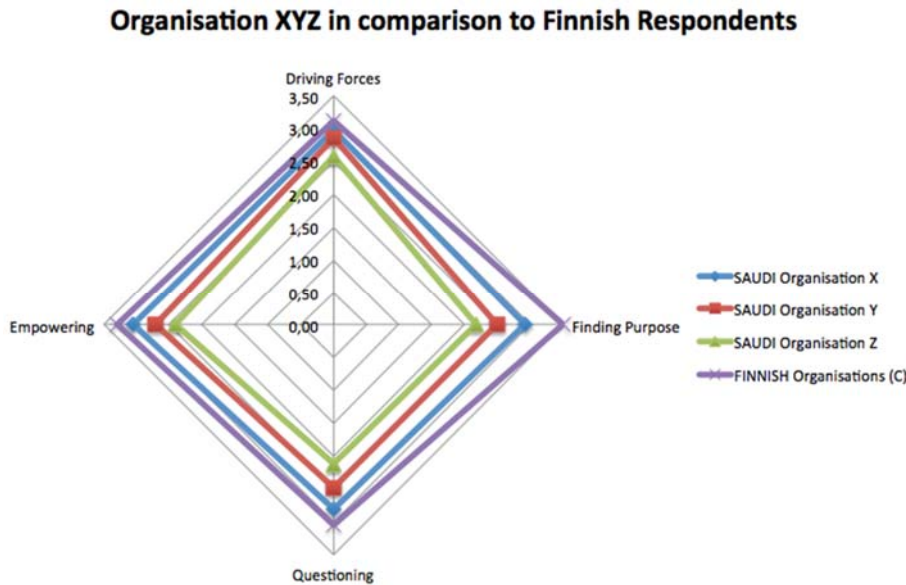


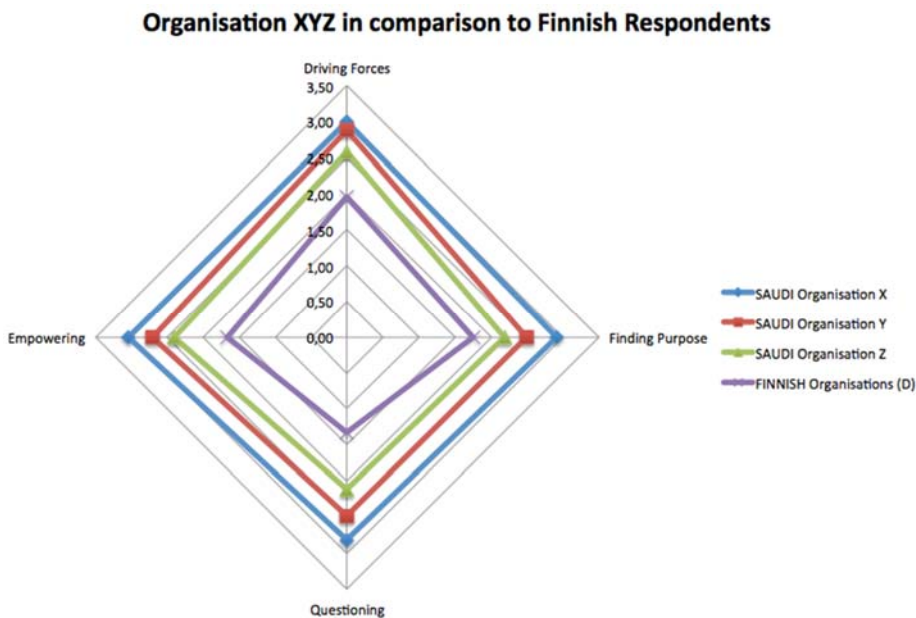
Figure 5-25: Host organisations versus 25 Finnish organisations

However, in spite of these positive comparative results above, it was noticed that the mean values of the case-study organisations had an acceptable variance range (variance = 0.35 around the average value of the 4-point Likert scale) and while its diamond was quite balanced, the 'questioning' element was slightly lower (mean=2.47). Figure (5-23) and (5-24) further confirm the status of host organisations as a LO in comparison with the best and the least performing organisations from Moilanen's survey. The host organisations, as per the given benchmarks, are placed in between the best and lowest performing Finnish companies, which provides a sense of stability in the results of this study. It also implies that Saudi organisations share with many Finnish companies the opportunity for improvement as while there are less performing companies, there are still better performing companies.



**Figure 5-26: Host organisations versus the best Finnish organisation**

Apparently, host organisation's diamond is smaller than the diamond of the best organisation (C) above, especially in 'finding purposes'. In this study, it can be argued that one of the main issues that host organisations face from a LO perspective is the sense of purpose that could support any possible change initiative. In this way, as will be discussed in chapter 9 of this thesis, a special attention will be provided to clarity of goals, which should be emphasized at all levels of the host organisations. This finding is considered a main contribution in this chapter.



**Figure 5-27: Host organisations versus the least good Finnish organisation**



While the diamonds of host organisations are completely larger than the diamond of the less learning organisation (D), organisation Z was the closest to the Finnish LO result in the element ‘finding purpose’. Nonetheless, the difference for all elements was clearly distinguishable, which implies that the Saudi host organisations were doing quite well in comparison with other organisations rated as poor in their countries. This is an important finding because it disqualifies the possibility that the Saudi host organisations may be positioned as the least on a global scale; rather, it can have the opportunity to compete on becoming part of the leading organisations. It has already proven from this benchmark that there are organisations who performed less.

### **5.9.2 KLUGE *et al.*’s (2001) BEST PRACTICE MODEL**

In Kluge *et al.*’s (2001) study, the authors provided a comprehensive framework to examine the current knowledge status of a company, including their efforts in terms of knowledge pull and the six characteristics of knowledge that distinguish it from other assets, namely subjectivity, transferability, embeddedness, self-reinforcement, perishability, and spontaneity. A group of 40 companies distributed roughly equally throughout Europe, the US and Japan was surveyed about a set of KM techniques based on a maximum score of 100 points. A cluster analysis of the point allocation was conducted and provided the outcomes for the more successful companies, which differed significantly from those for the less successful companies.

To compare the results of organisations X, Y and Z across the five dimensions of LO behaviours (i.e. knowledge pull, subjectivity, transferability, embeddedness and perishability), all mean values of host organisations’ ratings were adjusted to be consistent with the allocation of 100 points as per Kluge *et al.*’s study. The comparison was conducted for individual measurement items of each dimension as explained in the following sections.

#### **5.9.2.1 KNOWLEDGE PULL BENCHMARKING**

Knowledge pull is a key element of the organisational culture required for an effective KM strategy. Many organisations begin (and end) their KM strategy by trying to push knowledge using a top-down approach and infrastructure (e.g. IT). This usually fails despite the vast amounts of money often invested. Push is much easier than pull, so I focused more on pull strategies. Table 5-34 and Figure 5-25 illustrate the results.

Knowledge Pull Score out of 100	Organisation X	Organisation Y	Organisation Z	Less successful Organisations	More successful Organisations
Item 1: Host organisation sets targets to achieve or surpass world-class level	51	58	36	33	90

Table 5-34: Gaps in “knowledge pull” between host organisations and other organisations

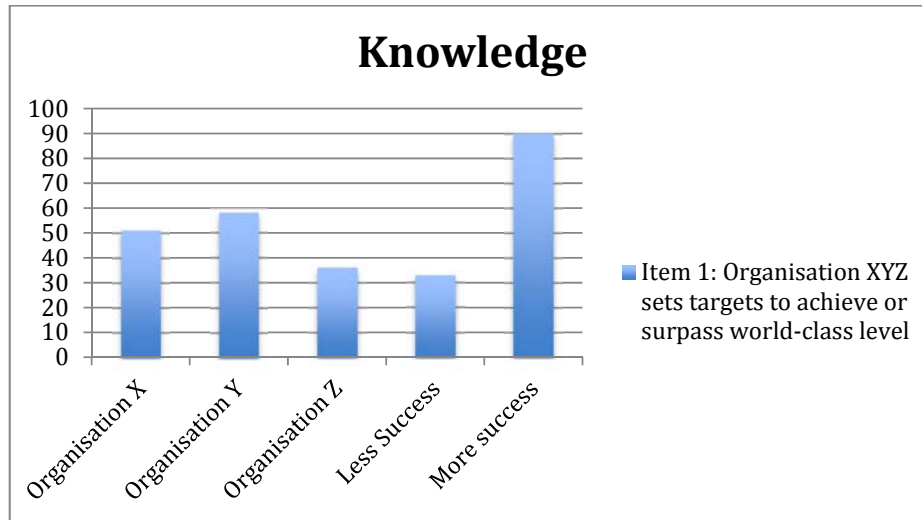


Figure 5-28: Illustration of gaps in “knowledge pull” between host organisations and other organisations

The above table and graph show that the gaps in ‘knowledge pull’ between host organisations is quite large, especially between organisation Z on one hand, and organisation X and Y on the other hand. This provides evidence that host organisations may require having different approaches to addressing their issues due to the variances detected. However, the focus in the thesis is to address the common weaknesses of the three host organisations as will be discussed later in chapter 9.

### 5.9.2.2 SUBJECTIVITY BENCHMARKING

Subjectivity means that there are always different interpretations, viewpoints, and context-based variations on knowledge. Overcoming subjective interpretations of knowledge becomes increasingly important as the company grows in size and in its geographic scope (and includes different national cultures as a result). Differences in understanding lead to mistakes, confusion, and probably failure. Table 5-35 and Figure 5-23 show the results of host organisations as compared with the lower and higher benchmarks.

Subjectivity Score out of 100	Organisation X	Organisation Y	Organisation Z	Less successful Organisations	More successful Organisations
Item 1: In general there is agreement on common values and rules between Host organisation and external partners (i.e. Overseas organisations that host organisations works with)	31	53	36	20	60

Table 5-35: Gaps in “subjectivity” between host organisations and other organisations

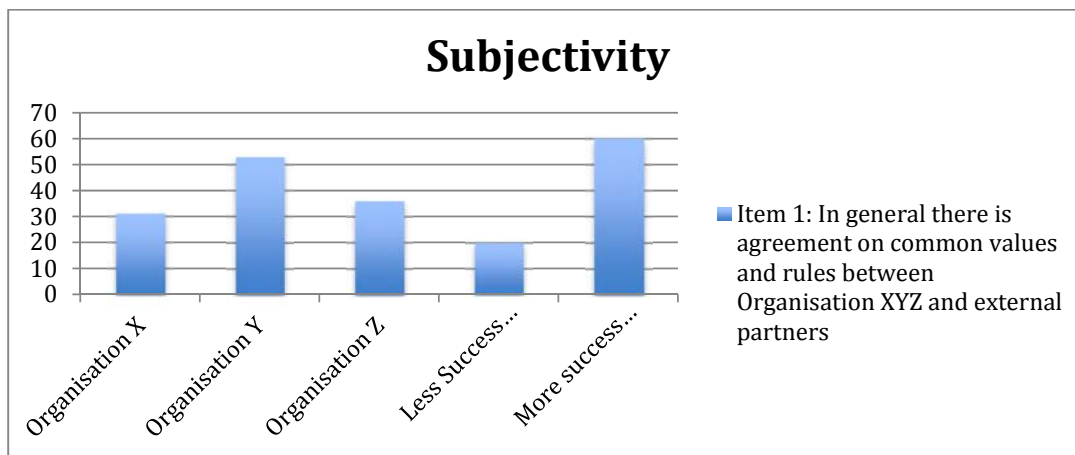


Figure 5-29: Illustration of gaps in “subjectivity” between host organisations and other organisations

The above table and graph show that there is a gap in subjectivity between host organisations and best practice. Although organisation Y is close to higher best practice benchmark, organisation X and Z are almost 50% less in their score. However, the host organisations are yet within the limits of the lower and higher benchmarks.

### 5.9.2.3 TRANSFERABILITY BENCHMARKING

Transferability is about more than communication. Value can be created by transferring knowledge into new contexts, which links to adaptation. Specificity issues can become major barriers to transferability. Therefore, it is about diffusing knowledge in ways that can help the business in non-obvious ways spread its knowledge. Table 5-36 and Figure 5-27 illustrate the results on this benchmark.

Transferability Score out of 100	Organisation X	Organisation Y	Organisation Z	Less successful Organisations	More successful Organisations
Item 1: Host organisation has internal and external benchmarking concerning process improvements	40	16	9	20	47

Table 5-36: Gaps in “transferability” between host organisations and other organisations

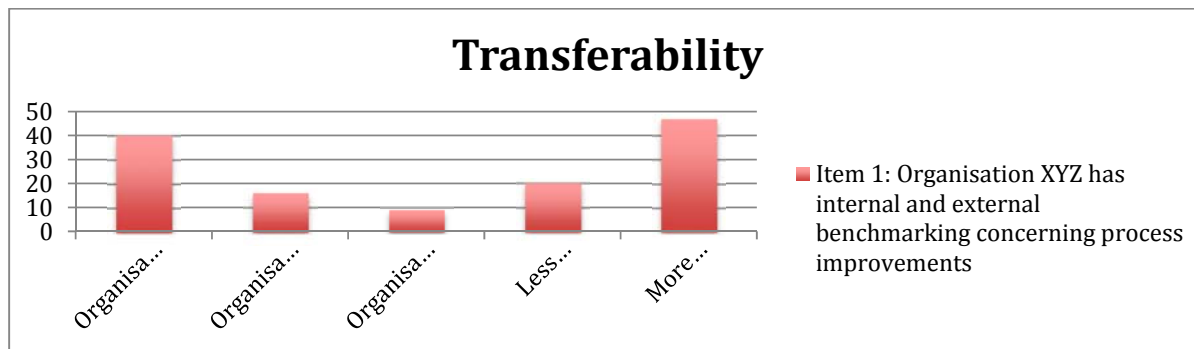


Figure 5-30: Illustration of gaps in “transferability” between host organisations and other organisations

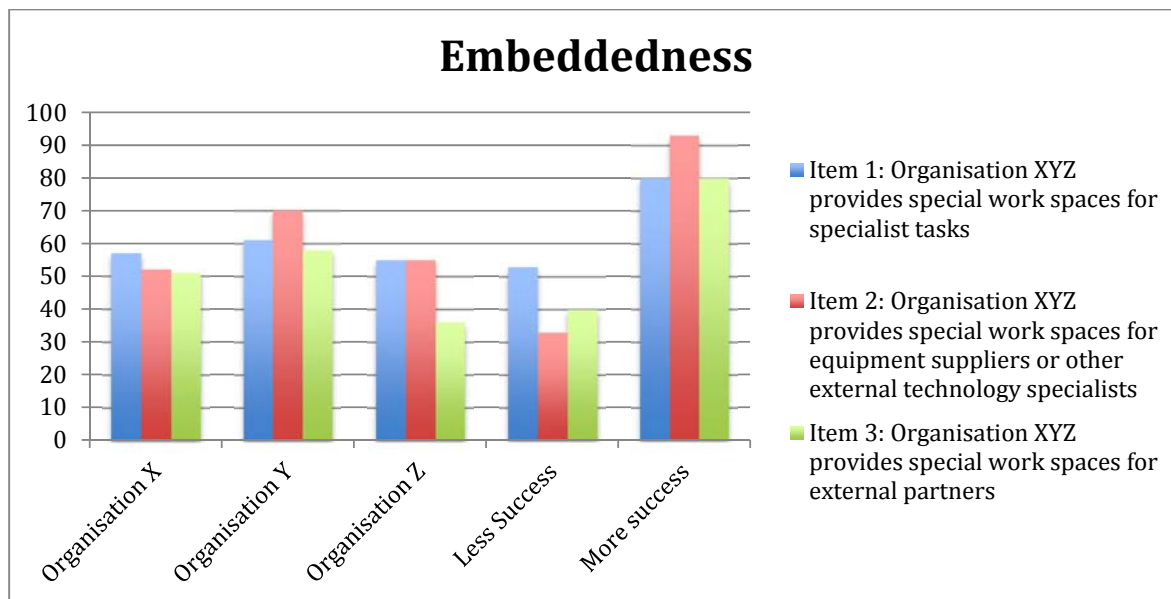
As the above table and figure shows, organisation Y and Z results were even lower than the less successful organisations in the US, Europe and Japan. Organisation X was quite better in this regard but yet none of the Saudi organisations were able to exceed the results of the more successful organisations in those countries. The results show consistency once again that the Saudi host organisations are somewhere between the less and the more successful organisations using different benchmark studies. In some way, these outcomes may be used as a motivator from an AR perspective because it shows the need to catch up with other organisations in other countries.

#### 5.9.2.4 EMBEDDEDNESS BENCHMARKING

Embeddedness is the degree to which the company’s knowledge lies hidden in the minds of its staff. The more embedded the knowledge, the more likely it is to be lost when staff members leave. The solution to the problem of embeddedness is to capture some of what people know and embed it in structural capital (e.g. databases) or even social capital. Table 5-37 and Figure 5-28 show that there are significant gaps in all items of embeddedness between host organisations and best practice. The results highlight that host organisation respondents may sometimes had a ‘halo’ effect in their ratings; that is, they perhaps rated the organisation higher than it actually was.

Embeddedness Score out of 100	Organisation X	Organisation Y	Organisation Z	Less successful Organisations	More successful Organisations
Item 1: Host organisation provides special work spaces for specialist tasks	57	61	55	53	80
Item 2: Host Organisations provides special work spaces for equipment suppliers or other external technology specialists	52	70	55	33	93
Item 3: Host organisation provides special work spaces for external partners (i.e. Organisations outside organisations X, Y and Z)	51	58	36	40	80

**Table 5-37: Gaps in “embeddedness” between host organisations and other organisations**



**Figure (5-31): Illustration of gaps in “embeddedness” between host organisations and other organisations**

### 5.9.2.5 PERISHABILITY BENCHMARKING

Speed is increasingly important in today’s business environment. For example, developing new products more quickly than competitors can create a first mover advantage. The value of

knowledge is unpredictable in this context but it generally loses value over time. Table 5-38 and Figure 5-29 illustrate the results for this measure.

Perishability Score out of 100	Organisation X	Organisation Y	Organisation Z	Less successful Organisation	More successful Organisation
Item 1: organisation provides continuous training related to standards and design rules	32	41	18	13	67
Item 2: organisation encourages recording of lessons learned/ FAQs and improvement ideas	29	27	18	37	77
Item 3: There is a central definition of technical standards and design rules	30	33	18	27	67
Item 4: In project teams, there is clear division of responsibilities between project leader and members	34	36	27	33	60

Table 5-38: Gaps in “perishability” between host organisations and other organisations

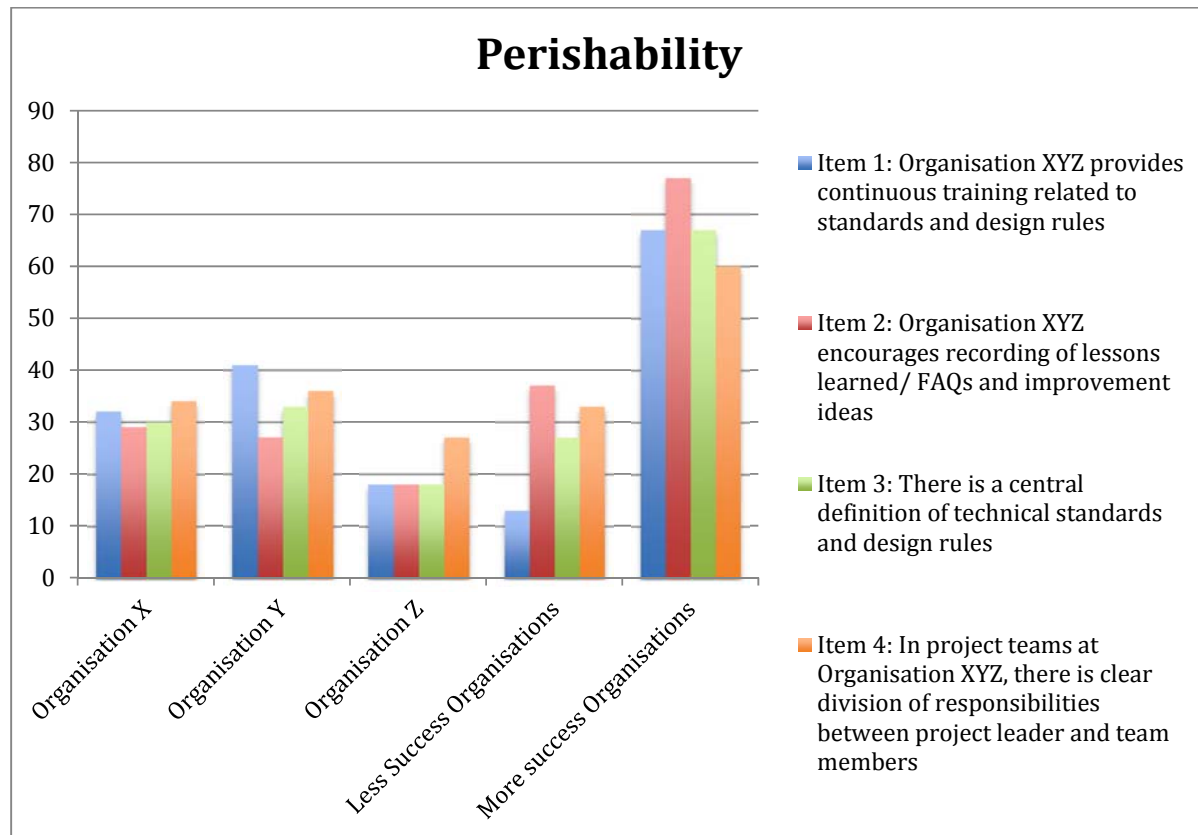


Figure 5-32: Illustration of gaps in “perishability” between host organisations and other organisations

The above table and graph show that there are significant gaps in the first two items of perishability between host organisations and best practice. Those gaps are considered substantially higher than expected and therefore, host organisations may find that this category is one of the most critical barriers for attaining the LO status.

### 5.9.3 KNOWLEDGE MANAGEMENT ASSESSMENT TOOL (KMAT)

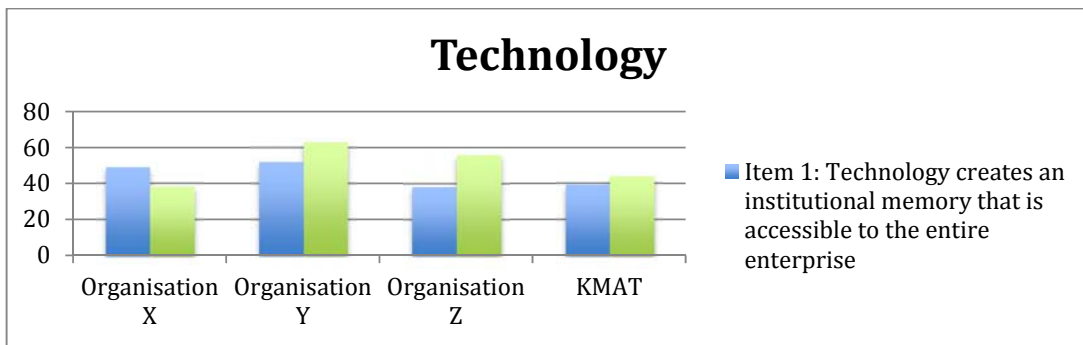
KM assessment is a diagnostic tool developed by Arthur Andersen in collaboration with the American Productivity and Quality Centre (APQC). This tool helps organisations analyse how effectively they are managing the knowledge process and how other organisations are faring in comparison. The KMAT was officially launched in September 1995 in Houston at the Knowledge Imperative Symposium and over 70 respondents representing diverse industries filled it out. The KMAT consisted of a set of 24 KM practices presented within an organisational KM model that investigates how four organisational enablers, namely leadership, technology, culture and measurement, can be used to foster the development of organisational knowledge. I used this tool to benchmark host organisations against the three dimensions of technology, culture and leadership. All of the mean scores were converted into a five-point Likert scale for consistency.

## TECHNOLOGY BENCHMARKING

Today, we see companies jumping on the technology bandwagon, connecting members of the organisation electronically so that they can communicate freely and work together on projects. Yet, the value of this activity is not always forthcoming (i.e. while Organisations may be linked to customers, they are not necessarily using technology to capture and share critical customer information). Likewise, they have not found ways to analyse and store information so that it can be used efficiently by other members within the enterprise (Hiebeler, 1996). Table (5-38) and Figure (5-29) illustrate the results.

Technology Score out of 100	Organisation X	Organisation Y	Organisation Z	KMAT
Item 1: Technology creates an institutional memory that is accessible to the entire enterprise	41	43	32	39
Item 2: Technology links all members of Host organisation to their external customers	32	53	47	44

Table (5-39): Technology measure



**Figure 5-33: Illustration of the technology measure**

The above table and graph compare how host organisations staff who took the KMAT rate where they stand. In general, a majority of host organisation staff (above 70%) believed that their organisation's technological performance was fair to excellent which is higher than other Organisations, especially in applying technology to create a widely accessible institutional memory and to link their member to external customers.

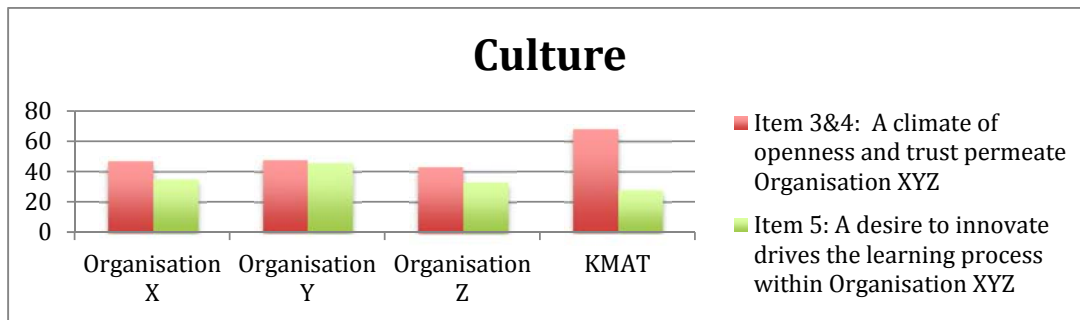
## CULTURAL BENCHMARKING

Most knowledge is contained in peoples' heads. If people get ahead in their organisations by keeping knowledge to themselves, the organisation is going to have a hard time convincing them of a new imperative to share. However, we can manage the knowledge process – the process of creating individual and team learning environments for sharing lessons learned in teams and using other techniques for leveraging and sharing the expressed output of team creativity (Hiebeler, 1996). Table 5-44 and Figure 5-30 illustrate the results for this benchmark.

Culture Score out of 100	Organisation X	Organisation Y	Organisation Z	KMAT
Item 1: A climate of openness and trust permeate	39	40	36	68
Item 2: A desire to innovate drives the learning process	29	38	28	28

**Table 5-40: Cultural measure**





**Figure 5-34: Illustration of cultural measure**

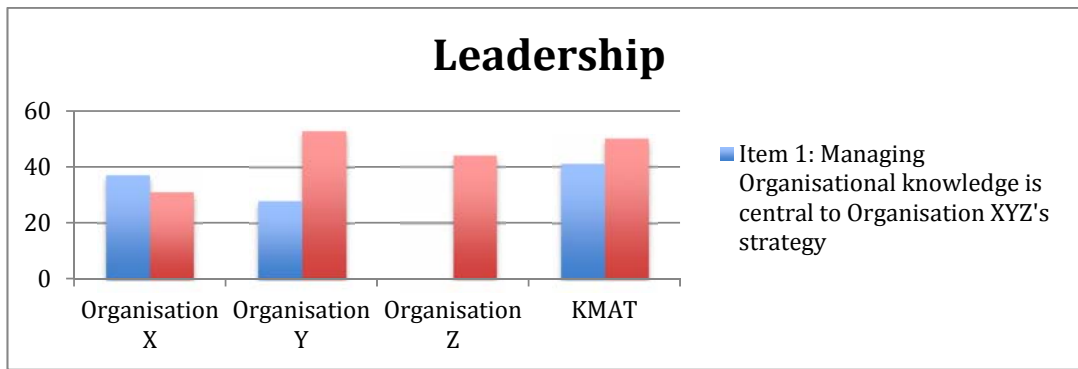
The above table and graph compare how well host organisations' staff who took the KMAT believe their organisations perform in practice. In general, host organisations' staff did not agree that their organisation was good at encouraging knowledge sharing (38%) and driving the learning process with a desire to innovate (32%). Although they seemed overall better at the second measure than the KMAT result, this result is still considered a low score.

## LEADERSHIP BENCHMARK

The role of the leadership in setting the direction for organisational members is paramount in any strategy. It is difficult for any research team to be successful in meeting the vast challenges of engineering research with the support, motivation and incentives from their top management. Table 5-45 and Figure 5-31 illustrate the results for this benchmark.

Leadership Score out of 100	Organisation X	Organisation Y	Organisation Z	KMAT
Item 1: Managing Organisational knowledge is central to host organisation's strategy	31	23	-	41
Item 2, 3 and 4: Individuals are hired, evaluated and compensated for their ability to contribute to the development of organisational knowledge	26	44	37	50

**Table 5-41: Leadership measurement**

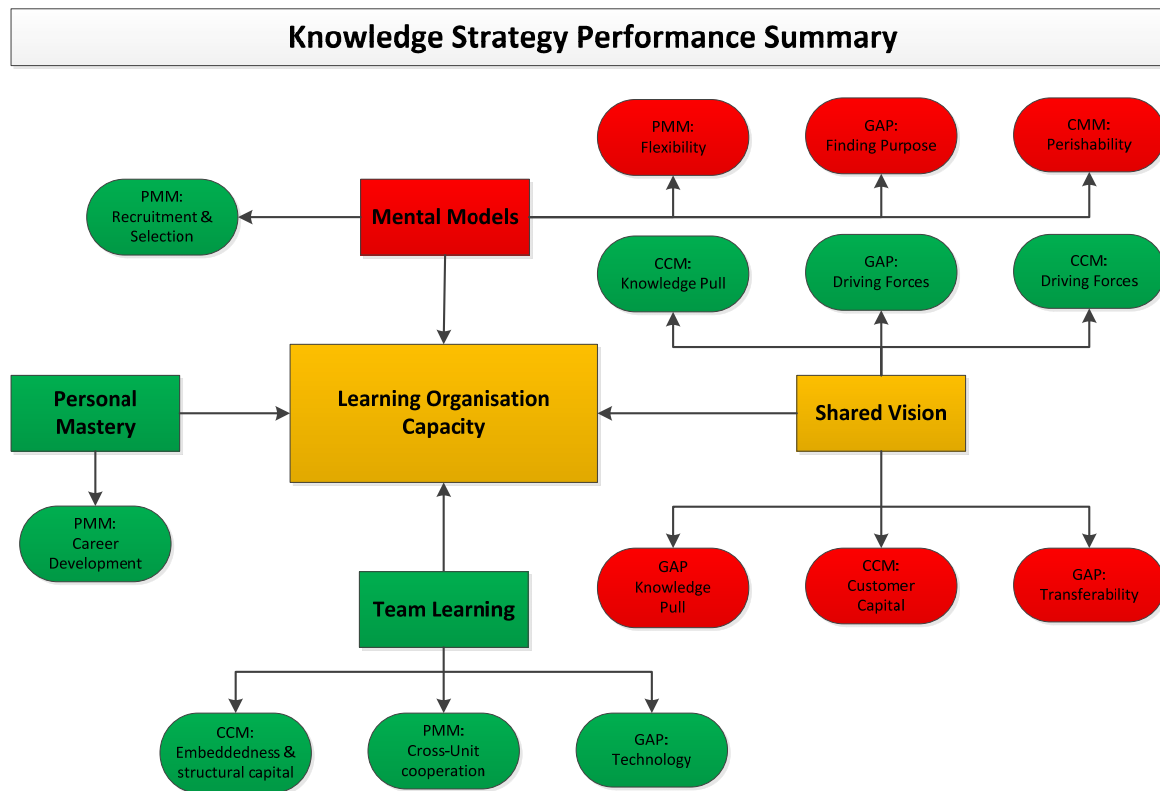


**Figure 5-35: Illustration of leadership measurement**

The above table and graph compare how host people who took the KMAT rate their leadership. The measure focuses on organisation's performance in modelling and supporting learning and in using learning strategically for business results. In general, host organisations do not seem to understand the importance of KM to their organisational strategy. In addition, the organisations have not satisfactorily evaluated and remunerated their staff for their contribution to KM. All the results in this area are still less than the benchmark, which indicates an opportunity for improvement.

### 5.10 OVERALL SUMMARY OF ANALYSIS AND REFLECTIONS FOR AR CYCLE 1

To validate the findings across the PMM, CCM and benchmark results, the LO model of Senge (1990) was used and mapped against each indicator of the models presented in this chapter. By cross checking all the findings, the 'big picture' reveals figure 5-37. The crosschecked highest and lowest LOC indicators were mapped to each LO dimension.



**Figure 5-36: The final overall assessment of the knowledge strategy at host organisations**

The final conclusions from the above figure demonstrate that the overall performance of the host organisations as learning organisations was moderate (i.e. orange). First, it is clear that the major performance deficiency at host organisations was their mental models. Finding purpose, flexibility and perishability results indicated with evidence that a significant defect exists in this area of the LOC at host organisations. The ability to make meaning from results, think creatively and reflect on experience seems low. The impact of the mental model dimension becomes even more adverse when the deficiency is more at the managers and top decision makers. This implies the possibility that policies and processes design are blocked by uncreative mental models.

Senge (1990) describes the way to improve our mental model by *turning the mirror inward*. He contends Argyris by quoting him saying: ‘although people do not [always] behave congruently with their espoused theories [what they say], they behave congruently with their theories-in-use [their mental models]’ because they never turned the mirror inwards. This means that host organisations need to expose their thinking because this hidden thinking is shaping how they act (Senge, 1990). This provides evidence for the need to start a new AR cycle to assess how people think and act. This implies examining how processes are thought through and how they are acted

upon. KT processes need to be examined from an action perspective. Mental models are also about how creative people are, which links quite directly to social networks and collective creativity.

Second, the performance of LOC is critical because the poor mental models also suffer relatively a poor shared vision. This means the staff commitment towards knowledge sharing, improving their cultural norms and towards the aspired future is low. The low performance in knowledge pull, customer capital and transferability indicators provide evidence to this finding. This is a serious threat to KT processes. This is another supporting evidence for the need to examine the knowledge flow dynamics to map where the faults are that relate to this LOC dimension.

Third, the results show that the individual performance represented by the personal mastery dimension was not in a critical situation. This supports the need to dedicate the next AR cycle to examining the KT performance on the organisational level. In order to that, the focus should be on activities and processes that contain knowledge flows within and across the borders of each host organisation. The results from the team-learning dimension did not show critical results, however, examining the work processes in the next AR cycle should further assess the accuracy of these findings.

### 5.11. CYCLE 1 – PHASE 6: REPORTING

As figure (5-37) below illustrates, this section describes the sixth phase of AR cycle 1. In this phase, I will present the segment of the AR journey that explains how reporting in this particular cycle took place. I will also present the result outcomes that emerged from this activity. Phase 6 of AR cycle 1 is shaded at which 25% of the project was completed successfully. The engaging phase of cycle 2 (chapter 6) follows this last phase of cycle 1.

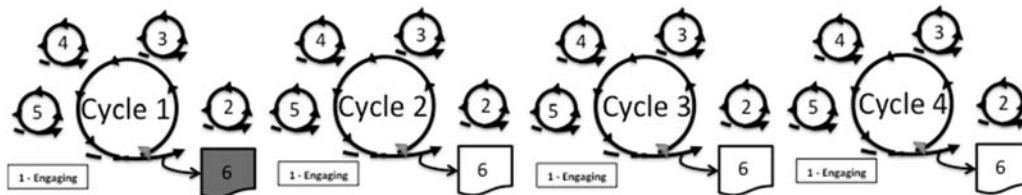


Figure 5-37: Cycle 1 – Phase 6: Reporting

The management at the three organisations were provided with findings report after the completion of this 18-week cycle. The report submitted was 79 pages in length. It included summary tables, definitions and detailed graphs of the findings and concluded with an overall ‘big picture’. The report provided executive management with a valuable context that would have been difficult to obtain from the online tool alone, since the tool was mainly quantitative. The report explained learning capability issues and performance issues to illustrate the gap that the following AR cycles needed to address. The report paved the way for emerging into the next AR cycle. It indicated opportunities for possible ways to improve LOC performance.

### 5.12. CONCLUSION

The original purpose of this study was to provide a solution to knowledge sharing challenges that could help the case-study organisations build their knowledge capability and consequently reduce their dependence on external expertise, thereby building internal capability. At the moment, engineering research organisations in Saudi Arabia need to increase their dependence on external knowledge to absorb and learn information that could be converted to internal knowledge where it could be disseminated and distributed in the institution's centres. This AR cycle presented this view by measuring the learning strength of the host organisations. I argue that the learning element is significantly more important than other KM elements at this stage. When an organisation achieves LO status, successful internalisation, dissemination, exploitation and use of shared knowledge can support the reduction of dependence on external expertise.

In order to embrace the full range of KM strategies, the host organisations must begin to embrace the LO concept and attain an acceptable benchmark. The survey conducted in this research is the starting point to gauge the readiness of the organisation to begin this journey. It will also, if repeated, be a measurement tool to gauge progress for future improvement cycles as a sign to their readiness for change. The survey in this AR cycle aimed to construct a reliable representation of staff perceptions of their current collective learning capability to be benchmarked and acted upon to implement a strategy for incremental cyclic improvements. The context of this project mandates that the concept mentioned above shall work in parallel with activities that attempt to solve internal problems on the individual, organisational and knowledge levels. The objectives of this survey were therefore:

- (1) To set a baseline in order to track changes to the host organisations' learning organisation capacities (LOCs) over the life of the project, although further measurements will be optional and may not be included in this project but may be conducted upon continuation of measurement.
- (2) To identify the actual and desired LOC; that is, a gap analysis, in terms of staff perceptions.

- (3) To develop a set of specific problems, that is, LOC attributes with the largest gaps between actual and desired performance.
- (4) To identify specific solutions, framed within the eight KM building blocks (creation, sharing etc.).

The emphasis in this AR cycle was describing a measuring instrument for diagnosing LOC status to enable the construction of a coherent understanding -exploitation- to the KT problem. Descriptive definitions for LO constructs and general theory covered in chapter 2 was difficult to compare with LOC measurement tools and KT constructs because both areas are not well operationalised nor widely validated from a holistically measurement perspective (Moilanen, 2001). This means that the generated empirical data and analysis in this cycle were valuable contributions to both its ability to link KT tools to performance measurement as a validation process for the LOC.

The ‘take action’ phase was the most exciting as it involved engaging in the field and exploring the host organisations while obtaining more of an ‘insider’ perspective. In this lengthy phase, which included long travel and full-day field work, challenges surfaced such as balancing academic work and practical interventions or dealing with possible failures related to the staff understanding and implementing the requested actions. These issues caused time management issues. A main assumption in AR is that the researcher must balance the practical interventions and academic work, however the way in which this balance is achieved is seldom considered.

The ‘analysis and reflection’ phase was the most difficult and lengthy among all phases of AR cycle 1. Since this was the first reflection phase conducted in this thesis, it was the most challenging. In this phase, I raised practical problems. I have learned that reflection requires the willingness to be open, to question, and to negotiate how AR is performed. Providing participants with a trustworthy space for reflection and argument is rewarding, nurtures learning and is free from judgmental or hostile views. In this way, we can turn uncertainties into fruitful and useful reflections, providing new alternative strategies for handling roles and interventions.

# CHAPTER 6: EXAMINING THE KNOWLEDGE TRANSFER PROCESS

## AR CYCLE 2

*“A process that does the wrong things faster doesn’t really help”*

*Sharp and McDermott (2001)*

### 6.1 BACKGROUND

In order to consistently connect the chapters of this thesis to the knowledge strategy introduced in chapter 5, this chapter builds on implementing core activities (processes) to become better than rivals. Lack of such valuable processes, consequently, results in inferior performance and lack of competitiveness. Activities are essentially capabilities that create value for the organisation. Resources are the building blocks of capabilities and the way they are combined in key activities then becomes a source of competitive advantage. This discussion helps build a bridge to KT, as a KM capability, and to BPR for identifying waste points (i.e. performance inefficiencies in the KT capability). Chapter 6 builds on chapter 5 by examining the capability gap in more detail using BPR logic, as well as further performance measures (i.e. TQM and lean thinking). KT as a capability looks at how work flows and how knowledge is shared, in order to demonstrate the application of the knowledge strategy.

While the previous AR cycle examined LOC as a system that contributes to organisational performance by helping to increase the OKB, this AR cycle will define the process of KT with a focus on exploring how KM may intervene to improve learning through the



process of KT. A new KT model is presented to cover the concepts introduced in chapter 3. The model builds on the notion that core business processes that facilitate improvement in LOC status are likely to be influenced by learning through KT processes, which are usually imbedded in core workflow. This illuminates the context for this chapter.

AR Cycle 2 builds on the conclusions of AR cycle 1 (see Figure 4-6 in chapter 4). The shortfall that case-study organisations face in meeting the LO ideals suggest that learning processes are the most influential LO factor. These learning processes are associated with possible deficiencies in the way work is carried out because knowledge work is mainly carried out through business processes. This cycle explores these processes. This narrows the scope of AR cycle 1 from the generic context of LO to the context of KT processes. Hence, AR cycle 2 looks at the activity or the system of KT from a process perspective.

Process performance measurement (PPM) and improvement activities are important tools for controlling and enhancing the efficiency and effectiveness of business processes (Molina *et al.*, 2007). Underpinning the host organisation's performance is a set of core processes that is actually responsible for how learning takes place (Mentzes *et al.*, 2001). Learning follows business processes in a coordinated and path-dependent way (Molina *et al.*, 2007). This suggests that learning processes and business processes are correlated. This correlation is an interesting area that requires further research and investigation (Terwiesch and Bohn, 2001; Jensen and Szulanski, 2004; Søberg, 2011).

Typical core processes in the Saudi engineering research industry sector include: creating research alliances, collaborating with foreign experts, recruiting competent scientists, conducting complex research experiments, documenting patents, publishing research results, commercialisation, providing expertise to the local industry and developing strategic scientific research plans for the nation. Within those processes resides most of the critical knowledge that is shared by process users (Minbaeva and Michailova, 2012; Minbaeva *et al.*, 2012). By knowing where these processes source knowledge, to whom they send it and how they disseminate it, case-study organisations may be better capable to understand how knowledge flows within a business process, and this might enable understanding how to tackle the KT predicament. A path-dependent trail of organisational processes is mapped to provide a platform for examining knowledge flow. This cycle aims to operationalise knowledge flow by mapping KT within the business structure.

### 6.2 THE IMPORTANCE OF THE AR CYCLE 2

Knowledge takes different perspectives in that it can represent a ‘state of mind’, a ‘process’, or a ‘capability’ (Alavi and Leider, 2001). The importance of AR cycle 2 comes from its focus on the ‘process’ perspective of knowledge. As mentioned earlier in this thesis (see chapter 3), identifying which processes in the organisation are conduits for knowledge is an essential starting point to improve KT (del-Rey-Chamorro *et al.*, 2003). The importance of this perspective is that it helps to uncover how *embedded* knowledge flow would perform within a core work process. This approach extends to differentiating between the levels of conscious intention involved (i.e. emergent flows versus constructed flows). AR cycle 2 is also important because it will reflect on a correlation that has been said to exist between KM performance and BPR performance (McKeen *et al.*, 2006).

For the host organisations, the practical benefit of undergoing this process was that it enabled them for the first time to explicitly codify important core business processes. They became aware of the importance of explicit codification of their core business processes. AR cycle 2 brought into the awareness of the leadership at the three host organisations that they needed to change their priorities from running their day-to-day business to investing in formalising and codifying their core processes to better measure performance (Gold *et al.*, 2001). This shift in priorities would allow more accurate performance measurement to take place. The questions posed in the semi-structured interviews were significant in that they provided evidence and context to the existing processes that were not documented as part of the policies and procedures of the organisations under study. This raised awareness and codified tacit processes that had developed and matured over the years of the business with measurable business processes.

This cycle helps in two ways: First, it provides a comprehensive list of core processes that will help the organisations to document their processes; and second, it identifies process obstacles that exist within those processes from a KM point of view (Cohen and Levinthal, 1990; Kogut and Zander, 1992; Porter-Liebskind, 1996) and from a BPR point of view (Kettinger *et al.*, 1995; Doolen and Hacker, 2005; Locher, 2007). The leadership can then attempt to improve practices, and periodically question them.

### 6.3 CYCLE 2 – PHASE 1: SITUATION ENGAGEMENT

As figure (6-1) below illustrates, this section describes the first phase of AR cycle 2. In this phase, I will present the segment of the AR journey that explains how the situation engagement in this particular cycle took place. I will also present the result outcomes that emerged from this activity.

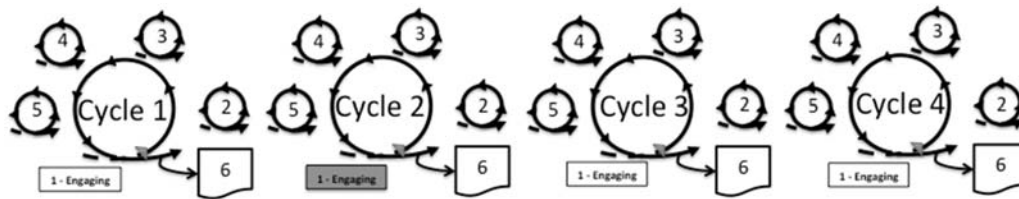


Figure 6-1: Cycle 2 – Phase 1: Situation Engagement

The benefits of identifying business processes have been proven to be significant (Bohn, 1994). The aim is to link what the host organisations should know (knowledge level) with what they should do (business processes level) in a way that could uncover process problems and simultaneously reveal improvement possibilities. This highlights the capability gap from a different perspective; that is, it highlights the gap between what is and what should be. After the completion of AR cycle 1, a clear gap was revealed, reflected upon and reported to the case-study organisations to improve their learning capability situation. The leadership of each organisation was made aware of the potential opportunity for improving their firm's capacity to reach the ideal LO. The awareness was evident but they had difficulty in converting this awareness into implementation. A clear understanding of how to change the situation was absent. As a result, I was able to engage with the case-study organisations to begin a new AR cycle to explore their activities.

A more detailed map of core business processes (see Appendix C) may visualise organisational activities to show exactly where change was needed to improve learning capabilities (Mentzas *et al.*, 2003). Increased awareness was considered a positive change; hence, it can be capitalised upon to engage the host organisations in AR cycle 2 to pin down specific business processes that, if improved, could enhance the LOC status (Coulson-Thomas, 1996).

KT techniques are applied to adopt best-practice business processes (O'Dell, 2000). Best practice KT requires the organisation to adapt the best practice to the new context after transfer (O'Dell, 2000). This is not a simple task because existing business processes at the host organisations need to be first identified, assessed, modified, and then contextualised to receive the new best practice. The process of modifying or replacing existing business processes is called BPR (Coulson-Thomas, 1996). BPR links to LOC in that both aim to improve the competitiveness of an organisation (Coulson-Thomas, 1996). In this context, AR participants established a shared understanding of the challenge. In this sense, the connections to the previous cycle (the capability gap theme) are continually built because BPR is a methodology used to examine the KT capability gap in more detail by revealing inefficiencies (i.e. waste points) in existing business processes and suggesting improved or new version of processes.

Although this is one way among many of solving the LOC problem, the focus in this phase was to guide the AR participants to engage in the problem from a KT process perspective. In addition to drawing attention to core processes that connected the knowers with the host organisations (i.e. focus on how the host organisations worked with external experts within each process), I brought attention to work processes that took place between the host organisations and the local industry as well.

Upon the emergent “shared understanding” of what the second AR cycle should be about, it was time to critically define the situation explicitly in a way that facilitated preparing an action plan. It was necessary to take AR participants to a higher level of awareness of the problem. This is explained in the next AR cycle phase “emerging definition”.

## 6.4 CYCLE 2 – PHASE 2: EMERGING DEFINITION

As figure (6-2) below illustrates, this section describes the second phase of AR cycle 2. In this phase, I will present the segment of the AR journey that explains how the emerging definition for this particular cycle was formulated.

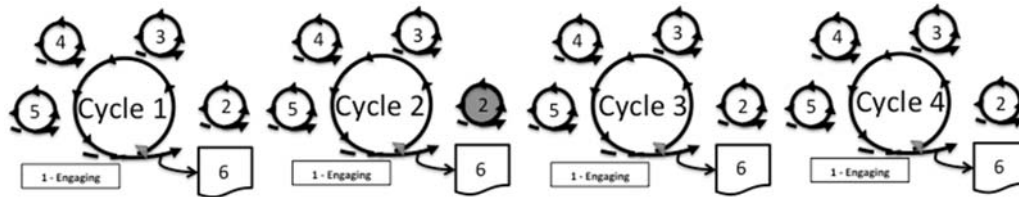


Figure 6-2: Cycle 2 – Phase 2: Emerging Definitions

In the previous phase (engaging), AR participants and I had informal discussions to allow a shared understanding to emerge about the ‘As Is’ KT processes and the ‘To Be’ aspirational processes (i.e. the KT capability gap). It was important to achieve consensus on how the KT capability could be described at the host organisations. Since AR is about changing a situation for the better, primarily for its stakeholders, but also for the community as a whole, it was essential to define the emerging problem. In this AR cycle, the focus is on the KT capability as a process. It was necessary to explore the difficulties AR participants face in relation to this phenomenon.

From the previous phase, AR participants understood that KT processes are key to solving the LOC gap. They felt that solving core business process obstacles may address LOC issues more effectively. It was time in this AR phase to define what business processes meant and how this relates to KT and KM. This phase will define the variables of KT to enable a better understanding of the enquiries involved.

A process is defined as a complete end-to-end set of activities that create value for a customer, where the customer can be internal or external and activities can be cross-functional or cross-organisational (Sharp and McDermott, 2001). Process management is introduced as concepts and practices aimed at better stewardship of business processes

(Davenport, 1990). BPR as a process management tool is understood as referring to deliberate experiments that fundamentally rethink and radically redesign business processes to bring about significant improvements in performance (Terwiesch and Bohn, 2001). BPR has proven to be an effective approach to process management on the practical level (Davenport, 1990). It fits well with my AR approach to combine BPR, KT and action in one practical framework assessment. Some researchers even consider BPR as an LO process in its own right that fills the KT capability gap (Terwiesch and Bohn, 2001). As I support seeing BPR as a model of learning, in this thesis it comes after the LOC AR cycle (chapter 5).

This AR cycle presents our attempt to improve business processes involving the transfer of knowledge within and across the borders of the three research host organisations X, Y and Z. The impact of knowledge on business processes has been shown to be influential (Bohn, 1994). I therefore aim to link what the case study organisations should know (knowledge level) with what they do (business processes) in a way that could uncover process problems and simultaneously reveal improvement possibilities.

My approach to improving KT is largely based on reducing ‘wasteful activity’. This AR cycle identifies the key ‘waste points’ to eliminate or reduce the time spent on these activities in order to improve KT processes. These waste points are usually the result of a multi-faceted range of problems. It is not that staff are lazy or incompetent, or that they suffer from other behavioural/attitudinal problems; rather, the waste inherent in the KT system is present in organisational systems and culture. The objective in this AR cycle is to identify the *locations* and *process attributes* of these waste points, while the next AR cycle aims to identify the underlying phenomena *causing* those waste points (Massingham, 2012). This approach uses business process mapping to explain not only *what* is happening but also *why* it is happening. It is the *why* context which will identify the nature of the KT capability gap and reveal *where* it is happening in the case study organisations’ activities. It was necessary to inquire into the what, why, and where contextual issues to address the KT capability gap.

To measure the effectiveness of the processes that house the flow of knowledge, we must first identify those core business processes. Knowledge that lies in less important

processes (non-core processes) is therefore likely to be considered non-strategic. I explained to the AR participants that face-to-face interviews would be conducted to elicit this information. The response was generally positive and a reasonable level of engagement was achieved. The following phase will explain how my understandings of overarching themes emerged to formulate a solid planning phase for AR cycle 2. Four enquiries have emerged from this AR phase:

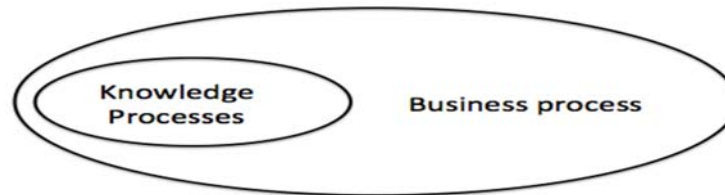
- (1) What business processes are core for the business to perform well?
- (2) Which of these processes act as KT conduits?
- (3) What wastage points exist in these processes?
- (4) How does knowledge flow within processes?

The first enquiry highlights a link between business processes and organisational strategy. The second enquiry links business processes to knowledge processes. The third enquiry seeks avenues for process improvement and waste elimination. This implies a link between BPR and KT improvement (Coulson-Thomas, 1996). The fourth enquiry suggests that knowledge blockage issues emerge from business process deficiencies (del-Rey-Chamorro *et al.*, 2003).

My exploration of KT starts, therefore, by exploring existing business *processes* and assessing how knowledge actually flows within those processes. For example, the process of *learning by doing* is described as an individual self-guided KT process (Senge, 1990). Other examples may be the exchange of knowledge between two people where one has more knowledge than the other, the exchange between an individual with a group of people, and the exchange of knowledge between a group or organisation and another group or organisation. This means there are different levels of KT, since work occurs at the individual, group, and organisational levels, and therefore, KT occurs on those same levels. Hence, business processes, which occur at each level, were mapped. This fits with the 'system' architecture to be presented later in this chapter. The knowledge flows in these levels represent 'knowledge processes' that flow within business processes (del-Rey-Chamorro *et al.*, 2003; Simonin, 2004). The literature does not provide a solid understanding of what is happening in these phenomena.

My intention is not to suggest new business processes that could complicate work; rather,

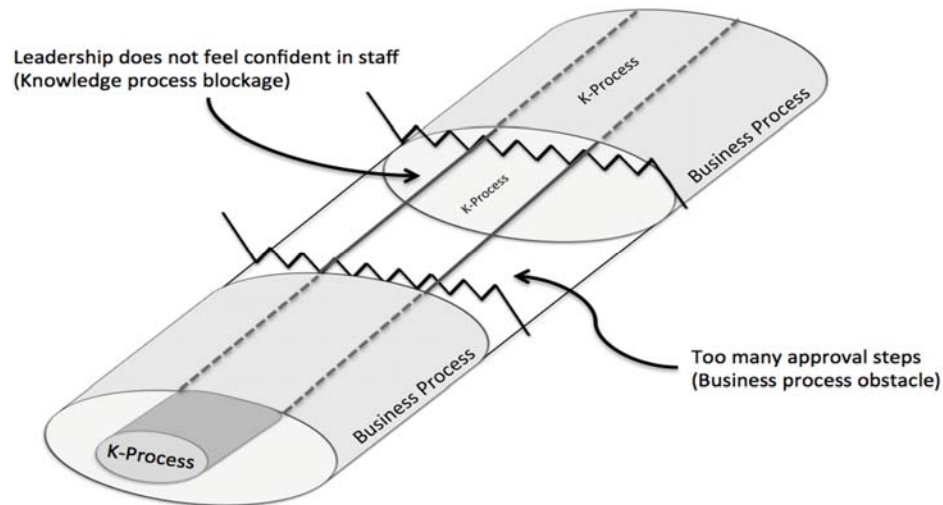
I aim to erect useful ‘knowledge processes’ to flow within existing business processes. This is a subtle distinction. Figure 6-3 illustrates the embeddedness of knowledge processes within core business processes. These process streams need to be aligned to meet strategic objectives. My first aim is therefore to carefully identify business processes that carry critical knowledge processes in the host organisations.



**Figure 6-3: Knowledge processes embedded in business processes**

The above figure shows how KT is part of each business process, not just an enabler linking processes together. In this sense KT is a part of capability growth because it represents a part of how the organisation used its resources to create capabilities. The problem for KT implementation described in chapter 3 (see Section 2.2), however, occurs when existing business processes are ill designed to act as conduits for efficient knowledge processes (i.e. business processes are too long, have too many waiting points, too many approval requirements, too much paperwork, too much conflicting information, are too inflexible, etc.). These kinds of processes are *unhealthy* and make it difficult for knowledge processes to survive in them since they carry numerous business process *obstacles*. The reasons behind the existence of those obstacles (effects) emerge from a deeper layer of issues (causes). These underlying causes are called knowledge process blockages (e.g. low trust between people causes inflexibility, poor skills among staff members cause processes to slow down, tacit complexities mean users receive conflicting information etc.). Figure 6-4 illustrates this concept.





**Figure 6-4: Business process obstacles and knowledge process blockages**

As can be seen from the example above, a business process that houses a knowledge process is burdened with time-consuming approval requirements (process obstacle). This obstacle blocks the knowledge flow within the knowledge process. The reason for this situation is that the leadership does not want thinking and decisions to be carried out by subordinates (knowledge blockage). Business process mapping and possible knowledge blockages in the process map were illustrated earlier in Figure 3-8 of chapter 3. The map provided a bigger picture of how multiple process obstacles are caused by multiple knowledge blockages that need to be lifted. Success in solving such difficulties is likely to result in improving LOC status as well.

In this cycle, I explore business processes from a structural perspective to locate *business process obstacles* using lean thinking approaches (Hines *et al.*, 2004). In the following AR cycle (cycle 3), I will explore why *knowledge process blockages* occur. Table 6-1 lists some characteristics for business process obstacles and knowledge process blockages.

	<b>Business process obstacles</b>	<b>Knowledge process blockages</b>
<b>Definition</b>	<i>Process that manage the business</i>	Process that manages knowledge flow
<b>Location</b>	<i>Waste points</i>	Usually associated with the location of business process obstacles but may exist in multiple locations
<b>Nature</b>	<i>Hard</i>	Soft
<b>Variables</b>	<i>Policies, procedures, management instructions</i>	Attitudes, values, culture
<b>Origin</b>	<i>Business</i>	People
<b>Impact</b>	<i>Short and long term</i>	Short and long term

**Table 6-1: Attributes of business process obstacles and knowledge process blockages**

It is important to understand *how* new and existing knowledge is brought into business processes. It is also important to understand how well the relevant processes use knowledge (Örtenblad, 2001). This implies a relationship between KT processes and business processes. The focus is on the dynamics of KT processes and how they are managed within a business process, and whether the system allows knowledge expansion or growth to occur (Lorange, 1996).

When the velocity of the workflow (the flow of tasks) in business processes exceeds the velocity of knowledge flow in those processes, performance deficiencies arise. It is therefore important to maintain an *accelerating learning* rate that is aligned with the acceleration of workflow in business processes. The literature does not properly address this subtle distinction between maintaining a rate of changing *volume* of OKB and a *rate* of changing growth of OKB.

### 6.5 CYCLE 2 – PHASE 3: PLANNING FOR ACTION

As figure (6-5) below illustrates, this section describes the third phase of AR cycle 2. In this phase, I will present the segment of the AR journey that explains how planning for action took place in this particular cycle.

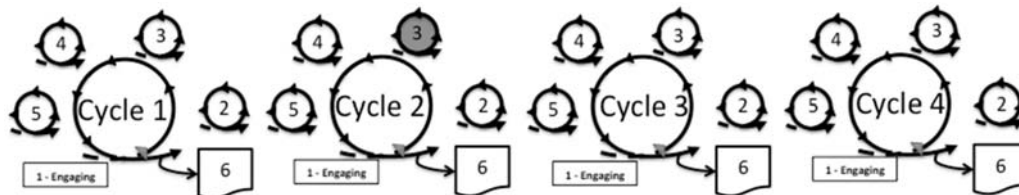


Figure 6-5: Cycle 2 – Phase 3: Planning For Action

The issue of waste is a concern for many organisations (Childe *et al.*, 1994; Harrington, 1991; Hines *et al.*, 2004). In the previous two phases of this AR cycle, the host organisations developed their awareness to a level where it became evident to them that it was time to plan for action. This was a critical point to reach whereby a plan of action can be suggested. With this rationale, it was agreed to plan for face-to-face semi-structured interviews aimed to help understand the existing processes. The detailed knowledge of work processes was mostly with managers. Therefore, they were targeted for this cycle.

There are many ways that waste can go unnoticed in businesses as it usually leaves business processes functional, but not functioning at an optimal level (Harrington, 1991). This may make it difficult to convince an organisation that there is actually a problem. Such hurdle was overcome by explaining that if they really want to know if their organisation has a KT process problem then core processes must be identified and using the KT processual lens. This argument was appropriate for convincing the organisations of the need to apply science in diagnosing their performance in a particular area. The transition to a planning phase was agreed and a list of interview questions was designed to capture the KT processes at the case-study organisations.

A failure to elicit core processes from stakeholders may impair the ability to effectively identify and eliminate process waste (Harrington, 1991). A possible challenge was that each participant involved in the value stream of the identified core processes might be

overly focused on his/her own role and deliverable in the value stream and not on the *entire* process from creation to application. The interview questions therefore were designed in such a way that brings a systemic perspective to knowledge flows.

By sustaining a sense of collective thinking among stakeholders (i.e. AR participants) using a systemic approach, freedom of expression was encouraged (Senge, 1990). The lack of a systems approach on the part of the stakeholders was expected in their discussions where there was an inclination towards blaming other parts of the value stream when issues of performance arose. Since this thinking approach may become a threat to the AR project as a whole, it was provided with additional rectification attention.

### 6.5.1 HOW DO WE OPERATIONALISE KT PROCESSES?

A business process is defined as the logical organisation of people, materials, equipment and procedures into work activities designed to produce a specified end result (Davenport and Short, 1990). Organisations have relied on business process performance measurement (PPM) systems to audit their competitiveness. However, with a focus on embedded knowledge processes, a new knowledge gap emerges (del-Rey-Chamorro *et al.*, 2003). Increasingly, organisations need the contribution of knowledge processes to improve both their *lag* indicators of strategic business performance and *lead* indicators that are firm specific indicators of actions carried out by specific individuals or teams. Lead indicators support the overall high-level lag indicators (Kaplan and Norton, 1996). In terms of closing the knowledge gap in business processes, KT processes may play an integral role. The enquiry into how to operationalise KT becomes essential.

A KT strategy should focus not simply on the transfer of tacit or explicit knowledge from an *object* point of view, but rather on the process of transfer (Zandar and Kogut, 1996). It is within these transfer processes that the value of knowledge may be lost (Szulanski, 2000), because KT within a process entails changes in context, time and location. Therefore, in developing a KT strategy (see chapter 9), organisations need to understand how KT processes function (this chapter), and also the barriers that impact them (see chapter 7) (Szulanski, 2000). The identification of those processes across an entire organisation is however considered a massive task. The necessity to align both business

processes and knowledge flows with the activity of process improvement becomes clear once the identification of core processes is completed (see Appendix C). By approaching a KT process improvement initiative using a BPR framework, it is possible to scientifically claim operationalisation in action.

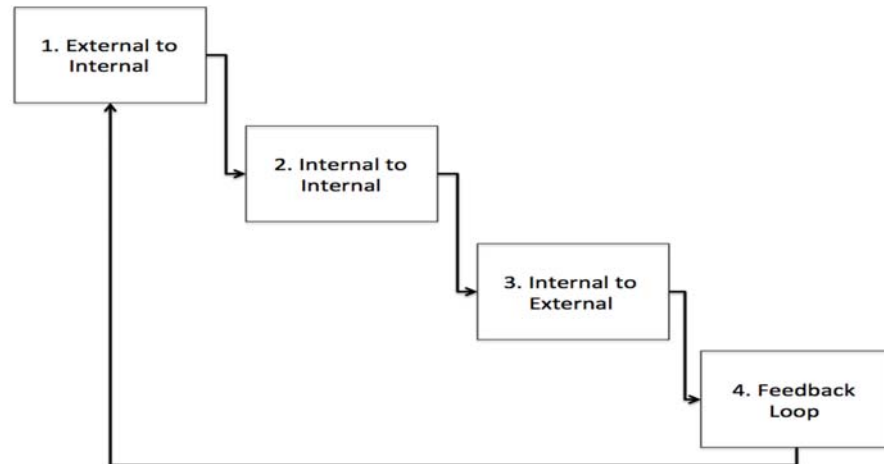
BPR is understood to comprise deliberate experiments that fundamentally rethink and radically redesign business processes to create significant improvements in performance and radical change (Terwiesch and Bohn, 2001). This fits well with the aim of operationalising KT processes that exist within business processes because BPR employs the measurement of activities to assess their effectiveness in improving performance. To operationalise KT processes, we need to combine BPR, KT and action in one framework.

Some researchers even consider BPR as an LO process in its own right (Terwiesch and Bohn, 2001). This provides a link between this AR cycle and the previous one (LOC measurement). BPR activities require experimentation as it learns from its iterative attempts to eliminate waste points from a given process and improve its performance to reach the objective it was designed to achieve (Terwiesch and Bohn, 2001). This is a model of learning. In many respects, the BPR approach emerges as an effective way to operationalise the action needed after defining the LO gap in AR cycle 1.

My approach to operationalise the KT activity was largely based on reducing ‘wasteful activity’ using the lean thinking methodology (Locher, 2007). This AR cycle, as mentioned earlier, provides organisations with an opportunity to (1) identify the key ‘waste points’ to increase process efficiency and effectiveness and (2) eliminate or reduce the time spent on these activities, thereby improving knowledge flow. The development of the interview questions in Appendix C was the foundation for operationalising the underlying theory behind KT process problems. The coding and analysis of the data emerging from the interviews will be discussed in the “analysis and reflection” phase.

To operationalise the integrative KT system presented in chapter 3 (see figure 3-8), the involvement of overseas experts as well as the local industry was necessary. Understanding how knowledge flows vertically from external experts to the case-study organisations, and then vertically once again from case-study organisations to the local industry requires this involvement. This represents an overall architecture for the way the

case-study organisations do business and, in this sense, operationalises the goals set out in Figure 3-8. Further interview questions were therefore developed to elicit the experiences of external overseas experts and the local industry users as shown in Appendix D. In this AR cycle, an integrative KT model was proposed to operationalise the concept of KT. This model proposes an overall system for managing KT as defined by Figure 6-6.

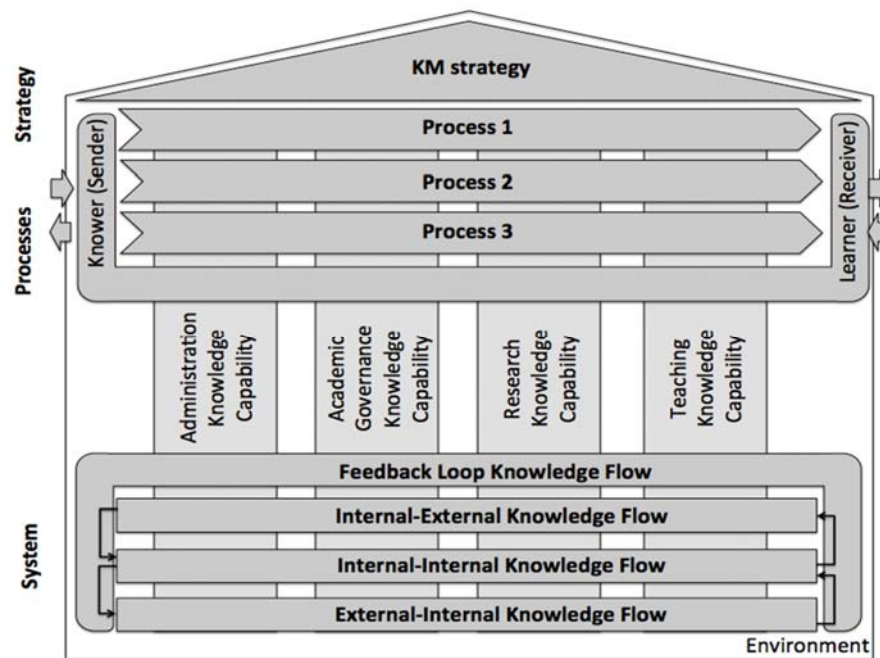


**Figure 6-6: KT Integrative system architecture**

The KT integrative architecture consists of three systems linked together to form the overall cycle of the flow of knowledge at the research host organisations:

- a. *External-to-Internal*: The flow of knowledge from external partners to Saudi research host organisations and their staff. This is System 1.
- b. *Internal-to-Internal*: The flow of knowledge between staff at the Saudi research host organisations. The KT within each host organisation is treated separately. This is System 2.
- c. *Internal-to-External*: The flow of knowledge from Saudi research host organisations and their staff to external partners – that is, local Saudi industry. This system also covers the KT between the host organisations since each organisation is considered external to the other. This is System 3.
- d. *Feedback Loop*: The system proposes a feedback loop to gauge the progress in terms of how successful the end result is at the receiving end. The flow of knowledge from the receiver to the sender regarding whether the knowledge was useful provides a second learning loop in that it may contain fundamental matters that could result in conceptual interventions. This is System 4.

The integrative system modelled in Figure 6-7 below extends the above concept to define further layers of the KT process. The four systems mentioned involve *different* knowledge capabilities that can be classified and explored separately. Once again, within those capabilities lie many business processes that involve *different* sender and receiver entities that exchange knowledge in *different* ways. All of these dynamics are captured in the figure below and allow individualised analysis to each layer. The exploration of the process of KT using a layered approach allows theorising the phenomena to produce operationalised solutions. In this way, I define the KT process from a BPR perspective and begin to present the KT theory used in this thesis.



**Figure 6-7: The thesis Integrative KT layered model (IKTM)**

There are four capabilities that define the knowledge processes at each of the three systems: academic governance, administration, research and teaching. These capabilities are grounded at the activities level. This typology helps define the key KT domain areas that the host organisations need to focus on when taking a KT initiative. In other words, these areas represent how knowledge is applied at the host organisations and it combines, from an RBV perspective, with other organisational resources to create value. These activity capabilities are defined as follows:

## CHAPTER 6: EXAMINING THE KNOWLEDGE TRANSFER PROCESS

- a. *Academic governance*: This is knowledge associated with managing academic activities. This work is typically done by the host organisations' leaders, middle managers, and other supervisory staff. This is Activity 1.
- b. *Administration*: This is knowledge associated with designing, implementing, and managing the processes that support academic activity. This work is typically carried by the host organisations' administrative staff, as opposed to academic staff. This is Activity 2.
- c. *Research*: This is scholarly activity associated with advancing the body of knowledge. This is Activity 3.
- d. *Teaching*: This is knowledge associated with the teaching process, as opposed to the content, which is covered in research. This is Activity 4.

By being able to define what each capability does for the organisational value stream, it will be more feasible to measure performance from a capabilities perspective, allowing the host organisations to develop measureable metrics that may be benchmarked against an ideal performance status. Within the above systems and capabilities, a third layer of analysis aims to identify how knowledge flows from senders (knowers) to receivers (seekers) by disaggregating each activity into discrete steps to explain what happens and when. This third layer identified knowledge processes that existed in the business processes of each capability activity. The fourth layer of analysis examined how well knowledge flows within each process. These layers are all represented in Figure 6-7 above to operationalise this AR cycle.

Theme	Description
<b>External-to-Internal</b>	External knowledge flowing from overseas individuals and organisations to internal (research staff) members of the organisation. This theme also covers lessons learned by the administration from external best practices.
<b>Internal-to-Internal</b>	Internal knowledge flowing within the borders of the organisation between different research staff, administration and faculty. One Organisational unit is learning from the experience of another.
<b>Internal-to-External</b>	Internal knowledge flowing from internal researchers to external knowledge users in the local industry. This flow takes place during client-funded projects, scientific collaborations or special assignment consultations and meetings. It also covers the flow of knowledge from the organisation to other local peer organisation such as knowledge from university to university.

**Table (6-2): First layer systems of the IKTM**

Sub-Theme	Description
<b>Academic Governance</b>	Knowledge associated with managing academic activities. This is work typically done by research leaders, and other supervisory staff. This is Activity 1.
<b>Administration</b>	Knowledge associated with designing, implementing, and managing the processes that support academic activity. Case-study administrative staff, as opposed to academic



Sub-Theme	Description
	staff, typically does this work. This is Activity 2.
Research	Scholarly activity associated with advancing the body of knowledge. This is Activity 3.
Teaching	Knowledge associated with the process of teaching, as opposed to teaching content. This is Activity 4.

Table (6-3): Second layer capabilities of the IKTM

### 6.5.1.1 PARTICIPATING ORGANISATIONS

A leading research university in the US participated in this AR cycle. This research-based university has been placed in the top five in rankings of the world's leading universities in engineering, technology and physical sciences in 2011 and 2012. It has been providing expert knowledge for a few years to Saudi research organisations and has developed joint ventures with one or more of the host organisations in this study. As a global leader in science and engineering research, it was important to understand how experts working at world-class research institutions viewed KT processes in the context of this study. In this way, I used this organisation to benchmark the KT processes and identify the capability gap between what is (processes at case study organisations) and what should be (processes at world's top five universities). In addition, I identified the business processes shared between the knower and the seeker, uncovering the knowledge flow behaviour in this context. Similarly, a large industry organisation in Saudi Arabia participated in this AR cycle to explain their KT experiences from a knowledge user perspective.

Organisations X, Y and Z that participated in AR cycle 1 are the same ones in AR cycle 2. This consistency was accomplished due to their commitment to further understand their KT problem and achieve a practical KT strategy at the end of the study. All three host organisations provided necessary formal approvals to conduct the interviews. I have been provided the freedom to select AR participants to ensure a true representation of the sample. In this way, validity of representation was ensured.

Another critical issue was securing acceptance from the host organisations to preserve the anonymity of the interviewees and the confidentiality of the recordings of the interviews. The management agreed that they would only be receiving a final report on the analysis and reflections emerging from the interviews without access to the interview transcriptions themselves or a list of AR participants' names. The information about

confidentiality was passed on to the AR participants and this allowed them to express themselves freely during the interviews.

### 6.5.1.2 PARTICIPATING INDIVIDUALS

A senior expert from the US who had been working with Saudi researchers was invited as an AR participant in this study to represent external knowers. The US scholar accepted the invitation and was interviewed. An RandD department manager of a leading local industrial organisation was also interviewed over the phone. Among all AR participants in all AR cycles of this thesis, this was the only individual to be interviewed over the phone.

The host organisations' AR participants came from four categories: research centre directors, assistant research centre directors (from engineering backgrounds), middle management department heads, and assistant department heads/deans (usually from administrative and management backgrounds). The sample focused on inviting individuals with knowledge of internal processes in terms of design and implementation.

In total, 13 individuals were invited to participate in this activity. Table 6-4 is a summary of the interviewees. The AR participants were directly invited to participate in this AR cycle and only one individual failed to accept the invitation. Participants signed a consent form that allowed them to withdraw their participation at any time without providing any reason. The voice recording would be destroyed if requested. They were invited to review the transcripts of the interviews and validate the context.

	Organisation X	Organisation Y	Organisation Z	External expert.	Local industry user
Research director	2	3	-	-	-
Researcher ass. director	1	1	1	-	-
Department head/dean	-	1	-	-	1
Ass. Dept. head/dean	1	-	1	-	-
Scholar	-	-	-	1	-
<b>TOTAL</b>	<b>4</b>	<b>5</b>	<b>2</b>	<b>1</b>	<b>1</b>

Table (6-4): AR participants in Cycle 2

As this was an AR study, the involvement of participants was not limited to the interviews. There were informal discussions that allowed reflections to emerge. I also had

the opportunity to observe how they worked and was offered the opportunity to view some of their work practices and documents and to meet other staff that shared their views. I also kept the participants updated on the developments of the study and how progress was made with the management of the host organisations. The justification for this was that AR participants needed to see and feel that practical steps were taking place to support the possibility for real change to occur.

### 6.6 INSTRUMENT DESCRIPTION

Three interview scripts were developed for three interviewee categories: host organisation participants, external expert, and local knowledge user. The interviews were intended primarily to detail the KT processes. The interview questions for the three categories were meant to capture AR participants' experiences related to KT processes from their different positions in the integrated system. The number of questions posed to participants from case-study organisations, external experts, and local knowledge users were 72, 60, and 32 respectively. The questions were constructed with four objectives in mind:

1. To identify as many as possible of the core processes that ran the critical business at the host organisations.
2. To elicit as many as possible of the knowledge processes that existed within the core business processes.
3. To uncover *how* knowledge flows behaved within the dynamics of the above processes.
4. To reflect on the analysis of the BPR activity and produce a management report that triggered possible change.

These questions were sourced from relevant literature on KT behaviour constructs (Massingham, 2012). A list of the questions is presented in Appendix C. In order to understand and improve KT, the main objective for this AR cycle was to identify the *locations* and *process attributes* of waste points in the business processes. The next AR cycle focused on underlying *behavioural* phenomena by asking: what are the *causes* of those *process attributes* and waste points (why do they occur)? (soft issues). The following phase will explain how the actual action was carried out.

## 6.7 CYCLE 2 – PHASE 4: TAKING ACTION

As figure (6-8) below illustrates, this section describes the fourth phase of AR cycle 2. In this phase, I will present the segment of the AR journey that explains how taking action took place in this particular cycle.

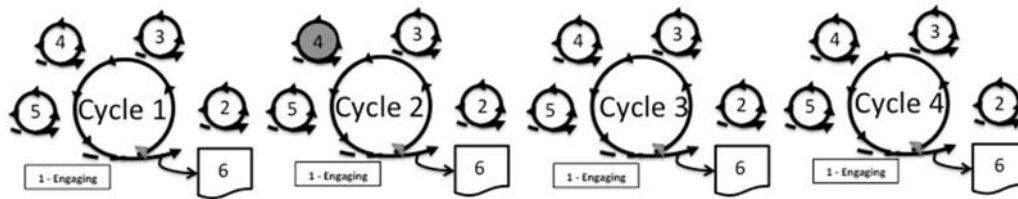


Figure 6-8: Cycle 2 – Phase 4: Taking Action

The logistics of organising interview times was challenging but manageable. All AR participants reported to the interview venues on time. They also answered all questions posed except two AR participants, one from organisation X and one from organisation Y who declined to answer some questions due to either the sensitivity of the question or due to previous commitments of confidentiality with other stakeholders or entities. However, this did not affect the overall elicitation process and a middle ground was developed during the interviews to extract useful information without confronting the AR participants and without breaking any commitments to confidentiality. Most participants read the consent forms carefully before signing but some did not and signed in good faith, although they were encouraged to read through the consent document.

A major challenge in this phase was to sustain the engagement of internal staff to the cause of the project. This was essential to (1) ensure the project continuation to the next AR cycles and (2) to continue the growth of momentum for possible change. The aim during the interviews and long discussions was to achieve increased engagement with the overall change program proposed by the project. Before starting the interview with the participants, it was necessary to discuss the progress of their organisations in meeting their existing objectives and strategies. Using an icebreaker strategy to prepare the way for difficult questions was essential and helpful in many respects.

## 6.8 CYCLE 2 – PHASE 5: ANALYSIS AND REFLECTION

As figure (6-9) below illustrates, this section describes the fifth phase of AR cycle 2. In this phase, I will present the segment of the AR journey that explains how analysis and reflection in this particular cycle took place.

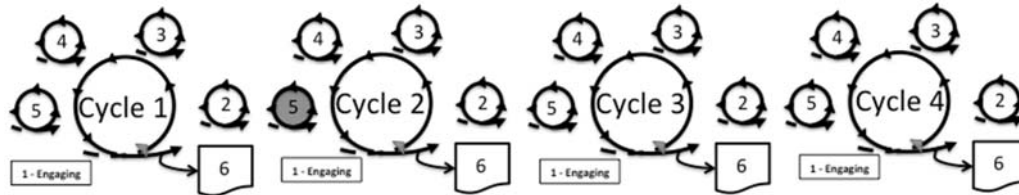


Figure 6-9: Cycle 2 – Phase 5: Analysis And Reflection

The interview transcriptions totalled to 523 pages and emerged into a coding structure using the IKTM. The NVIVO 9 software was used to manage this activity. A snapshot of the coding design is presented in Figure 6-10. The coding structure was based on the external-to-internal, internal-to-internal and internal-to-external KT systems. The codes supported the identification of core business processes. A total of 60 core business processes were identified. The identification of these processes underwent rigorous analysis in the form of detailed process mapping sessions.

Name	Sources	References
Knowledge sharing	0	0
External-Internal	0	0
Academic governance	16	54
Attributes of targetted external organisations	4	7
International Transactional Collaboration Agreement Design	10	32
Knowledge Sharing Agents	7	15
Measurement for KS outcomes	14	31
National Research Coordination Processes	5	9
Process for attracting external experts on part time basis	4	5
Processes for attracting external experts on full time basis	9	13
Processes for attracting external organisations on KS basis	11	12
Processes for attracting external organisations on transactional basis	6	7
Processes for managing IP with externals	6	10
Processes for managing resources and tools	2	3
Secretarial and coordination support services	5	6
Administration	19	43
Attributes of executives	10	15
International best practices	5	14
Knowledge Sharing approvals	12	17
Knowledge Sharing Strategic Process Thinking	17	44
Make vs. Buy Decision processes	6	11
Research	36	187
Attributes of external researchers	21	33
Attributes of internal researchers	18	49
Nature of External-Internal research processes	23	84
Research tools	7	11
Teaching	15	31

Figure (6-10): A partial image of the NVIVO 9 coding structure used to analyse the data

The level of change that could emerge is based on the distinction between single-loop and

double-loop learning. These two learning modes are decisive tools for “analysis and reflection” and are likely to determine the level of intervention – and improvement (Argyris and Schon, 1978). The level of questioning forces participants to challenge the underlying assumptions about the way business is conducted at their organisations. In many ways, participants tended to blindly accept the way their work was conducted in the past and tended to accept KT blockages as simply normal business. My questions encouraged participants to think about their work in new ways and to begin to consider new ways of conducting business (double-loop learning).

Single-loop learning focuses on the level of adherence to pre-established routines and explicit plans. This is about *are we doing things right?* Many consider this type of learning as less risky for the individual and the organisation because it maintains greater control (Smith, 2001). Double-loop learning is more creative and demanding in terms of reflective thinking (Argyris and Schon, 1978). It is about *are we doing the right thing?* Reflective thinking in double-loop learning is more original in questioning basic assumptions that does not take anything for granted. It questions variables, ideas and policies. In AR cycle 2, double-loop learning did not only reveal existing processes, but also what they should be, as capability growth road map.

### 6.8.1 THEORETICAL FOUNDATIONS: DATA ANALYSIS METHODS

Different approaches to applying these two modes of thinking exist in the performance improvement literature (Womack and Jones, 1996; Osayawe Ehigie and McAndrew, 2005; Stoica *et al.*, 2004; Ricondo and Viles 2005). Although this thesis is not aimed at bringing about process improvement, these approaches support the objective of exploring KT processes from different angles:

- a. Lean Thinking
- b. Knowledge Management (KM)
- c. Business Process Re-Engineering (BPR)
- d. Total Quality Management (TQM)

Figure 6-11 below provides a contextual visual link between KM, LO and most performance improvement approaches from the perspective that they share the objective of improving organisational output, each in a particular way.



**Figure 6-11: The different origins of performance improvement methods (Ricondo and Viles, 2005)**

The above approaches originated from diverse industry needs and geographical locations, which provides different lenses to understand the particular impacts of business processes on the process of KT. The above approaches, therefore, are not intended to be adopted in full in this thesis; rather, they are used to add specific situated insights to the phenomena of KT. The analysis presented using these approaches is neither comprehensive nor independent of the KT perspective.

However, there is literature that supports a relationship between quality control, process improvement, learning organisation and KM (Ricondo and Viles, 2005). Another reason for having multiple methods to explore the process of KT is that each method focuses on an element of improvement (i.e. lean on waste, BPR on change, TQM on adherence, KM on sharing and learning). A comparison between the above methods is presented in Table 6-5 with literature references for each approach.

As can be seen from the table below, each method has its own philosophical stance and characteristics to approach the improvement of business. KM, in comparison to other improvement approaches, focuses on strategic areas (see optimisation row), while other approaches trace inefficiencies regardless of the value the process represents.

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	<b>Lean</b>	<b>BPR</b>	<b>TQM</b>	<b>KM</b>
<b>Origin/ purpose</b>	1990/ Value creation	1986/ Process redesign	1980/ Quality	1990/ Continuous Learning
<b>Authors</b>	Womack, Jones and Roos (Locher, 2007)	Hammer, Davenport and Short (Hammer and Champy, 1993)	Deming, Juran, Crosby (Zairi, 1994)	Senge; Nonaka and Takeuchi (Davenport and Prusak, 1998)
<b>Approach</b>	Define value	Initiate, diagnose, redesign and reconstruct	Self-assessment, check, and act	Share experience, reflect, experiment and learn
<b>Results achieved and benefits</b>	Reduces waste, increases value added to end result	Downsize oriented, significant change	Customer satisfaction, continuous improvement	Reduces knowledge blockages, increases OKB
<b>Management style</b>	Long-term oriented, management by fact, participatory management	Aggressive and autocratic top management. Long- and short-term oriented	Long-term oriented, management by fact, capacity to involve all the staff, participatory	Long-term oriented, management by engagement, capacity to involve all staff, bottom-up approach
<b>Employee management, development and participation</b>	Maximum involvement, improvement of human potential Training on specific tools Extrinsic and intrinsic motivation trade-off	Use of reengineering teams as team leader People involvement, structured hierarchy Extrinsic motivation, Training for specialists of mapping and reengineering	Use of quality control circles, improvement teams, involvement, training for best practices, Extrinsic and intrinsic motivation	Use of knowledge sharing, social networks, communities of practice, learning from experience, training on OKB measurement
<b>Voice of the customer</b>	Voice of the customer is defined for the value added demand driven	Voice of the customer defined in relation to competition	Voice of the customer defined in relation to competition	Voice of the customer defined in relation to feedback learning
<b>Tools and techniques, IT</b>	Uses specific and well-coded tools	Tools for analysing and mapping processes, tools for problem solving. IT for mapping and reengineering the processes	Typical quality tools (basic, managerial and advanced). Problem Solving tools	More emphasis on personalisation techniques, use of knowledge bases
<b>Optimisation</b>	The entire system should be performed for all the systems	The entire system performed for all the systems. Few processes can be affected by reengineering	The entire system should be performed for all the systems	The entire system applied to core business processes. Less strategic areas not affected
<b>Day-by-day control of results</b>	Visual control. Performance indicators including lean metrics	Performance indicators	Performance indicators	Tacit control. Performance indicators

**Table (6-5): Characteristics influencing approach to improvement for adopted methods (Adapted from Chiarini, 2011)**



Using the table above, I aimed to use these approaches to explore improving KT processes to offer different perspectives that are complementary to the KM approach. For these approaches to be applied, all 60 core processes were mapped using a series of analysis and coding elicitations from the interviews. KT processes within the core processes were then identified and illustrated in the form of swimlane diagrams using Visio 10. Figure 6-12 presents a sample of the developed diagrams to illustrate an ‘As Is’ swimlane diagram for a KT process existing within one of the 60 core processes.

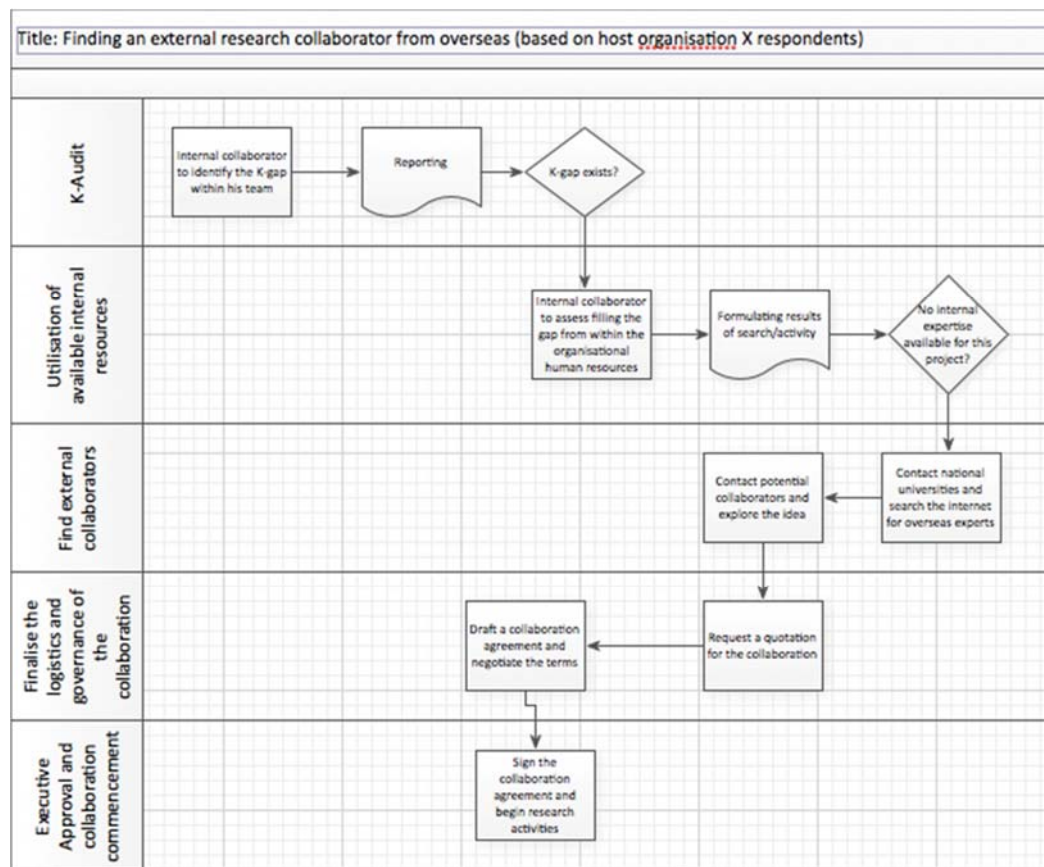


Figure 6-12: A sample of the 60-swimlane diagrams illustrating the KT processes in AR cycle 2

The blueprints for these maps were elicited by analysing the core processes coded in Appendix C. In addition to the codes for each KT process, coded data (i.e. quotes) provided further description and context for each KT process. For example, the following quote was used to identify one sub-process of the KT process of Figure 6-12:

The start of the international cooperation begins from identifying some external universities that are a target for cooperation and knowledge transfer. Executive management decides this. Whatever the university may be, our role is to explore and research the possibilities of signing an agreement with this university. The department of international cooperation reviews the agreement ...

The result was a set of KT process swimlane diagrams that visualised capability gaps on the external-to-internal, internal-to-internal, and internal-to-external KT systems of the IKTM of Figure 6-4. These KT process diagrams were then analysed to produce the tables shown in Appendix C. The analysis lenses used to generate the tables in Appendix C were Lean-thinking, BPR, and KM/TQM. In this way, both visual (i.e. swimlane diagrams) and analytical formats (i.e. Appendix C) were developed for the reflections outlined below.

### 6.8.1.1 LEAN THINKING AND BUSINESS PROCESS RE-ENGINEERING

Lean thinking provides a way to specify value, improve alignment of value creating activities, understand the way activities may increase effectiveness and reduce the time to perform tasks (Womack and Jones, 1996). Lean thinking primarily involves the identification and elimination of non-value creating activities or *muda* (waste). For the purpose of this analysis, waste is any human activity that absorbs resources but creates no value – including mistakes that require rectification, processing steps which are not needed, people waiting downstream for an activity that has not yet occurred upstream, and good or services that do not meet the needs of the customer (Womack and Jones, 1996). Lean thinking is lean as it is designed to allow organisations to do more with less, in particular, less human effort. Appendix C (Tables 1.1-3.4) provides a comprehensive list of identified core processes. These processes were analysed using lean thinking to enable possible elimination of waste points, thereby improving the flow of knowledge.

KT performance using the BPR approach is aimed at removing knowledge bottlenecks identified in business processes at the operational level. BPR questions KT process performance in meeting overall business objectives. As BPR makes change, processes become closer to align KM activities with business strategy objectives, an aim which has been vigorously advocated in the literature (Grant, 1996, 1997; Bontis *et al.*, 2002; Tiwana, 1999; Pfeffer and Sutton, 1999; Bierly and Daly, 2007; Hansen *et al.*, 1999; Robertson, 2004).

### 6.8.1.2 HOW TO USE DATA FINDINGS VIA LEAN AND BPR APPROACHES?

The data emerging from qualitative coding using the Integrated Knowledge Transfer Model (IKTM), presented in chapter 3, revealed the identified core processes in this activity. Each core process was then scrutinised using the lean thinking and BPR methods

to identify and assess the value stream of the activity the process manages. This activity is presented in Appendix B (Sections 1.1 to 6.4). Table 6-6 below provides the Lean classifications that have been used to identify waste points down the value stream. The classification names are only descriptors to reference the waste points throughout the analysis summarised in Appendix B and in the discussion to follow in this chapter. The literature may use different names for these classifications in different studies.

Classification	Definition
<b>Overproduction</b>	Produce more information than is required i.e. the customer sees no value.
<b>Waiting (Approvals)</b>	Wait for approvals (need for control must be weighted against additional time)
<b>Waiting (Batching)</b>	Documentation or detail required for the process is 'held' either until the scheduled meeting, or until there is enough worth doing.
<b>Transportation</b>	Time to transfer, plus the time in a 'queue' to be processed.
<b>Over processing</b>	Expend effort beyond the customers' needs i.e. reinvent the wheel.
<b>Defects (correcting)</b>	Discovery and correction of information, either incorrect or missing altogether, so lacking complete and accurate information.
<b>Underutilised people</b>	People not sufficiently sharing available knowledge

Table (6-6): Lean thinking approach classifications and definitions (Massingham, 2012)

The register of issues in Table 6-6 includes terminology of expected waste points. These waste points were placed in the context of the BPR approach in which they are considered existing deficiencies (Locher, 2007). BPR adopts the classifications presented in Table 6-7. Solutions from the lean thinking process are presented in the BPR context in the 'To Be' classification, while the existing waste points represent the 'As Is' classification. Caution must be exercised since the core processes were elicited from three different organisations. Although considerable similarity was found, some practices differed and therefore this study adapts the findings to present an industry-based discussion (Saudi engineering research industry) rather than the individual organisation focus.

Classification	Definition
<b>'As Is' processes</b>	Current processes that show who does what, when. This maps how the phenomenon under investigation, in this case, knowledge transfer, happens at the case study organisations. Understanding the 'As Is' stage enables entry into the 'To Be' stage.
<b>'To Be' processes</b>	Processes that determine 'a set of improvements or design characteristics that will work in concert to achieve process goals'. This maps how the phenomenon should happen. It includes changes to existing processes, which aim to improve the phenomenon, i.e. KT. The 'To Be' process maps represent the ideal scenario and the ways to remove the waste points and, in our case, the knowledge flow blockages.

Table 6-7: BPR approach classifications and definitions (Sharp and McDermott, 2001)

In using the above approach, it is possible to generalise the ‘what is’ process activity, by obtaining an overall ‘qualitative’ consensus about what is happening within the key systems and activities. This is illustrated in Appendix C (Systems 4.1 to 6.4). In developing the tables for Systems 4.1 to 6.4 from the coded data of the interviews, I found, in some processes, conflicting information on what each process entailed. In such cases, I applied a qualitative assessment to decide the most accurate description of the process, as the AR participant may not provide some details.

Further, I differentiate elicited aspirational themes from problems/issues raised (i.e. I unpack complaints to conclude the way AR participants like things *to be*.). The ‘To Be’ column of Systems 4.1 to 6.4 in Appendix C was also qualitatively derived from the interviews. When answering questions about how knowledge was transferred, AR participants switched between describing what happens (existing problems associated with KT) and what they aspire to make happen. This required an extensive qualitative coding and analysis to segregate the ‘As Is’ from the ‘To Be’ processes. This allowed a significant understanding of each process. Also, the considerable penetration into the case study organisations’ business structures uncovered *how* KT occurs, thereby illustrating the current capability gap.

Appendix C provides three sets of comprehensive analyses based on: (1) Lean thinking (Tables 1.1-3.4), (2) BPR (Tables 4.1-6.4), and (3) KM/TQM (Tables 7.1-9.4). By reflecting on the data findings in Appendix B, the three sets of analyses illuminate process deficiencies, waste points, faults, and knowledge blockages. A qualitative assessment is conducted between the three sets to determine how well a process is performing. The following sections provide a qualitative assessment to the identified 60 core processes.

### **6.8.1.3 REFLECTION: IN WHAT AREAS ARE HOST ORGANISATIONS DOING WELL?**

The core business processes that were performing well from a value stream point of view were only 5% of the total 60 processes, as shown in the table below. When a core process has a small number of waste points that minimally impact the KT activity and the capability gap then it was considered to be a ‘*doing well*’ core process. Value stems from the contribution of the core process to the knowledge strategy and the capability gap. This means if a process was doing well, then it was likely, as a KT capability on its own, that it

supported the knowledge strategy. Hence, the findings of this chapter are linked back to the capability gaps identified in chapter 5. The performance strength of these processes, however, does not exclude the effort to replace them with even higher value process (i.e. new knowledge).

Process in Appendix C	Process description
1.1.7	Attract Partner organisations
1.1.8	Commercial research
1.3.4	Research Tools

**Table 6-8: Core processes performing well at case study organisations**

The case study organisations' strength in the three core processes in the table above indicate sound performance in attracting top ranked research partners. Research tools and conducting commercial research was rated well by AR participants.

#### **6.8.1.4 REFLECTION: IN WHAT AREAS DO WE NEED TO SIGNIFICANTLY IMPROVE?**

The core business processes that require significant improvement in their performance from a value stream point of view are considered 'need to significantly improve' processes. This means that these processes have major KT capability gaps for the case study organisations. They were found to be 40% of the total of 60 core processes as illustrated in Table 6-9.

Process in Appendix C	Process description
1.1.1	National Coordination
1.1.4	Agent
1.1.9	Measurement
1.2.1	Attributes of Executives
1.2.2	International Best Practice
1.2.4	Strategy
1.3.2	Attributes of Internal Researchers
1.3.3	Nature of External to Internal Research Process
2.1.1	Knowledge brokers
2.1.5	Secretarial support services
2.2.3	Community Engagement
2.3.1	Researcher attributes
2.3.2	Organisational Leadership of research
2.3.4	Group Accountability/Roles

Process in Appendix C	Process description
2.4.2	Training junior researchers
3.1.1	Regulation of external partnerships
3.1.3	Attract local industry partners
3.1.4	Relationship Management
3.1.6	Commercial Research Unit
3.1.7	Human resources
3.2.3	Approvals
3.3.2	Create commercial opportunities
3.3.5	Knowledge flow mechanisms
3.4.1	Train the local industry

**Table 6-9: Core processes that to improve significantly at host organisations**

While some of the above processes directly involve KT as a capability, others contain waste points that affect KT sub-processes. This table links the previous discussion on KT as a capability to the data findings. In the following section, I present detailed analysis and reflections on the data findings to illustrate how the type of sub-process can be used to describe the waste points within an ‘As Is’ and ‘To Be’ framework. I answer the following questions:

- (1) What processes directly involve KT as a capability?
- (2) What types of sub-processes can we use to describe the waste points in some of these processes?

Appendix C provides a detailed list of the above processes and the reflections below discuss how those processes occur within a KT phenomenon.

#### **6.8.1.5 REFLECTION: KT OCCURRENCE WITHIN THE KT SYSTEMS**

The reflections in this section explain how knowledge flows within the KT system’s architecture. As explained earlier in IKTM of Figure 6-4, these systems are considered the basic layer in the process of KT. This section therefore explores how knowledge was transferred in the context of each system separately. The data drives the findings where I elicit the way in which AR participants see KT occurring.

Upon the realised understanding of the KT phenomenon, I took the further step of assessing all KT processes and prioritising them for possible improvements in an action

plan. Two elements have driven this assessment: (1) the importance of each core process in the value stream and (2) the feasibility of achieving waste elimination (Sharp and McDermott, 2001; del-Rey-Chamorro *et al.*, 2003). The views of AR participants were analysed to produce a qualitative set of perception indicators for importance and feasibility measures. These perceptions were translated into a scale of 1-5 as defined in Table 6-10 below.

Measure	Importance	Feasibility
1	The core business process has no to little importance to any knowledge flow that may impact any of KT architecture levels	The core business process has no to little opportunity for improvement due to restrictions of different types such as resources, approval, difficulty, etc.
2	The core business process identified slightly noticeable value to the knowledge strategy and capability gap	The core business process has a slightly noticeable opportunity for improvement due to restrictions of different types such as resources, approval, difficulty, etc.
3	The core business process identified measurable value to the knowledge strategy and capability gap	The core business process has a measurable opportunity for improvement
4	The core business process identified significant value to the knowledge strategy and capability gap	The core business process has a significant opportunity for improvement.
5	The core business process directly influences the knowledge strategy and capability gap	The core business process has a directly clear and guaranteed opportunity for improvement

Table 6-10: Defining the qualitative measurements for importance and feasibility

The above table stands as a definitional reference. It is used in the following reflections for Figures 6-11, 6-12 and 6-13. The purpose of this assessment was mainly to guide executives to prioritise their action plans within a change initiative.

## KNOWLEDGE FLOW SYSTEM FROM THE ‘EXTERNAL-TO-INTERNAL’

This section explores how KT occurs within the KT external-internal system. The data (Process [1.3.3]: Nature of external to internal research process – see Appendix C) suggests that researchers spend a significant amount of their time in tasks that were developed before or is being done elsewhere (i.e. time spent reinventing the wheel). The data identified this as an ‘As Is’ process. An efficient KT process allows researchers to reuse previous knowledge and avoid spending time on issues that have been done previously (i.e. eliminating waste) (Crute, 2003). Consequently, researchers can employ this time to create new ideas and to work on problems that have not been addressed before (Crute, 2003). As a result, the quality of the new ideas will increase, and therefore, the

quality of the business process and associated work outcomes will improve. The ‘As Is’ process showed that autonomy in some capability areas could result in repeated mistakes during an external-internal KT. For example, the following quote illustrates how the AR participant felt about their ‘As Is’ repeated mistakes and his aspiration towards a ‘To Be’ process for establishing external-internal collaboration agreements:

The Russian space agency was very strict. They were using 15 lawyers to negotiate with the Saudi party. We sent one person to them to negotiate with 15 lawyers. This was a big error from our side to send a single person. Now, we are working on the project that regulates the process of international cooperation, where there are leading scientists working on it.

The above quote shows how the researcher learned from the Russian party in terms of their standardised policies and negotiation process. He also highlighted how the Saudi party learned from the resources the Russian party prepared for the external-internal KT agreement. The Saudi party identified many waste points that they found could be eliminated with a Standard Operating Procedure (SOP) as mentioned in Appendix C.

The data (Process [1.1.1]: National coordination) illustrates an ad hoc ‘As Is’ process that contains many waste points and explains how external-internal KT occurs. The following quote illustrates how the AR participant perceived this ‘As Is’ process as a poorly managed effort at the national level in terms of external-internal KT:

The problem is that there is no national agency responsible to coordinate for this task [external-internal KT]. More importantly, there is no national agency qualified to do this kind of job... Saudi Arabia should have a ministry for scientific research like many other countries in the world. All national research institutions, whether governmental, private, or part of universities would report to this ministry... If a ministry was present, then complete databases would be made available, updated, and it would be checking after research activities, controlling the progress of research on a national scale and so on.

This external-to-internal KT capability is missing on a national level. Hence, a gap is identified. The quote also suggests a ‘To Be’ capability through the activity of connecting research organisations under a national ministry. From the above examples (and others in Appendix C), it was evident that it was essential to fully understand ‘As Is’ processes in to identify how external-to-internal KT occurred so that the good aspects could be preserved while the bad aspects could be eliminated, improved or replaced. The capability gap between the ‘As Is’ and ‘To Be’ processes required a detailed understanding of both.

From an action perspective, in order to eliminate waste from the 21 external-to-internal processes identified in Appendix C, it was essential to begin with high value stream processes that were more important than other processes to host organisations as well as



more feasible to alter. The 21 external-to-internal KT processes were plotted against importance and feasibility as shown in Figure 6-13. The dotted circle below shows the most appropriate processes to begin with for possible improvement using the lean approach. Table 6-13 explained the qualitative assessment to position each process. A multiplication factor of 2 was applied to the figure for schematic clarity.

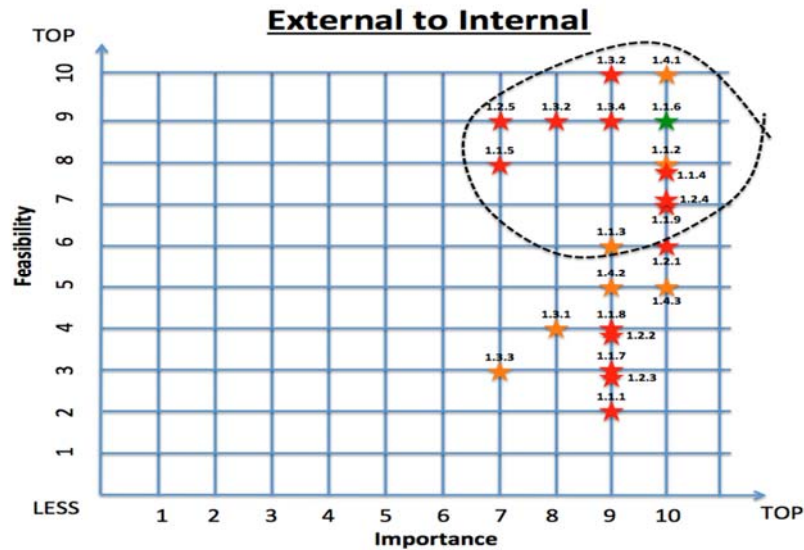


Figure 6-13: Importance versus feasibility of External-Internal KT processes

From an AR perspective, I have suggested in the management report (submitted to host organisations' leadership in the reporting phase of this cycle) that it would be more economical to focus on feasible improvements especially because they are governmental and may face significant difficulties in realising all the aspirational 'To Be' processes. For example, Figure 6-13 above shows that AR participants perceived the Process (1.4.1) (Sending people overseas to learn) as the most important external-internal KT process and easiest to improve. This guides the decision makers to make quick and economical choices for change. The second important process with equal change feasibility was Process 1.3.2 (Criteria to evaluate suitability of *internal* experts for research collaboration). As perceived by AR participants, the aspirational 'To Be' rectification to this core process, while extremely important to external-internal KT, was easy to adopt and thus makes sense to begin with.

## KNOWLEDGE FLOW FROM THE 'INTERNAL-TO-INTERNAL'

## CHAPTER 6: EXAMINING THE KNOWLEDGE TRANSFER PROCESS

The focus in this section is on exploring how KT occurs within the KT internal-internal system. A total of 20 core processes were identified to relate to the internal-internal KT system as illustrated in Appendix B (Systems 2: 5.1 to 5.4). Each process was analysed in the same manner that System 1 (the external-internal KT system) was assessed, in which ‘As Is’ and aspirational ‘To Be’ processes were identified. The data (process (2.1.1) Knowledge brokers, (2.2.3) Community engagement, (2.3.1) Researcher attributes and (2.4.1) Building a research team) suggests that many processes related to the internal-internal system at the three host organisations were affected from a capability perspective. The data analysis findings in Appendix B show varying ‘As Is’ defects, delays, and under-utilisation among other inefficiencies. In order to locate the activity in which a capability issue existed, it was essential to analyse the ‘As Is’ processes and disaggregate its sub processes. The ‘As Is’ process helped explain the KT phenomenon.

Any KT process contains the following elements: knower, message (knowledge), codification system, communication channel, seeker, and de-codification system (Krone *et al.*, 1987). From these elements, the main factors that explain ease or difficulty of KT can be highlighted (Gupta and Govindarajan, 2000). In this manner, the coded data was used to elicit identified issues. For example, the following quote by the AR participant illustrates the defect (correcting) in the ‘As Is’ Process 2.1.1 (Knowledge Brokers) as well as the ‘To Be’ aspiration as perceived by the AR participant:

If you want to ask someone to give out knowledge to others and you don’t have this task in your job description... I don’t have this job description in my job. When I talk to that person to give a lecture to us, I communicate with him as a researcher. There is nothing I have to support me so I can’t be effective in this coordination task or as KT officer. If something like this is behind my name then it will give me power to communicate. The job description is very important.

The above data provides evidence that the internal-internal KT coordination ‘As Is’ process contains the defect of undefined roles. The ‘To Be’ process was to be attained by raising the capability of internal staff to first identify suitable staff, assign roles, provide role descriptions, embed roles in job redesigns, provide resources and system support, and link with career development review metrics. In this manner other core processes were addressed.

The data Process 2.4.5 (Building a teaching team) considers team implementations capability to be a fundamental element to fulfil assigned requirements (Dyerson and

Mueller, 1999). Hedlund (1994) maintains that organisations that wish to improve their KT should develop processes that contain temporary groups of workers, where lateral communication is predominant. This lean thinking criterion (i.e. 'To Be' process) coincides with the TQM team-based approach and can be applied both to the 'As Is' process above and to the data findings in Process 2.3.4 (Group accountability/roles). Dougherty (2001) maintains that the use of teamwork facilitates the creation of a shared image of the work, which in turn facilitates internal KT in the organisation. This defect correction may improve the 'As Is' process to realise the aspired 'To Be' process.

The data Process 2.2.2 (Strategic management) suggests that many activities and incentives could help overcome the 'As Is' bureaucratic process setbacks. A supportive leadership, nonetheless, may resolve this dilemma by not allowing the organisation's hierarchy to be an obstacle in the workplace. Structuring the organisation in such a way that it would no longer be necessary to go up through the hierarchy to access opportunities provided by the knowledge being used could eliminate wasted KT opportunities. Teece (2000) advocated flat hierarchies as an enabling approach to KT. Leonard-Barton (1992) proved that internal KT was positively impacted by a relative lack of hierarchy. The problem with this issue was that the ability to change from an 'As Is' to a 'To Be' process was found to be low as illustrated in Figure 6-14.

The processes of the internal-to-internal KT system processes were mapped against the value and feasibility of change to identify the areas where waste elimination efforts would best be targeted. This activity was done previously in the external-internal KT system and now it is applied in the same manner to the current system. Figure 6-14 below shows that 13 of the 20 internal-to-internal KT system processes presented in Appendix C had high importance in the value stream and were relatively feasible to improve through lean thinking waste elimination.

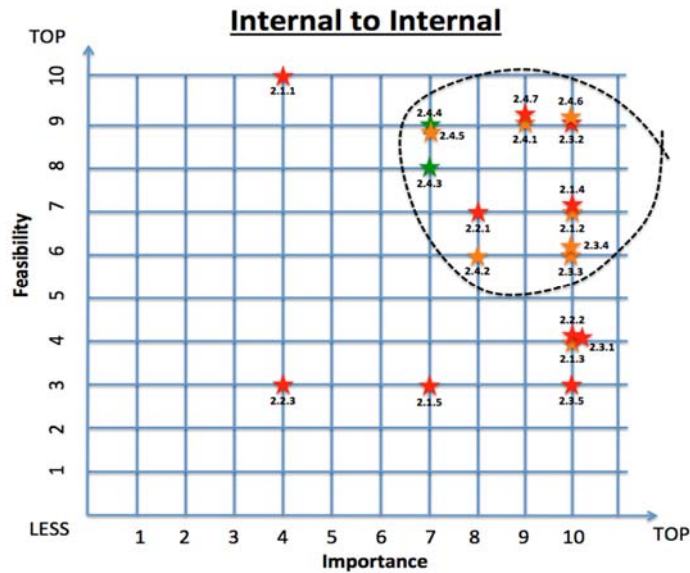


Figure 6-14: Importance versus feasibility of Internal-External KT processes

In the management report at the end of this AR cycle, I suggested addressing the capability gaps that existed in Processes 2.4.6 (Lecturing) and 2.3.2 (Organisational leadership) since they represented the most important and feasible activities (i.e. ‘As Is’ processes) to transform into ‘To Be’ aspired processes. This transformation may also support transforming towards the aspired LO.

## KNOWLEDGE FLOW FROM THE ‘INTERNAL-TO-EXTERNAL’

The focus in this section is to explore how KT occurs within the internal-to-external KT system. A total of 18 core processes were identified in Appendix C (System 2: 6.1 to 6.4). This system had the lowest number of identified core processes, which may indicate that the host organisations have fewer business relationships with the local industry than with overseas (external) organisations. The data also suggests that the local industry organisations that are involved in the activities for the processes in this KT system are limited. While the internal element is represented by the three host organisations, only 11 local industry organisations were found to represent the external element.

The data Process 3.3.3 (National benefit) suggests that the host organisations in Saudi Arabia need to embrace their responsibility to lift the quality and image of local engineering research and related industries. The data suggests that internal-to-external KT

is financially driven. The local industry must pay the host organisations for collaboration to occur. The trigger event (i.e. agreement of local industry to pay) is seen by AR participants as inappropriate because they feel that their organisations should focus on establishing the research relationship rather than the financial gain. Without this trigger, the host organisations prefer to work with overseas organisations. The following quote by the AR participant illustrates his view on this ‘As Is’ process while suggesting a ‘To Be’ aspired process to support the national benefit:

If you do a project with someone in the USA, who owns previous IP on the topic, then the produced IP will be seen as US. This applies to European partners. But if there is a Saudi Arabian partner then the name will be Saudi Arabia only. When people see Saudi Arabia with USA, 90% of the people will think that Saudi Arabia supplied the money and the US did the work, and they will not give you the credit. That’s what most people think.

This stance supports the strategy of focusing on the internal-to-external KT system rather than on the external-to-internal KT system. This view originates from priorities that reach beyond the spontaneous benefit of a given project at a host organisation to the level of national benefit. The responsibility that the government has allocated to the host organisations as national ‘knowledge factories’ requires that the process of partner selection should take the national benefit into account.

The local industry in Saudi Arabia is unique because it comprises both very large oil, petrochemical heavy industries and small privately owned industries. There are few counts of technological manufacturing industries or engineering-based development enterprises. This background suggests that there is a big knowledge gap between host organisations and the local industry that may be as big as the gap between the host organisations and the international expert organisations. The internal-to-external KT system thus requires diffusion in the internal-to-internal KT system in order to contextualise the acquired knowledge from the external-internal KT system and make it appropriate for transfer within the internal-to-external KT system. In this way, the three systems are integrated.

The data Processes 3.1.1 (Regulation of external partnerships), 3.1.2 (Identification of local industry partners), and 3.1.3 (Attraction of local industry partners) show that the 18 core processes identified in this system (internal-external KT) mostly focus on how internal-external KT begins. The occurrence of this difficulty at an early stage of the KT

process indicates that defects exist in the ‘starting’ state of the research relationship between the host organisations and the local industry. The data suggests that the relationship is not solid enough to develop a steady KT initiative between host organisations and the local industry. The following quote provides evidence that the ‘As Is’ process faces several difficulties that range from KT capability to activities that bypass research:

With regards to the biggest local industrial partners, are they really research oriented from a mindset perspective to finding new technologies? You can say all our factories are operations oriented. The smaller industries are owned by big businessmen who are looking for quick revenues, and they are far away from this subject. They are not looking for what you call long-term investments. Even if they have 5 or 6 guys, shuffling papers, the real people are outside. The other point is that it is not easy to penetrate and have good communication and interaction with them. You can see little initiatives here and we don’t know if there is what you call kingdom wide teamwork.

The ‘To Be’ Lean actions to develop an efficient KT process between the two ends is thus suggested in Section 3.1 of Appendix B to focus on coordinating different sub-processes. However, as Jensen and Szulanski (2004) describe it, “[s]ubstantial attention has been devoted to prescribing adaptation as a necessary component in transfer of knowledge from a parent to a child” (p. 509). The theory behind MNC KT from parent to subsidiaries may be applied to reduce the significant waste found in the transactions taking place in the internal-external system on the basis that the type of process between the sender and receiver is non-competitive (Flynn *et al.*, 1994; Mentzas *et al.*, 2001; Jensen and Szulanski, 2004). The ‘To Be’ process may adopt the idea of parent (internal host organisations) and subsidiaries (external local industry).

Currently, the value of the processes between the case-study organisations and the local industry does not have the same value as their counterparts in the external-to-internal and internal-to-internal KT systems. Figure 6-15 shows more than 50% of core processes outside high feasibility ( $\leq 5$ ). Due to regulatory restrictions, the feasibility of eliminating waste points is low. Unique to this system, the KT capability gaps are suggested to reside on both KT sides, although they were mainly seen by AR participants as coming from the local industry side. Many informal discussions took place with the AR participants about this point and the results showed complexity and sensitivity towards this issue, making it difficult to elicit useful data. The reason for this seems to be due to both KT parties being local, which is not the case when discussing foreign partners in the external-to-internal KT system. Further research is needed to uncover the microelements of this phenomenon.

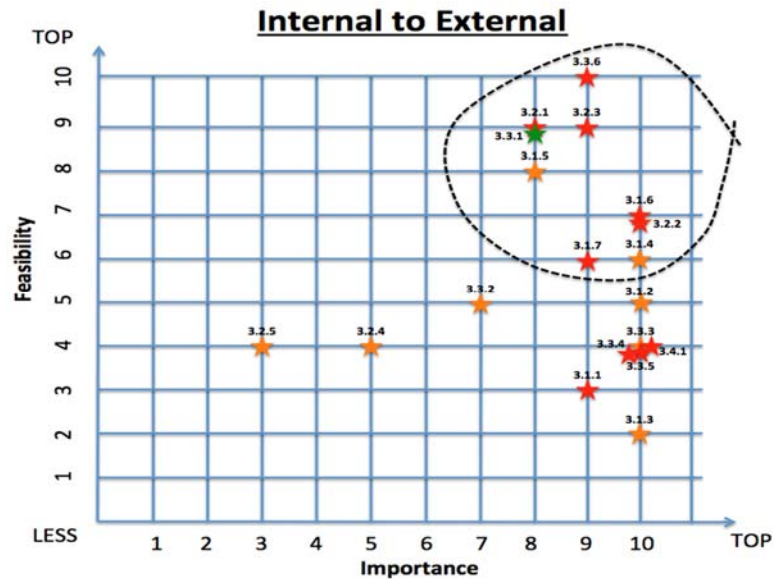


Figure 6-15: Importance versus feasibility of Internal-External KT processes

The above figure shows that Process 3.3.6 (Performance metrics) was feasible to resolve. This process, given its poor ‘As Is’ condition, was recommended in the management report to be addressed as per a ‘To Be’ aspiration in Appendix C. This process is currently unsatisfactory and can be improved significantly based on the findings.

The data Processes 3.2.1 (Funding) and 3.2.3 (Approvals) showed that funding and approvals respectively were also found to significantly affect the KT capability. Host organisations currently want to conduct profitable business from the local industry but the local industry finds this to be inappropriate as the confidence has not yet been established in the capabilities of the host organisations. Many resources at the host organisations are wasted (not used) because of their insistence on charging high rates to the local industry while the local industry is unwilling to pay. Resources remain idle due to this disagreement between host organisations and the local industry. Also, approvals for establishing the relationship take too long and not only waste time but can drain motivation until it falls an unrecoverable level.

## 6.9 KNOWLEDGE MANAGEMENT AND TOTAL QUALITY MANAGEMENT

The previous section provided reflections from lean thinking and BPR perspectives. This section provides reflections from a TQM perspective. As an approach to management, it is made up of a “set of mutually reinforcing principles, each of which is supported by a set of practices and techniques” (Dean and Bowen, 1994, p. 395). The focus on TQM was

validated with respect to the strategies for improving the organisation's performance (Hackman and Wageman, 1995). In the area of the relationship between the organisation and its environment, TQM drives the practice of cooperation with both customers and suppliers. Host organisations may consider knowledge providers to be 'knowledge suppliers' while the local industry is the 'customer' who uses the output from host organisations' research outcomes. Cooperation with suppliers and customers means that host organisations' relationships with 'suppliers' and 'customers' are non-competitive (Flynn *et al.*, 1994).

TQM focuses on technical components of management, such as process control. Teamwork means processes are based on groups rather than individuals. Process control focuses on making the organisation's processes comprehensible to the people who carry them out (Saraph *et al.*, 1989). By synergising the concepts of TQM with KM in the context of KT processes, an emergent set of reflections is realised in Sections 7.1 to 9.4 of Appendix B. This section will present reflections on the activity of identifying KM/TQM measures for the 60 core processes identified from the host organisations' work practices based on the three systems of the IKTM.

On the other hand, KM projects typically identify the knowledge bottlenecks within a process, and to solve them is the requirement of any KM solution (Palte *et al.*, 2011). KT solutions are composed of knowledge processes, the outcomes of which address the knowledge constraints of the business process (del-Rey-Chamorro *et al.*, 2003). The knowledge process outcomes solve the business process knowledge bottlenecks, so those outcomes have to be measured to monitor the performance of the KT process. Those outcomes are taken as entities in the way that they are elements that influence the business process.

### 6.9.1 HOW TO USE DATA FINDINGS USING THE KM APPROACH?

The KM business process ideas used to measure the performance of the KT process are presented in Table 6-11. As mentioned earlier, it can be noticed that the TQM approach has been embedded in this section since TQM is mainly about adherence to quality measures (Flynn *et al.*, 1994; Zairi, 1994). In our case these quality measures are specifically sourced from KM guidelines. Once again, the intention here is not to



implement a TQM activity, but to elicit some learnings from it that could help in exploring the process of KT. I have found that KM and TQM are correlated in the context of exploring KT processes in that TQM systemises KT processes while KM measures the knowledge outcomes from the systemisation activity. Also, TQM and KM share the principle of leadership commitment (Ahire *et al.*, 1996; Black and Porter, 1996). Therefore, it can be argued that it is valid to use a combined measure of analysis.

As KM performance measurement and its impact on organisational performance is a well researched area (Jennex and Olfman, 2005; Yu *et al.*, 2004; McKeen *et al.*, 2006), the classification presented in Table 6-11 is a representation of the measurement metrics suggested in this study to assess the core processes identified and illustrated in Appendix C (IKTM systems 7.1 to 9.4). These metrics have been tested and validated in a recent ARC project (Massingham, 2007–2011), which provided acceptable validity and reliability outcomes. On this basis, little discussion will be provided on the origins and philosophical stances of these measures. Instead, the focus will be on how these metrics help us to understand the process of KT related to the 60 core business processes of the host organisations presented in Appendix C.

Classification	Definition
<b>Subjectivity</b>	Knowledge involved is highly tacit and depends largely on the individual expert, leaving it vulnerable to opinion.
<b>Redundancy</b>	Excess of information (overlapping knowledge domains, i.e. waste)
<b>Incomplete coverage</b>	Work missing information due to inadequate searching capabilities
<b>Duplication</b>	Work that is wasted (found elsewhere)
<b>System fault</b>	Organisational level KM issues e.g. inadequate supporting systems, databases etc.
<b>TQM fault/audit</b>	Process cannot or is not measured/monitored
<b>Knowledge loss/decay</b>	Lessons learned are lost (i.e. not captured)

Table 6-11: KM approach classifications and definitions (Massingham, 2012)

The TQM measures have also been combined to generate common indicators for KM/TQM performance. The assessment of data findings regarding whether the core processes were working effectively in the organisation has been symbolised with traffic lights. The following coding is shown in Appendix C (last column on the right):

- (1) Green means the process was consistently identified by project focus groups and interview subjects and the project team could pinpoint evidence to suggest that it was being consistently implemented in the research organisation.

- (2) Orange means the process was identified in discussions with the research staff as important but there was little evidence to suggest that it was being carried out consistently across the research organisation (may warrant further investigation to validate), and
- (3) Red means the process was not explicitly discussed but best practice suggests that it is critical for effective knowledge transfer. There was no evidence it was being carried out consistently across the research organisation. The following sections represent the detailed process findings of this chapter.

### **6.9.2 REFLECTION: IN WHAT AREAS ARE WE DOING WELL?**

The core business processes that were performing well from a KM/TQM point of view were only 6.7% of the total 60 processes:

<b>1.1.6 Attract Collaborators</b>	Recruit partners for a full-time period
<b>2.4.3 Formal training</b>	Conducting staff training in classroom environment
<b>2.4.4 Training the experts</b>	Learning for senior staff
<b>3.3.1 Applied Research</b>	Analyse industry data

**Table 6-12: Processes rated as performing well**

Once again, the findings show that there are only a few core processes for which AR participants have confidence that they are performing well to support the process of KT. From a KM/TQM perspective, the majority of core processes do not serve the process of KT effectively and therefore, searching for underlying reasons becomes necessary. Each core process in the ‘doing well’ list was marked with the applicable defects in Appendix C as described in Table 6-13 but had an overall performance of green.

### **6.9.3 REFLECTION: AREAS WE NEED TO SIGNIFICANTLY IMPROVE**

At the host organisations, 51.7% of core business processes needed significant improvement as processes for KT. The findings show that 41.7% of core processes have less need than the list below (orange coded). Although these less serious processes are performing better, they may evolve into red coded processes in the future if not resolved. This is because knowledge and people are dynamic and tend to decay if not reinforced. The decay may occur in the form of KT blockages or system failures. The AR participants rated the following core processes as serious:

## CHAPTER 6: EXAMINING THE KNOWLEDGE TRANSFER PROCESS

Process code	Process description
<b>1.1.4 Agent</b>	Person(s) to identify partners and negotiate contracts
<b>1.1.7 Attract Partner organisations</b>	Recruiting joint ventures
<b>1.1.8 Commercial research</b>	Paying partners for knowledge
<b>1.1.9 Measurement</b>	Metrics to report knowledge sharing activity
<b>1.2.1 Attributes of Executives</b>	Skills to identify and capture opportunities regarding external knowledge
<b>1.2.2 International Best Practice</b>	Imitate the way leading international universities manage their external to internal knowledge flows
<b>1.2.3 Knowledge Sharing Approvals</b>	The process of approving external to internal knowledge flows
<b>1.2.4 Strategy</b>	Designing and implementing a future direction in terms of external to internal knowledge flows
<b>1.2.5 Make v Buy Decision</b>	Decision about whether to acquire knowledge from external sources or develop it internally
<b>1.3.2 Attributes of Internal Researchers</b>	Criteria to evaluate suitability of <i>internal</i> experts for research collaboration
<b>1.3.4 Research Tools</b>	Systems to enable research collaboration with external experts
<b>2.1.1 Knowledge brokers</b>	Formalising the role of knowledge sharing for certain academic staff responsible for diffusion
<b>2.1.4 Enabling systems</b>	Supporting activities to facilitate knowledge sharing and connect this with organisational and personal gain
<b>2.1.5 Secretarial support services</b>	Administrative support for the codification process
<b>2.2.1 Management Standard Operating Procedures (SOPs)</b>	Guidance for academic staff promoted to management positions
<b>2.2.2 Strategic management</b>	Principles of strategic leadership
<b>2.2.3 Community Engagement</b>	How to work with the community on a goodwill basis
<b>2.3.1 Researcher attributes</b>	How to persuade staff to share knowledge with other staff
<b>2.3.2 Organisational/Leadership</b>	Activities necessary to facilitate knowledge sharing between staff, which can be performed
<b>2.3.3 Individual Initiative/Roles</b>	How individuals can research
<b>2.3.5 Conducting Research</b>	How to become a strong researcher
<b>2.4.7 Teaching Governance</b>	Establish teaching support group/unit
<b>3.1.1 Regulation of external partnerships</b>	Leadership of partnerships with local industry
<b>3.1.6 Commercial research unit</b>	Administrative support for external research partnerships
<b>3.1.7 Human resources</b>	Provide capability to resource projects
<b>3.2.1 Funding</b>	Funding policy in conducting research with industry partners
<b>3.2.2 Intellectual Property</b>	Policy on intellectual property involving research with local industry
<b>3.2.3 Approvals</b>	Criteria for approval of research with local industry
<b>3.3.6 Performance Metrics</b>	Measurement of research with local industry
<b>3.4.1 Train industry</b>	Industry staff to work with researchers on campus

**Table 6-13: Core processes rated as serious**

In order to meet the knowledge strategy and fill the capability gap identified in chapter 5, the above processes need to be addressed. Also, the attainment of the LOC status and capability growth is also dependent on addressing the above issues. Detailed discussion on the list above is now presented.

### 6.9.4 REFLECTION: RESULTS ON KT SYSTEMS

The application of KM and TQM measures was based on the three systems suggested by the IKTM, namely external-to-internal, internal-to-internal, and internal-to-external KT systems. Based on the findings presented in Appendix C, the following analysis provides a theoretical discussion as a further level of understanding KT processes at host organisations.

### KNOWLEDGE FLOW FROM THE 'EXTERNAL TO INTERNAL'

The focus in this section is to explore how KT occurs within the external-internal KT system. The core processes discussed in this section are listed in Sections 7.1 to 7.4 of Appendix C. The data Processes 1.1.1 (National coordination), 1.1.2 (Identify external partner), 1.1.4 (Agent), 1.1.5 (Attract visitors), 1.1.6 (Attract collaborators), 1.2.1 (Attributes of executives) and 1.2.2 (International best practice) share the subjectivity (highly tacit) KM issue classification. It seems the leadership and middle management are relying on their tacit capabilities to manage the business. This suggests that the rules that have been codified to guide the core processes are less clear. The process of KT therefore lacks consistency as the AR participants indicated that instructions sometimes change due to subjective decisions made. The following quote by a middle management decision maker, in response to a question about the procedure followed to address the capability gap at his organisation, provides evidence that KT issues to bridge their capability gaps were mainly addressed through personal experiences and tacit knowing:

I met with a Korean expert ... This expert worked for Samsung and had experience in this field [KT]. He said they started by bringing American experts to their organisation, and they paid them US\$150,000 and US\$160,000 in salaries per month ... Then things and developments start emerging once you begin this way ... We, at this stage, will go into basic car performance research in some shallow areas and cooperate with Ford company for instance to sell some patents that we can actually develop. Once we do some work, we can sell to them. Like what goes in Germany. An engineering school in a university advances a new engineering technology and then sells it to Mercedes. They get paid for that and in this way, they fund their research. That is a good start ... Back to Samsung, they began to bring those experts from the US and they made their visa processing and all related logistics very smooth to an extent that they didn't feel any noticeable struggle. The next step is to send

## CHAPTER 6: EXAMINING THE KNOWLEDGE TRANSFER PROCESS

those nationals who gained good experience from those experts to go and work at Ford, for example, for free, on the cost of the hosting organisation here in Saudi Arabia. Ford will be getting trained engineers for free, its benefitting for them. A win-win scenario. For two years, they work for you and then come back.

When the AR participant was asked if there is a formal plan that represents a standard operating procedure (SOP) for the above plan, he replied that there was none. The above plan was subjective, did not rely on a formal procedure and in some ways was disorganised. It is necessary to have a tacit element in decision-making but it should be collective rather than centralised. It also should be formalised in an SOP to address the details of the decision for execution. This means that by translating subjective decision activities into formally created teamwork documents, a better process of KT will emerge. When decisions, as in the above situation, come from the top with little discussion of their formation processes, experiential backgrounds or tacit elements, little knowledge is shared.

The data Process 1.1.7 (Attract partner organisations), 1.1.8 (Commercial research), 1.2.4 (Strategy), and 1.2.5 (Make versus buy) involved the ‘inadequate coverage’ issue classification as illustrated in Appendix C. Many blind spots existed because of a lack of sufficient information to do the job efficiently and effectively. It seems that the flow of knowledge involved weak connections to knowledge sources. This means that external-internal KT processes occurred at times when competency gaps were ignored in the strategy of the organisation. The result of this was either slower processes or incorrect outcomes because a lack of background knowledge. Similar issues in the data Processes 1.3.1 (Attributes of external researchers), 1.3.2 (Attributes of internal researchers), 1.3.3 (Nature of external-internal research process), 1.4.2 (Academic staff teaching skills) and 1.4.3 (HDR student supervision skills) were found to support the above finding.

The data Process 1.1.9 (Measurement) showed that case study organisations lacked lead and lag indicators. This was an extremely important KM/TQM performance indicator that the host organisations needed to consider. As Table 7.1 in Appendix C suggests, three steps were needed as KM/TQM rectification considerations: “Metrics to be designed, communicated, and audited” (Kaplan and Norton, 1996, p. 91). Host organisations currently have fragmented reports throughout their organisations to measure their

external-internal KT systems. Statistical figures are based on count. The following quote by a research centre director supports the existence of this process classification issue:

We are measuring the advancement in terms of knowledge use and KT by the number of papers that we published, by the number of people who are doing research, or capable of doing research and by the services that we perform for, for example, for companies... [KT] is to have common research between you and others externally. We currently have, yes, but I think not up to the standard. Well, we have it part of our KPI but we measure it in different ways like joint supervisions, joint projects, but I mean the measure itself, how to measure transfer of knowledge, I would be happy to find a way to measure it in a very precise way.

The LOC survey conducted in AR cycle 1 was one important metric that could enter into strategic consideration by the host organisations where lead and lag indicators may be mapped to provide action items guided by lead indicators. Past performance outcomes could comprise the lag indicators in similar ways (Kaplan and Norton, 1996). The detailed indicators presented in chapter 5 were rarely recognised by AR participants despite being measured at their workplaces.

The data Process 1.1.2 (identify external partner) suggested the process issue classification of under-utilised people. Still, host organisations were not addressing the need to effectively identify external partners through the intelligence of their researchers. Although many researchers and scientists had the ability to help in the search process, AR participants highlighted that the task was being kept in the hands of incapable individuals or in some cases capable individuals who were busy. Competency mapping tools were relevant to fill this capability gap but the management also had another capability gap in recognising the need for such tools despite being able to take such initiatives. In other words, people with intelligence in this area need to be empowered. This process was not measured which kept the gap hidden.

### **KNOWLEDGE FLOW FROM THE ‘INTERNAL TO INTERNAL’**

The focus in this section is to explore how KT occurs within the internal-internal KT system. The core processes discussed in this section are listed in Sections 8.1 to 8.4 of Appendix C. The data Process 2.3.1 (Researcher attributes), 2.3.3 (Individual initiative/roles), 2.3.4 (Group accountability/roles) and 2.3.5 (Conducting research) illustrated the requirement of social strengthening processes as a KT capability since this issue seriously affected these processes. This is why ‘Duplication’, ‘System faults’,

‘Knowledge decay’ and other classifications were occurring in the research capability layer. The following quote illustrates the issues identified in the data:

I don’t know what is the way to cooperate or to do some project with other institutes. How to communicate?... [organisation X] has like more than [anonymous number] institutes and unfortunately each institute is working separately.

The above data shows that internal-to-internal KT processes do not contain the communication mechanisms for KT. On the individual level, the unit of analysis in the internal-internal KT system consisted of knowledge flow between a researcher in the organisation and another colleague. On the departmental level, the factors that affected the process of internal KT can be divided into the knower internal unit, the seeker internal unit, the relation between the two, and the knowledge itself (Gupta and Govindarajan, 2000; Simonin, 1999; Szulanski, 1996). In both levels of analysis, communication sub-processes represent an important KT capability.

The data Process 2.3.3 (Individual Initiative/Roles) suggests that the way research is conducted internally is fragmented; hence, the internal-to-internal KT lacks strategy. In studying internal-to-internal KT systems, issues emerging from how research is conducted by individuals and research units are important identify in order to increase efficiency and facilitate the flow of knowledge between different internal units. All of these issues are currently affecting the case-study organisations’ internal-to-internal KT systems from procedural and social perspectives (Liebeskind *et al.*, 1996). For example, the following quote illustrates how research should be initiated (aspiration) as compared to the status quo perceived by the AR participant:

To find ideas or to start up ideas, there are different ways for doing that. The ones that I know of is that you start up with a problem and you try to search for a solution, for a way to resolving the problem... The unique thing about it is really listening to the people who are having the problem. Lots of times here, its, you know the research in here [...], is basically, [...] if you come to it, people who are trying to do research conduct it based on their interests, not the need or a given problem.

The research indicates that KT as a capability occurs in an ad hoc fashion since researchers do not search for needs to transfer real-life experiences into their research; rather, they limit themselves by inventing virtual problems, thus bounding internal-internal KT. The issue classification is therefore ‘systems lacking’. The KM/TQM

rectification considerations, as illustrated in Appendix C, suggest a need for: establishing vision, strategy and procedures for cooperation at intra-organisational levels of knowledge sharing; incentives to be established; mechanisms communicated; and infrastructure established.

The data Processes 2.4.2 (Training junior researchers), 2.1.1 (Knowledge brokers), 2.1.4 (Enabling systems), 2.3.4 (Group accountability/roles), 2.4.1 (Building a research team), 2.4.5 (Building a teaching team), and 3.1.4 (Relationship management) are critical core processes because they link the past experience of the host organisation's researchers with its future generations through teams. When senior researchers do not feel obligated to pass on their experience to the newer generation, significant damage occurs to the value stream and the process of KT (Process issue classification: system fault).

The KM/TQM rectification consideration suggests aspirational processes that structure the organisation into work teams. This is one of TQM's basic principles that may link the different sub-processes together to allow the transfer of knowledge to occur between different generations of researchers (Harrington, 1997). Given the current process issues at host organisations, improving coordination between sub-processes of a given core process emerges as a need when people who have the most contact, due to the tasks they carry out, cannot coordinate among themselves using the classical hierarchical mechanisms. Teams break this capability gap by eliminating hierarchies and replacing them with direct contact using team-based activity. To allow internal-internal KT to occur effectively, such activities require systems with a greater degree of flexibility (Grant *et al.*, 1994). Improving KT may produce an output measure for TQM teamwork activities, thereby, enhancing the KT capability.

The data Process 2.1.1 (Knowledge brokers) and 2.2.1 (Management standard operating procedures – SOPs) suggests another important issue in the relationship between control of TQM processes and internal KT. Empirical evidence from this study suggests that the systematic use of control processes in the organisations has an influence on the search for and transfer of knowledge. First, having reliable information on the processes aids in identifying problems. This is the first step that should be taken toward KT processes



(Szulanski, 1994). Without clear guidance on what the search is for, processes for KT will fail.

The data Process 2.2.2 (Strategic management) suggests aspirations towards reduced risk as perceived by seekers of knowledge. This meant that internal-internal strategic management processes allow knowledge seekers to know what to expect and what to focus on. It is not a case of trusting what the knower says, but rather of knowing what, in the context of the KT, is really important to acquire. Given the vast amount of knowledge passed on, seekers of knowledge need a strategy to know what the theme is that is being transferred. Systematic use of control processes could bring the knowledge seekers to trust the KT process system and accept the aspirational goal of effective internal-internal KT activities.

### **KNOWLEDGE FLOW FROM THE ‘INTERNAL-TO-EXTERNAL’**

The focus in this section is on exploring how KT occurs within the internal-external KT system. The core processes discussed in this section are listed in Sections 9.1 to 9.4 of Appendix C. Technology industries are important for the growth of the Saudi national economy. The data Process 3.3.1 (Applied research), 3.3.4 (Leading edge research) and 3.3.5 (Knowledge flow mechanisms) suggest key aspirational processes for the internal-external KT system. Given the fierce global competition that prevails in these industries, researchers have attempted to identify the factors that determine success and failure of high technology organisations (Carroll, 1993; Rumelt *et al.*, 1991). If constant innovation, as a key core process for KT at local industry organisations, is the key to gaining and sustaining competitive advantage in technological industries in Saudi Arabia, then this innovation will rely on the ability of the local industry to *assimilate* and *exploit* different types of knowledge. In Saudi local industries, very few have the resources (especially knowledge) needed to sustain innovation. Non-competitive strategic alliances between host organisations and local industries may become an important approach by which the local industry can address a critical KT capability gap (Flynn *et al.*, 1994).

The data Processes 3.1.1 (Regulation of external partnerships), 3.1.3 (Attract local industry partners) and 3.1.4 (Relationship management) suggest constructing effective

means for KT to the local industry. Strathern (2006) proposes considering three types of vehicles: ‘products’ of research (patents and publications), ‘projects’ (research collaborations), and ‘persons’ (knowledge embedded in researchers moving around). These three vehicles of KT would stand as the core of policy efforts. Contemporary research policies aim at supporting the movement of knowledge products from research organisations to industry in order for industry to use such products in development and innovation processes (Stöckelova, 2012). The data Process 3.1.7 (Human resources) suggests a need to support joint projects and the movement of researchers between the academy and industry.

The data Process 3.1.3 (Attract local industry) and 3.1.4 (Relationship management) implies a need to build on the core processes of the external-internal system discussed earlier. Since the host organisations were proposed as mediators between overseas external knowers and local external seekers, it was fundamental to understand how the host organisations should behave as system integrators (Schonberger, 1990). Cooperation comes from establishing relations with the previous and subsequent links in the value chain that go beyond mere commercial relations to become a form of interaction based on cooperation with agents outside the organisation in the local industries sector. The following quote illustrates how the AR participant explains this integration process from an aspirational KM/TQM perspective:

When you go to visit people outside, for example, we go to ARAMCO and SABIC, I should look for the type of research they are doing, the type of equipment they are using and so on. If you don't have all the equipment to compete, no one is going to come to you, because they would feel that they are already ahead of you. So, now you try to improve your labs by bringing in new equipment. This is first. Second, if you get in contact with certain guys, they can relay information to you, then you go to talk to your group to tell them this subject is worthy, why not do research. Then we tell our contacts who ignited all of this, we have some ideas. I would need samples of publications to show to those guys, of course. Now, you can gain their trust and they will say that those guys are building experience and it is worthy from us to support them. Ah, this is I think the best way to go through what I call evolving collaborations between zones with industry... I think this is knowledge transfer taking place.

The above quote explains how KT would occur in the context of the internal-to-external KT system. The sub-processes suggested provide subtle but significant hints on how to address the current issues faced by the host organisations. It depends on the maturity of the host organisations in behaving as pillars to integrate the outside world with the local world.

The data Process 3.1.4 (Relationship management) suggests that TQM may contribute to KT by reducing the complexity involved in coordinating different links in the chain of value (Wruck and Jensen, 1994). Learning from TQM to become good integrators in the context of KT processes can provide a new aspirational dimension to KT theory. The organisation must establish a network of relations with external agents using social networks. Within this framework, the relations between the host organisations and the players in the value stream go beyond a mere commercial relationship (Dean and Evans, 1994). Lubatkin *et al.* (2001) state that innovation occurs increasingly in networks rather than in individuals, which suggests that although host organisations position themselves as knowledge providers to the local industry, they may aspire to learn from the feedback loop of the KT process.

### SUMMARY OF KEY FINDINGS AND REFLECTIONS

In this section, I frame the KT cognitive process around the ‘what’ element by using the three layer systems (i.e. external-internal) and the activity (i.e. academic governance). By identifying the activity, AR participants made their own cognitive connections regarding the resource underlying the KT capability (i.e. what do I need to know to do this?). In this context, it is important to distinguish between content and capability. Content is subject matter expertise (SME) as in electrical engineering. Most researchers, when asked about their knowledge, focus on their SME, and not their activities. In this case, the ‘what’ element is mainly about SME (i.e. content).

Knowledge about capabilities that is job-related knowledge (e.g. how am I a lab assistant?) or activity-related knowledge (e.g. how do I do academic governance?) is not a well-known research area (Massingham, 2012). This became a capability gap for host organisations, which resulted in findings that were aspirational rather than actual (i.e. ‘what should be’ rather than ‘what is’). Most KT processes identified how knowledge was or could be transferred. The focus was on the ‘how’. Only occasionally did the processes identify ‘what’ or ‘why’ or ‘when’. Therefore, I did not focus on what knowledge was being transferred. The following list is a summary of the key findings relating to KT processes within and across the organisations involved in this thesis:

- (1) There were certainly a considerable number of existing processes that needed to be improved. There were few 'green' processes, and many 'red' processes. There were also aspirational ('what should be') processes that did not currently exist but needed to be developed.
- (2) I found that in terms of the Lean/BPR analysis, a substantial proportion of processes suffered from Defects (correcting). Most of these were the result of inadequate or incorrect information about existing processes. People were not aware of how to undertake these processes or they did so incorrectly. Therefore, there was considerable waste in the overall knowledge transfer architecture and its systems at the host organisations due to defects.
- (3) I found that in terms of the KM/TQM analysis, the main problems were incomplete coverage (largely due to blind spots – or being unaware of other knowledge), but also organisational-level issues, including inadequate KM systems and TQM faults (things not being measured).
- (4) Rather than identify all strategic and non-strategic systems or processes at the host organisations, only the core knowledge critical processes were tested. I encourage the reader to look through the tables in Appendix B.
- (5) On the positive side, I found mainly organisational-level capability gaps as opposed to individual-level issues. There were some areas of knowledge-level capability gaps (i.e. subjectivity), but most of these gaps could be addressed quite readily.

The overall 'big picture' to the issues of KT processes is summarised using the IKTM in table (6-14). The IKTM was presented in this chapter to map KT systems with KT capabilities. Therefore, the table below maps the KT processes against two references: (1) KT system, and (2) KT activity. The KT systems are external-to-internal KT, internal-to-internal KT and internal-to-external KT. The KT activities represent KT capabilities on the basis of administration, academic governance, research, teaching and community engagement. Only high importance processes rated 8 and above were mapped.

## CHAPTER 6: EXAMINING THE KNOWLEDGE TRANSFER PROCESS

	Administration activities	Academic governance activities	Research activities	Teaching activities	Community engagement activities
EXTERNAL-TO-INTERNAL KNOWLEDGE FLOW	1.2.5 Make v Buy 1.2.4 Strategy design	1.1.5 Attracting expert visitors 1.1.4 Agent activity 1.1.9 Measurement 1.1.6 Attract Collaborating organisations	1.3.2 Evaluating suitability of Internal Researchers 1.3.4 Availing research Tools	No applicable process	No applicable process
INTERNAL-TO-INTERNAL KNOWLEDGE FLOW	2.2.2 Strategic management	2.1.4 Enabling systems	2.3.2 Organisational Leadership of research	2.4.7 Teaching Governance 2.4.3 Formal training 2.4.4 Training the experts	No applicable process
INTERNAL-TO-EXTERNAL KNOWLEDGE FLOW	3.2.3 Approvals 3.2.1 Funding 3.2.2 IP management	3.1.6 Commercial research unit 3.1.7 Human resources management	3.3.6 Performance Metrics 3.3.1 Applied research activity	No applicable process	No applicable process

Table 6-14: Overall ‘big picture’ summary of the highest and lowest performing KT processes at the case-study organisations based on KT system versus activity

First, the above table shows that the external-to-internal KT system has 7 highly important but inefficient KT processes of which 2 processes relate to the administration activity capabilities, 3 processes relate to academic governance activity capabilities and 2 processes relate to research activity capabilities. This highlights that the main issues are not at the research activity level only; rather it is more at the administrative (top and middle management). Teaching and community engagement activities did not emerge with inefficient and highly rated processes.

Second, the above table shows that the internal-to-internal KT system has 4 highly important but inefficient KT processes of which one process relates to the administration activity capabilities, one process relates to academic governance activity capabilities, one process relates to research activity capabilities and one process relates to teaching activity capabilities. This highlights, once again, that the main issues are not at the research activity level alone; rather it is also at the administrative (top and middle management) and the teaching. Two highly important processes related to teaching activity capabilities were considered efficient. This strong capability relates to internal training. A KT strategy may focus on this strength to address weaknesses in other processes. Therefore, the host organisations may be able to balance its capabilities in a way that reduces its weaknesses.

Third, the above table shows that the external-to-internal KT system has 6 highly important but inefficient KT processes of which 3 processes relate to the administration activity capabilities, 2 processes relate to academic governance activity capabilities and 1 process relate to research activity capabilities. This highlights once more that the main issues are not at the research activity level; rather it is more at the administrative (top and middle management). The research related activity capability actually emerged with one important and simultaneously efficient process. This process relates to applied research activities. This provides evidence that researchers at host organisations are likely to be capable of conducting innovative research, however, their main problem is management. Deming has always raised the issue of engineering work being affected by management; rather than being from the engineering work itself. It is how good talent is exploited (Chiarini, 2011). This strongly suggests that a further AR cycle is required to uncover the hidden issues that explain the occurrence of these inefficiencies.

## 6.10 CYCLE 2 – PHASE 6: REPORTING

As figure 6-16 below illustrates, this section describes the sixth phase of AR cycle 2. In this phase, I will present the segment of the AR journey that explains how reporting in this particular cycle took place. I will also present the result outcomes that emerged from this activity. The engaging phase of cycle 3 (chapter 7) follows this last phase of cycle 2.

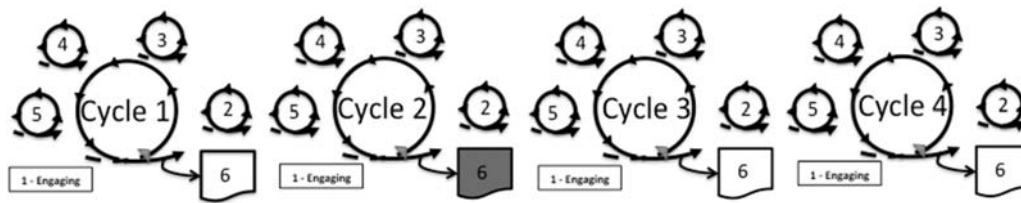


Figure 6-16: Cycle 2 – Phase 6: Reporting

The executive management at the three organisations were provided with a detailed analysis report after the completion of the fieldwork of this AR cycle. The findings of the report were a little surprising to them because they noticed numerous gaps in the business processes system. Although, some individuals reacted negatively to this, it attracted the attention of others and motivated them to proceed in further exploration of underlying problems. This effort was invested towards securing acceptance to proceed to AR cycle 3 whereby a deep investigation would take place for identifying knowledge blockages from the perspectives of knowledge characteristics, individual, organisational, national and international levels. This was a total shift in thinking compared to the focus of this AR cycle, which focuses on the process aspect of KT.

The general reaction to the report was positive and promising. The report submitted was 68 pages. As mentioned earlier in AR cycle 1, this report also allowed the action learning methodology to provide data on progress and change development using a baseline and a benchmark approach since the report played the role of a diagnostic document. It was obvious to the management at the host organisations that this AR cycle needed to be complemented with a further AR cycle to pin down the root causes of the process issues identified in this cycle. This formed the basis for AR cycle 3.

## 6.11 CONCLUSION

BPR, Lean thinking and TQM use change management techniques, process measurement techniques, problem-solving techniques and IT techniques (Flynn *et al.*, 1994). The findings in Appendix B helped understand how KT occurs. Managers can use core process maps to understand what it is they are trying to manage when they want to improve KT. On deeper investigation, the analyses provided a roadmap for improving the way host organisations, as ‘knowledge factories’, operate. As knowledge is their most valuable resource, the improvement to the way it is managed will have a fundamental impact on performance. Lean and BPR methods identified waste points (i.e. blockages in knowledge flows). The ‘why’ question allows for the next AR cycle to commence.

Research on KT has produced attempts to study internal knowledge flows (Hansen, 1999) or external knowledge flows (Inkpen, 1998). In this thesis the two are integrated to formulate an empirical understanding of how they interact. Although there are some studies that simultaneously contemplate internal and external flows, their emphasis was not on integration; rather, they aimed at assessing the suitability of either one as an alternative to the other (Lubatkin *et al.*, 2001). This refers to the make versus buy decision (Lepak and Snell, 1999, 2002). This decision meant the organisations tried to prioritise the feasibility of one at the expense of the other for the purpose of selecting the best option. However, external and internal KT processes should not be seen as alternatives; they should, I argue, be integrated. In this AR cycle, I explored the integration that combines inter-organisational level KT with intra-organisational level KT and I aligned this approach with vertical and horizontal KT (Postrel, 2002). I started this discussion in chapter 3 and illustrated a conceptual design in Figure (3-10). This chapter provides the empirical element of this work.

This AR cycle carefully explored knowledge flows using three systems: external-internal, internal-internal, and internal-to-external. The first and third systems are inter-organisational, while the second is intra-organisational. Actual real-life core business processes taking place in the host organisations were identified and classified to fit into applicable systems. This activity was realised through a rigorous exercise from the



qualitative coding of host organisation participants' interview transcriptions to identify core processes. The identification of core processes was a challenging task since it required deep organisational penetration, data mining and acknowledging the difference between content and capability when discussing what was being transferred in KT. With qualitative analysis applied to each business process, and reflective scrutiny of the resultant analysis, a management report emerged which enabled the host organisations to be *aware* of their capability gaps and which suggested possible *aspirational* 'should be' processes.

In order to conduct a fair assessment of business processes at the host organisations, it was legitimate to initially search for effective frameworks that accurately measured and improved business process performance from the context of KT effectiveness and efficiency (Wiig, 1995). These frameworks represented specific lenses that defined how we saw the problem. The perception of the problem influences how we reach a solution. The KM lens for viewing business processes is now accepted in the business community as an important tool for increasing competitiveness in a knowledge economy (Grant, 2005). KM is considered to be an effective technique effective technique for improving efficiency in regards to many aspects of businesses like knowledge flow, and how business processes serve competitiveness and strategically enhance LOC to meet organisational objectives (Sveiby, 1997).

The methodology for this AR cycle used the coded transcripts analysis of the interviews conducted with staff in organisations X, Y and Z over a period of 30 weeks. The data was analysed over this period using a layering approach grounded in the reality of how AR participants worked on a day-to-day basis. In addition to discussing the KT barriers they faced, which will be presented in chapter 7, participants also explained how they processed their work. They provided details on KT-related processes and work flow structures that they routinely followed. By providing the details described in this chapter I aimed to reconstruct the reality of how participants did their work in relation to the KT domain.

The layering approach was useful for bringing simplicity to a complex set of KT processes. The first layer of analysis was constructed by classifying knowledge flows into

KT levels that began with KT from external experts outside the borders of the organisations. The second dealt with KT within the borders of the organisations then eventually, the third layer examined KT to the local industry surrounding the organisations. The second layer of analysis was the core work conducted by academic staff. This is how knowledge was applied at the three research host organisations. Throughout the process of coding using the guidelines of the IKTM, the NVIVO software was used to organise the results in a way that BPR, Lean, TQM and KM concepts could be applied.

The transfer of knowledge about research between staff at the host organisations, (i.e. internal to internal KT), was multifaceted. Respondents mentioned a wide range of issues. Some of these were existing processes for sharing knowledge about research, some were about sharing research itself, some were processes, which were not done well or did not exist but should have done. The next step was to validate these issues with host organisations' management through the cycle report and then from this point onwards to aggregate the final findings of this AR cycle into similar categories to those of AR cycle 1, and then to link them with broader findings, which will emerge from the subsequent AR cycles 3 and 4.

# CHAPTER 7: EXAMINING THE KT BARRIERS

## AR CYCLE 3

*"...world class researchers when coming here from abroad to give us [knowledge]... they would like to give [knowledge], but can we take? This is the question that we should ask ourselves: can we also take?"*

*Deputy Research Centre Director, Organisation Y*

### 7.1 INTRODUCTION: UNDERSTANDING THE PROBLEM

The 60 core processes identified in AR cycle 2 may have been designed without regard to the skills, attitudes, and behavioural norms of host organisations. A process with such disregard will fail irrespective of its workflow design or information systems (Sharp and McDermott, 2001). Aligning a business process with its environment is as important as aligning it with the business strategy (Sharp and McDermott, 2001). By looking outside the process and into the environment, new perspectives emerge. While this thesis, thus far, has provided both practical and theoretical explorations of strategy and the ‘what’ questions involving KT and LO processes from both a knowledge and a KT capability perspective, it still needs to address the ‘why’ question regarding KT phenomena. In the following sections, I present the context of the chapter, constructs relating to OL, and initial concepts relating to KT barriers. These elements are introductions to examining *why* KT processes behave in the way they do (i.e. ‘As Is’). This will uncover *the root-cause* for capability difficulties, gaps and waste points identified in the previous chapters.

## 7.2 THE CONTEXT OF THIS CHAPTER IN THIS THESIS

This chapter examines the barriers to KT in more detail. Chapter 5 established the knowledge strategy gap by measuring respondent perceptions of the LOC. This was AR cycle 1 in the AR cycles presented in chapter 4 (see Figure 4.4). Chapter 5 (AR Cycle 1) found that the case study organisations had not yet achieved LOC status, and identified areas for improvement. Chapter 6 identified the barriers to OL by mapping the activities and workflows of the case study organisations, and symptoms of blockages or waste points. This was AR Cycle 2 in the AR Cycles presented in chapter 4 (see Figure 4.4). Chapter 6 (AR Cycle 2) found that there were significant inefficiencies in OL at the case study organisations, and that KT was a cause. In chapter 7, I examine the KT capability gap by measuring barriers to KT in three areas: knowledge itself, the individual, and the organisation. This is AR Cycle 3 in the AR Cycles presented in chapter 4 (see Figure 4.4). In doing so, I uncover the underlying causes of the symptoms identified in chapter 6.

As explained in chapter 2, developing LOC is necessary for success in today's global knowledge economies. At the individual and group levels, LOC enables innovation and creativity suitable for knowledge workers, who contribute to the OKB (Massingham and Diment, 2009). OL is the process of changes in the OKB, and represents growth in the organisation's competence to act and solve problems (Massingham and Diment, 2009). KM is the specific set of interventions designed to change OL (Probst *et al.*, 2000). Therefore, the achievement of LOC involves the use of KM interventions, framed as OL change initiatives, and designed to increase the OKB (Massingham and Diment, 2009). This explains the relationships between chapter 5 (LOC), chapter 6 (OL), and chapter 7 (KM). KT is a key KM capability. An examination of the KT barriers in chapter 7 helps to identify roadblocks that are blocking the increase in the OKB.

## 7.3 ORGANISATIONAL LEARNING INEFFICIENCIES

After reporting on AR cycle 2 (chapter 6), it was evident that further exploration to uncover underlying knowledge barriers to KT was necessary. According to Bohn (1994), knowledge allows "the making of predictions, casual associations, or descriptive decisions about what to do" (p. 63). With this in mind I ask the question: what does it mean when we do not

know what to do in a given situation? In exploring this question one needs to note firstly that this lack of clarity causes OL inefficiency and secondly, if we do not know what to do, we need to examine the knowledge we have because such questions imply some sort of lack of knowledge. However, it may also imply that the knowledge exists but it is unused. In other words, is it possible that the required knowledge is blocked *somewhere* within the organisational process system? Either way, a knowledge flow is necessary to transfer in new knowledge (in the former case), or re-organise the flow of existing knowledge in the workplace (in the latter case). Knowledge must always, therefore, circulate (flow) to be useful.

To enhance OL efficiency, Schulz (2001) adopts a broad understanding of knowledge flow as being the aggregate volume of ‘know-how’ knowledge that is transmitted per unit of time. The intensity (speed) of the flow (transmission) of knowledge thus builds on the potential (i.e. intention) of the seeker and the knower. This potential is triggered by need and uncertainty (Galbraith, 1973). Need creates movement towards what is needed, or the movement of what is needed towards the entities who need it; or perhaps both movements take place simultaneously. This implies that flow is about speed and acceleration (knowledge volume/time<sup>2</sup>). *Planned* knowledge flow speed and acceleration are therefore dependent variables of need. Figure (7-1) illustrates this concept. Ideally, the more need there is, the faster *planned* knowledge flows and accelerates. Realistically, when knowledge begins to flow (i.e. initiation phase in Szulanski, 1996), it starts facing knowledge blockages that force speed to reduce or eventually stop upon the exposure of multiple blockages (speed becomes zero).

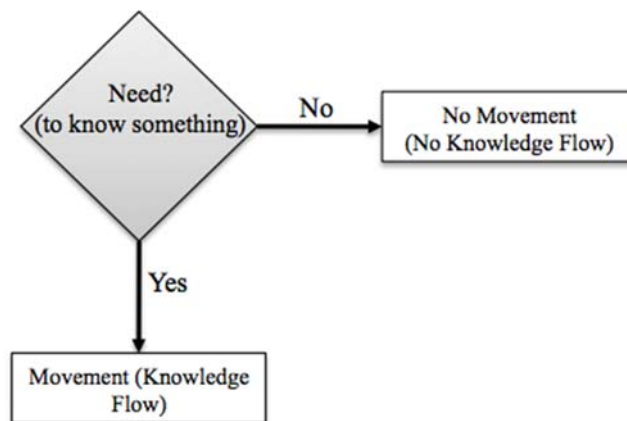


Figure (7-1): The ideal relationship between *need* and knowledge flow

*Unplanned* knowledge flow (i.e. knowledge coming to us without asking), however, is not a dependent variable of need. A typical example is knowledge coming from social networks because it is usually not planned (Baker, 1993), but researchers found that exerting order to informal talk (i.e. planning it) in social networking activities adds additional value and efficacy to knowledge flow (Rodan and Galunic, 2004). Although it is relatively easy to be exposed to *unplanned* knowledge flows, such unplanned exposures do not address pre-defined situational (i.e. organisational) needs. This is especially true in engineering domains since knowledge requirements are usually very specific and the chances that such knowledge will be captured in unplanned events is low. Since this knowledge is seen as a significant factor in innovation, it requires more planned knowledge flows that are targeted to address such specialised knowledge (Baniak and Dubina, 2012).

## 7.4 KNOWLEDGE TRANSFER BARRIERS

The issue here is not business process design as it was in chapter 6 (AR cycle 2); it is the ability to use the process as intended through addressing possible obstacles. In other words, there are factors that negatively affect the intended purpose of a business process, thereby causing a barrier in the otherwise smooth path of the flow of knowledge. The architecture in which these barriers will be explored in this cycle builds on a layered framework: (1) knowledge characteristics barriers, (2) individual barriers, (3) organisational barriers, (4) national barriers and (5) international barriers. This architecture is discussed in further detail in Section 4.1. KT barriers are integrated using this architecture. For example, motivation is an individual-level issue that is introduced using this architecture. Other factors relating to the individual level will be examined to provide a complete understanding to the individual-level barriers. In the same way, organisational level barriers are integrated in one layer. For example, a positive culture is an organisational-level need. Also, sufficient organisational resources are needed for implementing processes as intended. Otherwise, barriers to the flow of knowledge will surface.

In each barrier layer in this architecture, *need* may create the momentum to overcome the barriers. For example, on the individual level, there should be a feeling that motivates individuals to aggregate their *need* into action. Such feelings trigger a greater awareness of the need, thereby enabling certain behaviours and actions which enhance knowledge flow,

and as a result, KT succeeds. The speed and acceleration of such KT is dependent on the congruence of knowledge with such behaviours. Negative behaviours impede knowledge flow and lifting such individual barriers allows *need* to create a coefficient that is efficient enough (ideally 1.0) to impact the speed of knowledge flow. In the same way, I address different constructs using the proposed architecture.

A word of caution on this chapter: the interrelatedness between many concepts that represent this cycle is complex. Not only does *need* drive knowledge flow, but it also drives motivation. Motivation spreads through communication to establish a shared purpose. Communication is driven by the perceptual feelings of the involved communicators but it needs their trust to be able to communicate transparently and effectively (Schein, 2006). Having trustworthy communication implies higher ability to pass on tasks that contains knowledge that the seeker is willing to use. This introduces this cycle's complexity. The range of conceptual ideas, measurements, and the relationships between constructs is complex. I have endeavoured to reduce this complexity by isolating each construct as a separate barrier using the knowledge, individual, and organisational framework adopted from Dr Massingham's ARC research.

### 7.5 THE IMPORTANCE OF AR CYCLE 3

Saudi Arabia is attributed with various contextual, economic, individual, cultural and political influences (Alshumaimri *et al.*, 2010, 2012; Iqbal, 2011). As a starting point, I examined publicly released data by the host organisations to capture previously findings. The findings were statistical reports that lacked qualitative assessment. It was rare to find critical examination of KT processes in any of the publications. Statistics such as number of annual patents, publications, research projects and funding schemes revealed some aspects of research strengths and weaknesses but were not relevant to identifying underlying problems within KT processes. For example, there was little data on individual-level perceptions that could reveal micro-level attributes. The findings of this AR cycle is likely to be unique in Saudi Arabia and therefore this chapter may be considered an important contribution to understand engineering research work environments in Saudi Arabia.

## 7.6 CYCLE 3 – PHASE 1: “SITUATION ENGAGEMENT”

As figure 7-2 below illustrates, this section describes the first phase of AR cycle 3. In this phase, I will present the segment of the AR journey that explains how the AR participants engaged with AR cycle 3.

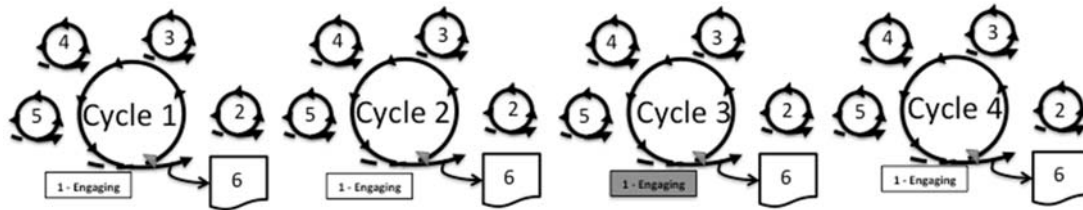


Figure 7-2: AR Cycle 3 – Phase 1: “Situation Engagement”

The 60 core processes in the cycle 2 mapped the deficiencies in performance using Lean, BPR, TQM and KM approaches. However, the outcome of AR cycle 2 revealed many ‘what’ and ‘why’ questions about reasons underlying the identified deficiencies. In order to understand the behaviours underlying those process waste points, a new AR cycle was needed to explore the issue at more depth. AR participants engaged in the project by asking: *What are the barriers that caused the waste-points to occur in the first place?* They wanted to know *why is knowledge flow inefficient?*

The management reports that emerged from AR cycle 2 resulted in further enquiries. This necessitated for AR cycle 3. The root-cause for KT issues in each of the 60-core ‘As Is’ processes was still not explained by AR cycle 2. Their corresponding ‘To Be’ processes may have inherited hidden issues that may affect their performance. As a result AR cycle 3 was proposed to uncover the root-causes for the findings of AR cycle 2. This began with informal visits to the host organisations to define the structure of AR cycle 3 and the practical steps to commence action. This stage was considered advanced, as around three years had elapsed in this research. It was necessary to find gaps in the research before it was too late or inappropriate. The result of these reflections was that it was too early to define a solution or to discuss the topic of solutions. It was more appropriate to continue examining the barriers to KT at the host organisations until they have been thoroughly identified. This was a strategic key point to design this cycle, which allowed exploring a clear set of enquires based on the findings of the previous cycle.



## 7.7 CYCLE 3 – PHASE 2: “EMERGING DEFINITION”

As figure 7-3 below illustrates, this section describes the first phase of AR cycle 3. In this phase, I will present the segment of the AR journey that explains how the AR participants engaged with AR cycle 3.

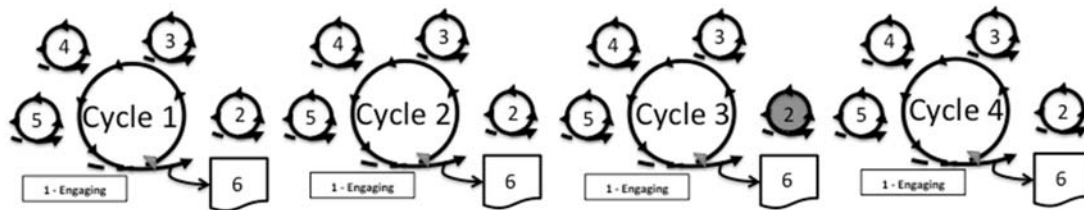


Figure 7-3: Cycle 3 – Phase 2: “Emerging Definition”

In AR cycle 2, I questioned the principles upon which processes were built upon. While 60 core processes were mapped, the AR participants and I questioned the basic principles of each process. Similarly, in AR cycle 3 (this cycle), we questioned values, personal beliefs, attitudes, and intentions that led to possible inefficiencies in AR cycle 2 (Argyris, 1980). The difference between the previous cycle, AR cycle 2, and this cycle is that the former is about highlighting process *design problems*, while this cycle is about highlighting process *behaviour problems* on all levels of the three architectures. Since value is only created by action (using knowledge) the way in which action is carried out is key to value creation.

It was difficult for some AR participants to accept that negative values, beliefs and attitudes existed at their organisations. This disbelief needed to be changed through the use of double-loop learning. If AR participants were unwilling to admit to the status quo, it would be unlikely for the AR activity to be in a position to uncover the theories-in-use at the organisations, and this would have left the study reliant on espoused theories that do not resemble reality. Evaluating governing values (and intentions) is what characterises double-loop learning and this helped AR participants to discover reality (Argyris, 1980).

While there were difficulties in shifting the AR participants to a double-loop learning mindset, a relatively successful result was attained to bring agreement on treating the semi-

structured interviews as faithfully transparent and open to generate an arena for reflective discussion. The questions posed in the interviews were aimed at examining:

- (1) What are the root causes of the barriers that occur within the knowledge flows of the identified core processes in AR cycle 2?
- (2) Why do these causes exist in the context of the host organisations?
- (3) How do the findings for questions (1) and (2) link with relevant theory?

The first enquiry addresses the definitional phase of the problem. The root causes are considered static elements that AR participants need to identify. Another level of depth was to uncover possible hidden phenomena. The objective was not to address a problem that hid another problem beneath it without detecting the root cause. During the coding of the transcriptions of the interviews, I was able to identify 912 barriers, which were merged into 269 barriers. These barriers were linked to their relevant constructs and tabulated according to the barrier architecture introduced earlier (i.e. knowledge, individual, organisation). Each level contains a number of constructs and sub-constructs. Appendix E emerged as a comprehensive document that explained the 269 barriers.

The third enquiry serves this AR cycle in two ways: first, it validates the empirical findings and reflections of this AR cycle with the literature findings, and second, it provides an opportunity for theoretical development in the field of KT. The theoretical development part of this AR cycle, in summary, was aimed at achieving the following:

- (1) Confirming previous research cited in the literature
- (2) Discovering new research themes that could be aggregated to existing research in the literature.
- (3) Discovering an original finding that can stand as the basis for new theory or conceptual development.

The third enquiry of this AR cycle was not interesting to AR participants as they were concerned with solving their real-life problems rather than with the academic field of KM. Therefore, my discussions with the participants were mainly about the first two enquiries. I engaged with my academic supervisor, Dr Peter Massingham, in a rigorous dialogue to uncover the theoretical underpinnings that could establish possible connections between theory and the findings of the first two enquiries.

### 7.8. CYCLE 3 – PHASE 3: “PLANNING FOR ACTION”

As Figure 7-4 below illustrates, this section describes the third phase of AR cycle 3. In this phase, I will present the segment of the AR journey that explains how planning for action took place in this particular cycle. I will also present the outcomes that emerged from this activity.

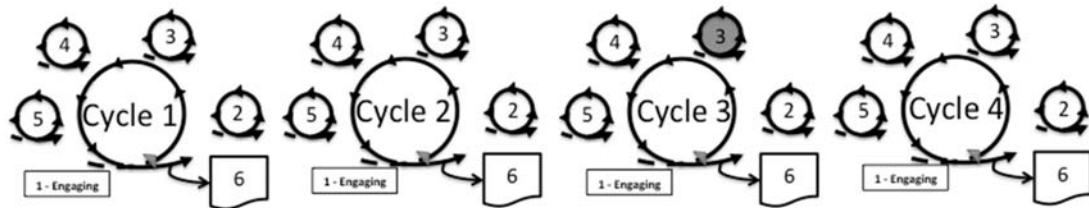


Figure 7-4: Cycle 3 – Phase 3: “Planning For Action”

Argyris and Schon (1974) suggest that people design actions in order to achieve intended consequences and that they should monitor what they do to learn if their actions are effective. It is their concern that when people learn that their intended outcomes are not achieved, that they try to re-do their design in a different way to satisfy their governing variables, although they may claim different governing values (i.e. espoused theory). Argyris and Schon (1974) assert that people hold maps in their heads about how to plan, implement and review their actions. They further assert that few people are aware that the maps they use to take action are not the theories they explicitly espouse. Also, even fewer people are aware of the maps or theories they do use (Argyris, 1980). These assertions have a significant impact on AR since they raise concerns that participants, and the researcher, may engage in false claims while actually each participant holds a theory-in-use that contradicts with the explicit AR plan. I found that this AR planning phase required the following in order to appropriately address the situation of the study:

- (1) Transparency
- (2) Critical monitoring of what is actually happening rather than what we think is happening
- (3) Applying bilateral engagement in discussion.

Eliciting the intrinsic values and beliefs of AR participants to uncover what they feel and believe are the causes of knowledge blockages is a delicate task, especially in a culture that is known for being protective and conservative.

### 7.8.1 HOW DO WE OPERATIONALISE OUR UNDERSTANDING OF KT BLOCKAGES?

In order to identify the problems underlying the process of KT at the host organisations, I used, as with AR cycle 2, a semi-structured discussion guideline (Gibbs, 2007). The criteria for identifying stakeholders were based on the level of each participant's involvement in engineering research activities that may be core to the process of KT according to any one of the three identified systems of the IKTM introduced in chapter 6 (see figure 6-4, pp. 18).

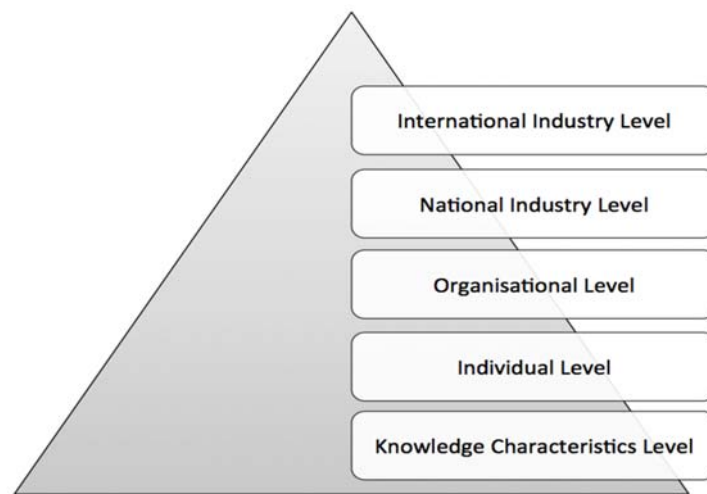


Figure 7-5: Architecture for levels of analysis of knowledge barriers

The knowledge barriers architecture is a system of five levels of analysis, which represent the following classification levels:

- a. *Knowledge characteristics level*: The barriers to the flow of knowledge caused by the knowledge itself. This is level of analysis 1.
- b. *Individual level*: The barriers to the flow of knowledge caused by individuals, whether internal or external. This is level of analysis 2.
- c. *Organisational level*: The barriers to the flow of knowledge caused by the organisation itself. This is level of analysis 3.

- d. *National level*: The barriers to the flow of knowledge caused by national factors in Saudi Arabia. This is level of analysis 4.
- e. *International level*: The barriers to the flow of knowledge caused by international or global factors. This is level of analysis 5.

Based on the literature survey, an assessment was made as to the most influential behaviours and phenomena that cause knowledge blockages. This framework was adapted from Dr Peter Massingham's work on his ARC project. These influences have been added to the above model based on the appropriate level of analysis. Figure 3-7 of chapter 3 presents the initial conceptualisation of this model before the fieldwork was conducted. After the coding of the data and the finalisation of further literature reviews, a final version of the model was created. Figure 7-6 presents the knowledge blockages model. Table 7-1 defines each element of the model and provides reading references.

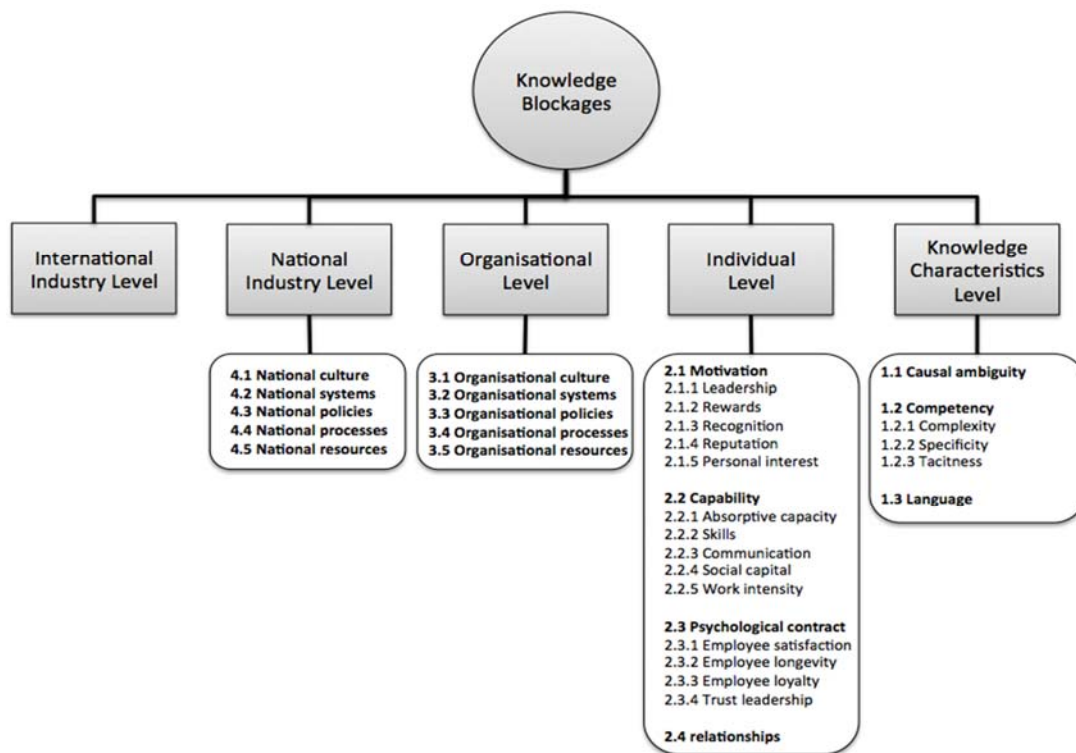


Figure 7-6: KT barriers model

## 7.8.2 INSTRUMENT DESCRIPTION

The instrument for this AR cycle was based on a semi-structured interview instrument (see Appendix D). Targeted AR participants were engineering researchers who had been working on activities that involve knowledge sharing, joint research with external research

institutions, training of researchers, and project managers for local industry research services. The questions were designed to elicit knowledge blockages in the host organisations' business process structure based on the constructs in table (7-1). The instrument was designed to take 1.5 hours for each interview, before which a consent form was signed (see Appendix D). All interviews were conducted on a one-to-one basis. Since the interview was designed as semi-structured, there was planned time for participants to add additional comments or discuss further issues not included in the interview questions.

Construct	Definition	Literature references
<b>Knowledge ambiguity</b>	The difficulty in understanding aspects of knowledge either in terms of relational processes or characteristic attributes	(Ciabuschi and Martin, 2012)
<b>Knowledge complexity</b>	The degree of depth and specialisation of the discipline-based knowledge residing in internal and external human experts, decision-making processes, and incorporated expert system applications.	(Clancy, 1985)
<b>Knowledge specificity</b>	An organisation's specific knowledge and capabilities that may be developed internally and are difficult to apply elsewhere	(Pfeffer, 1994)
<b>Knowledge tacitness</b>	Hard-to-codify accumulated knowledge and skills that are gained from experience	(Haas and Hansen, 2005)
<b>Knowledge of language</b>	The internal, subjective process of apprehending the <i>meaning</i> of something	(Carroll, 1993)
<b>Individual capability</b>	The individual's ability to send, receive and internalise knowledge	(Massingham, 2012)
<b>Individual motivation</b>	The psychological processes that cause the arousal, direction and persistence of voluntary actions that are goal oriented	(Mitchell, 1982)
<b>Individual psychological contract</b>	A set of unwritten expectations and subjective beliefs that exist between employees and their employers and govern the continuing development of the employment relationship.	(Schein, 1965)
<b>Individual relationships</b>	Successful formation of regular contact that results in creating a social network	(Kang <i>et al.</i> , 2007)
<b>Organisation al culture</b>	Shared beliefs and practices of people in the organisation	(McDermott and O'Dell, 2001)
<b>Organisation al policies</b>	A plan of action designed by the organisational decision makers in which they specify the intended action for organisational members in relation to possible states or situations	(Zeng <i>et al.</i> , 2005)
<b>Organisation al processes</b>	Repetitive tasks for producing a product or service, including the people, procedures, machines, and software in that system.	(Bohn, 1994)
<b>Organisation al resources</b>	Tangible and intangible productive assets owned by the firm	(Grant, 2008).
<b>Organisation al systems</b>	A collection of an interrelated moving parts or components that work together to perform a complete function or purpose	(McNabb, 2007)

**Table 7-1: The constructs of the KT barriers architecture**

The objective for pre-defining the above constructs was to provide a scientifically validated basis for the interview questions and the coding process. The examination of these constructs will show which ones contain more barriers and why. Figure (7-7) illustrates a color-coded scheme for presenting the assessment output.

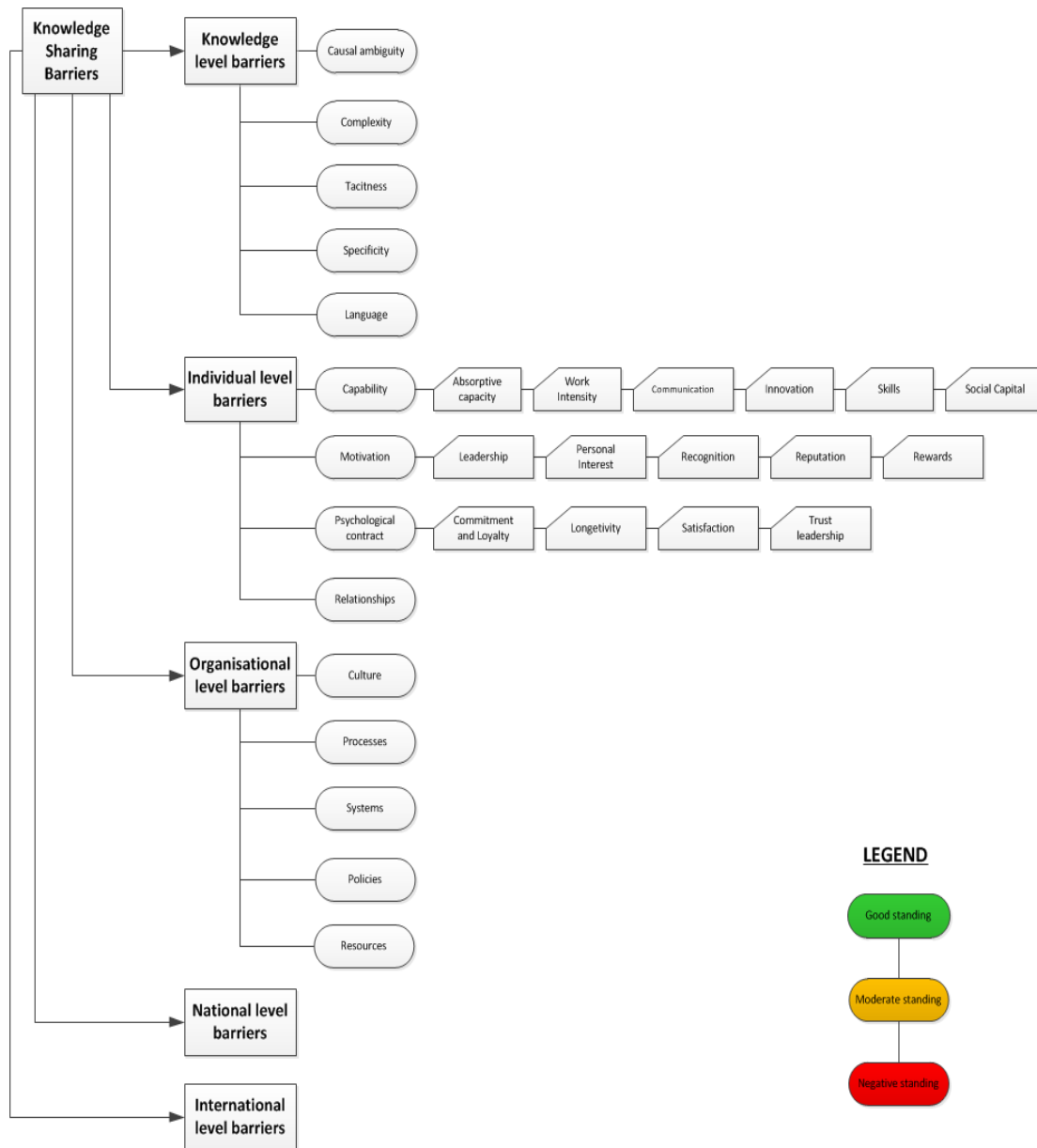


Figure 7-7 - Base map for color-coded examination results

The above figure will be used at the end of this chapter to input the final assessments for each construct using a color-coded reference as indicated in the lower right corner of the figure. Additional constructs were added to the figure (i.e. national level, international level barriers) due to emerging findings that developed from a grounded theory approach (Gibbs, 2007) in this part of the thesis. The selection of the colour code was qualitatively assigned based on (1) quantity (i.e. the number of KT barriers under the sub-construct) and (2) quality (i.e. the level of impact that each barrier had on the host organisation, grounded from data that emerged from the AR participants).

### 7.8.3 PARTICIPATING INDIVIDUALS

Some details on the interviews that were conducted in AR cycle 3 are shown in Table 7-2 as follows:

Organisation	One-to-One interviews Phase Participants	Area of specialisation	Hours committed
Organisation X	3	Energy, petroleum, chemical, and environmental engineering	5.5
Organisation Y	2	Energy, petroleum, geophysics, and biological, genomics engineering	4.5
Organisation Z	4	Nanotechnology, civil, electrical, and nuclear reasoning Engineering	7.5
Sub-Total	9	--	17.5
AR cycle 2	13	Middle management	23.5
Total	22	--	41

**Table 7-2: Demographic data on PAR interviewees**

The above table illustrates the number of AR participants in this cycle compared with AR cycle 2. It also shows the time commitment that the staff at the host organisations provided as compared to the previous cycles. The approach that this thesis took ensured the use of multiple data collection tools (i.e. on-line questionnaires in AR cycle 1, interviews with managers in AR cycle 2, interviews with staff in AR cycle 3 and focus groups with executives in AR cycle 4). This approach implies the use of triangulation as means for validation (Gibbs, 2007). The consistency between the findings of each tool was qualitatively verified. Despite some discrepancies between the online survey findings and the interviews, the majority of the data was considered consistent and reliable across the different research tools.



## 7.9 CYCLE 3 – PHASE 4: “TAKING ACTION”

As Figure 7-8 below illustrates, this section describes the fourth phase of AR cycle 3. In this phase, I will present the segment of the AR journey that explains how action took place in this particular cycle. I will also present the results that emerged from this activity.

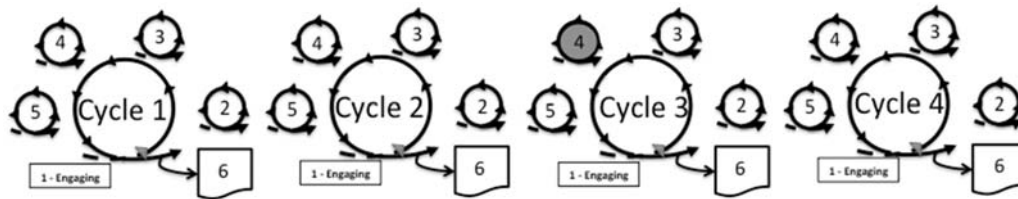


Figure 7-8: Cycle 3 – Phase 4: “Taking Action”

Participants were interviewed over time durations not exceeding two and a half hours per session. Each participant in the interviews signed a consent form that was approved by the ethics approval committee at UOW. Consent forms were stored at UOW (see Appendix B). Table 6-1 is a summary of participant numbers and fields of specialisation.

Employing a longitudinal approach, I engaged participants in discussions about their perceptions of interactions with management and with their peers. Participants also engaged in discussions concerning individuals from outside their organisations. External input was sought to validate the points raised for the external engagements through the participation of an external knowledge provider from a western research organisation and a knowledge user from the local industry. In AR cycle 4, management was approached to validate the overall findings (see chapter 8).

### 7.10 CYCLE 3 – PHASE 5: “ANALYSIS AND REFLECTION”

As Figure 7-9 below illustrates, this section describes the fifth phase of AR cycle 3. In this phase, I present the segment of the AR journey that explains how analysis and reflection in this particular cycle took place.

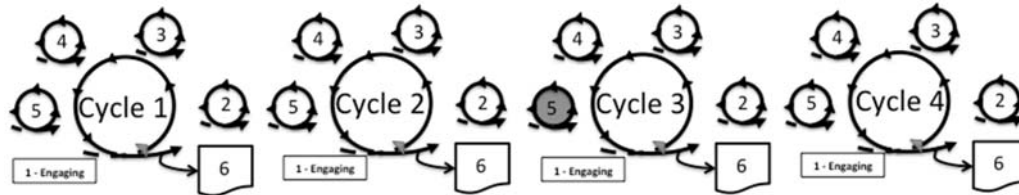


Figure 7-9: Cycle 3 – Phase 5: “Analysis And Reflection”

A total of 269 knowledge barriers were identified within the 60 core processes identified in AR cycle 2. The data of this cycle was iteratively coded. The initial coding cycle was done to ensure that the knowledge blockages model presented earlier in Figures 7-2 and 7-3 were appropriate for the analysis phase. The second cycle was to commence on actual coding for the main levels. The third was to disaggregate the coding into the child nodes. The fourth cycle was to eliminate redundancies (i.e. coding viruses). The fifth was to add emerging themes that were not present in the model. A snapshot of the coding design is presented in Figure 7-10.

The image shows a screenshot of the NVivo 9 software interface. The 'Nodes' list on the right side of the window displays the coding structure for AR Cycle 3. The list is organized into a hierarchy of nodes, with 'AR Cycle 3 (Knowledge blockages)' as the main category. Below it are several sub-nodes, including 'Individual level barrier', 'International level barriers', 'Knowledge level barriers', 'National level barriers', and 'Organisational level barriers'. Each node has a corresponding 'Sources' and 'Reference' count.

Name	Sources	Reference
AR Cycle 2 (Knowledge sharing process)	0	0
AR Cycle 3 (Knowledge blockages)	0	0
Individual level barrier	0	0
Capability	0	0
Motivation	0	0
Psychological contract and Emotio	0	0
Relationships	30	122
International level barriers	16	65
Knowledge level barriers	0	0
Causal ambiguity	18	37
Competency	0	0
Language	11	25
National level barriers	0	0
IT systems	3	3
National culture	24	69
Policies	14	40
Processes	14	21
Resources	14	24
Systems	18	44
Organisational level barriers	0	0
IT systems	7	9
Organisational culture	32	189
Policies	37	218
Processes	45	603
Resources	33	148
Systems	40	256

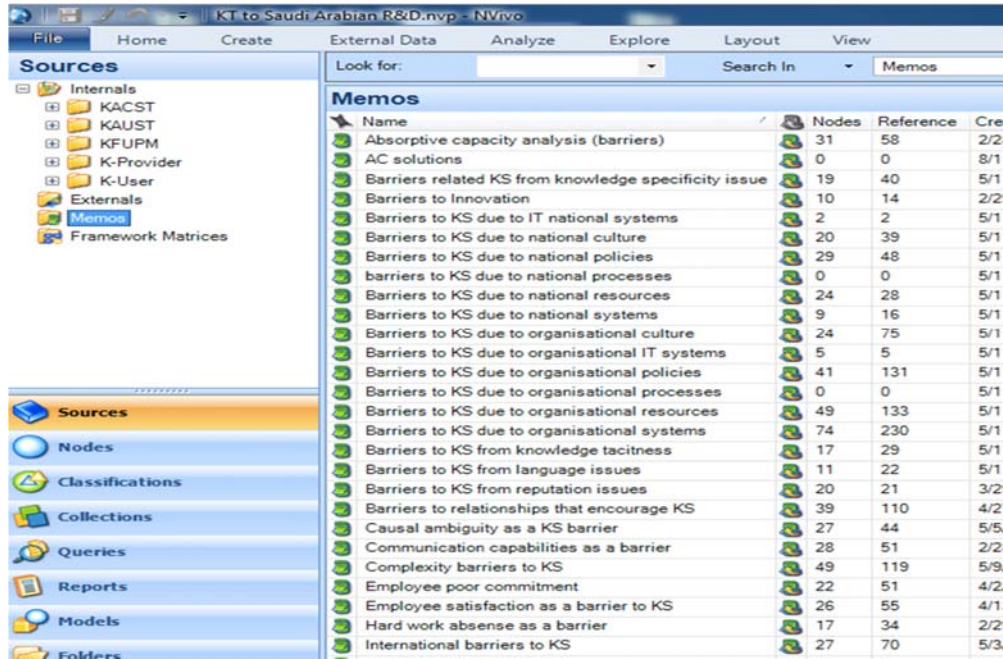
Figure 7-10: AR cycle 3 coding structure (partial image from NVIVO 9)

### 7.10.1 REFLECTIONS ON CYCLE 3 DATA RESULTS

Eliciting real-life knowledge blockages required comparisons between the various answers to the each question in the semi-structured interview described in the ‘plan for action’ phase. These comparisons were undertaken to explore conflicts in views and consensus about causes and effects. Ideally, knowledge flow blockages are observed in the same way across the organisation, but this was not the case here. Data results showed that the reality at host organisations was highly subjective and was perceived differently by AR participants. The use of data results was therefore non-linear. This indicated a need for reflection on how to use data results to critically uncover contextual factors and produce reliable propositions. My epistemological approach was (1) analysing data by interpreting its practical meaning as seen by AR participants, and (2) analysing data by interpreting its theoretical implications. The two approaches are explained further:

### 7.10.2 PRACTICAL ANALYSIS

It was necessary to elaborate on the elicitation of meanings from the gathered data. I analysed attributes, behaviours and factors that were fragmented and dispersed in the rich data. This analysis produced 114 pages of tabular data as presented in Appendix E. The appendix presents code references to each knowledge blockage. The fourth column presents supporting data quotes. The purpose of adding quotes was to enforce the transparency of the AR approach. The fifth column contains the analytical interpretations of my elicitations of meaning of context. Some explanations may not be obvious from some quotes since they sometimes require (1) other quotes, (2) environmental contexts and (3) qualitative derivation from other blockages. These interpretations were modelled using linked memos to coded data in NVIVO 9. Memos represent the interpretations of column 5 in Appendix E as meanings to the nodes (Bazeley, 2007). Memos represent the non-linearity of interrelated blockages. Such memos were iteratively refined and discussed with AR participants before proceeding to the analysis of Appendix E. A partial snapshot of memos is illustrated below.



Name	Nodes	Reference	Cre
Absorptive capacity analysis (barriers)	31	58	2/2
AC solutions	0	0	8/1
Barriers related KS from knowledge specificity issue	19	40	5/1
Barriers to Innovation	10	14	2/2
Barriers to KS due to IT national systems	2	2	5/1
Barriers to KS due to national culture	20	39	5/1
Barriers to KS due to national policies	29	48	5/1
barriers to KS due to national processes	0	0	5/1
Barriers to KS due to national resources	24	28	5/1
Barriers to KS due to national systems	9	16	5/1
Barriers to KS due to organisational culture	24	75	5/1
Barriers to KS due to organisational IT systems	5	5	5/1
Barriers to KS due to organisational policies	41	131	5/1
Barriers to KS due to organisational processes	0	0	5/1
Barriers to KS due to organisational resources	49	133	5/1
Barriers to KS due to organisational systems	74	230	5/1
Barriers to KS from knowledge tacitness	17	29	5/1
Barriers to KS from language issues	11	22	5/1
Barriers to KS from reputation issues	20	21	3/2
Barriers to relationships that encourage KS	39	110	4/2
Causal ambiguity as a KS barrier	27	44	5/5
Communication capabilities as a barrier	28	51	2/2
Complexity barriers to KS	49	119	5/9
Employee poor commitment	22	51	4/2
Employee satisfaction as a barrier to KS	26	55	4/1
Hard work absense as a barrier	17	34	2/2
International barriers to KS	27	70	5/3

Figure 7-11: AR cycle 3 partial image of the NVIVO 9 memo structure

The practical interpretation analysis presented in Appendix E was used in three ways:

- (4) At a strategic level: to inform the leadership to determine whether their research organisation was performing satisfactorily and where they needed to focus most. This search was conducted through the submission of the AR cycle 3 report that explained the 'reporting' phase of the cycle.
- (5) At a tactical level, to inform middle management and determine whether there is a significant difference between major groups in terms of their perception. This was carried out through AR participation and informal discussions after the report was submitted to the leadership.
- (6) At an operations front-line level, to bring awareness to researchers about the issues raised, which should bring to the surface new enquiries and hopefully new behaviour and action to change.

### 7.10.3 THEORETICAL ANALYSIS

This is a data driven chapter, where data informs theory. In the previous section, I presented the practical analysis and introduced Appendix E. In this section, I connect data and the analysis of Appendix E with the development of theory by qualitatively

connecting the data that confirms or extends existing theories. If relevant theory was not found, a new theoretical perspective is assumed. This is supported by the evidence-based theory development approach (Pfeffer and Sutton, 2006). Rousseau (2006) best describes this approach as: “A paradigm for making decisions [solutions] that integrate the best available research with decision makers’ expertise [...] to guide practice towards more desirable results” (p. 257).

In this sense, data and previous research are combined to develop a deeper understanding of the KT problem. This may lead to effective solutions, as the practical outcomes in the study will be connected to the root cause of the identified problems. Human behaviour requires a multidisciplinary perspective to grasp the essence of the problem and therefore I employ Suddabys’ (2006) notion that “new discoveries are always the result of high-risk expeditions into unknown territory” (p. 633).

The search for the root-causes underlying human and organisational behaviour required exploring ‘unknown territories’. I focus here on theoretical perspectives that may (1) confirm, or (2) extend existing theory. Once I found that I was unable to connect the data with a relevant theory, I proposed a new theoretical perspective, which may resemble a theoretical seed (Senge, 2006). The findings in this chapter brought several new perspectives to the KT phenomena.

Based on chapter 3 of this thesis, I classified the barriers to KT into knowledge characteristics barriers, individual-level barriers, and organisational-level barriers. I began the study with this framework in mind, following the work of my supervisor, Dr Peter Massingham. However, as the research evolved, I found that these KT barriers needed to be extended to include national and international-level barriers. Hence, they were added to the model shown in Figure 7-7 above. This model should guide the reader throughout the phases of this cycle.

### **7.11 KNOWLEDGE CHARACTERISTICS LEVEL BARRIERS**

This section adopts a characteristics-based ontology to uncover the effects of knowledge on its own flow. Given that knowledge is a ‘loose, ambiguous, and rich’

concept, which precludes simple reduction (Alvesson and Kärreman, 2001), different perspectives exist as to how the nature of knowledge could impact KT. The knowledge characteristics level argues that knowledge itself may cause KT barriers, essentially because it may be difficult to share with others. This section of the thesis aims to identify the aspects of knowledge that make sharing difficult. Alavi and Leidner (2001) present knowledge as (1) an object; (2) a process; (3) a link to information; or (4) a capability. The ‘object’ perspective observes knowledge as a thing to be stored and manipulated. Knowledge as a ‘process’ tackles embedded practices where actions themselves demonstrate knowledge. The “linkage” perspective focuses on the processes of transfer and retrieval as opposed to the substance of what is to be known (Schoenhoff, 1993). Knowledge as ‘capability’ suggests the potential for learning and experience. I adopt the latter perspective, and translate this capability into four constructs: (1) language, (2) causal ambiguity, (3) complexity, (4) specificity, and (5) tacitness.

### 7.11.1 LANGUAGE

It is argued in this study that language comprehension is a knowledge characteristic level construct that may be a root cause of KT-related barriers. Language comprehension is defined as the internal, subjective process of “apprehending the *meaning* of something” (Carroll, 1993, p. 44). In the context of KT, the practical outcome of this construct is that seekers can accurately and efficiently comprehend what is conveyed to them by the knower. From an input view, lack of language abilities creates a barrier to the KT process. In the context of barriers to KT, the following data examples provide evidence of underlying theoretical concepts.

First, the data (code: [3.4.2] KT between speakers of different languages, see Appendix E) supported several existing theories of language competency for KT. AR participants, as knowledge seekers, explained that they become frustrated with language barriers during KT. The following quote illustrates that this finding existed across the case study organisations on a large scale:

Most of the experts who come here speak English and it’s difficult for most of the researchers here to understand them since they are young and most of them cannot

... speak English ... I got the feeling or have the feeling that ... there is 10-15% who can speak English and understand it very well, but others on a scale of 1 to 6 are 2 to 3.

This finding becomes even more significant when research centre directors also fall into the category of weak English speakers. This weakness was not limited to young researchers, as the following quote was from a research centre director:

Of course the words that I am using [in this interview] are not professional, I understand... There are some difficulties [that I am experiencing to express myself]... one of them is the language.

This implies that language-related KT barriers affect knowledge seekers at host organisations on almost all levels. This finding supports Klein (1986), who found that language is the most important practical skill needed by humans for receiving knowledge from other people. While this finding is about knowledge seekers, the next finding is about the impact of language competency of this situation on the knowers.

Second, the data (code: [3.4.5] Willingness of the knower to cooperate) extended existing theories of language in the context of engineering KT. AR participants explained that some knowers may not be willing to practise using simple language with novices in the language during a KT process. This is considered a knowledge level issue because language competency is a barrier which prevents the seeker from performing in the KT process. The seeker needs language not only to keep the KT process efficient but more profoundly to sustain the knowers' willingness to pass on his or her expertise. The following quote illustrates how the knower is frustrated with a seeker who is not able to understand his language regarding the fabrication of electronic wafer sheets, thus causing an inefficiency barrier to the KT process:

Dealing with someone [a knowledge seeker] who [is weak in English]... [requires that] you have to go back [in selecting simple terminology] to kindergarten with him and explain every single thing to him to understand.

From the above quote, the knower's willingness, despite motivation, to proceed with the KT process may be influenced by their perception of the seeker regarding their language abilities. The knower realises that this barrier has caused an inability to share mental models; hence, frustration arises. This extends the theory of Polanyi (1969) on language as a critically important process within knowledge flow. The data



finding extends Polanyi's theory to indicate more specifically how perceptions of language ability may influence the shared mental models of the knower and the seeker, and thereby their willingness to engage.

In summary, the findings contribute to the understanding of language as a knowledge characteristic-level barrier to KT, by confirming its input measure influence between speakers of different languages. The findings also showed that the KT process at the early stages, influences the interaction between the knower and the seeker. The findings showed how the knower and seeker reacted to this issue and how this created yet another barrier that have affected the willingness of the knower to engage under such conditions.

### 7.11.2 CAUSAL AMBIGUITY

This study argues that causal ambiguity is a knowledge characteristic level construct that may be a root cause of KT-related barriers. This concerns the causal connections between specific actions and corresponding results (Lippman and Rumelt, 1982; Reed and DeFillippi, 1990). This construct suggests that the cause and effect phenomena may be difficult for a seeker to comprehend. The practical outcome is that seekers (those who need to know) do not understand the cause and effect of the knowledge being sought. Causal ambiguity refers to knowledge itself rather than the individual or the organisation. It involves knowledge of what happens before and after the use of the knowledge being transferred. It is a knowledge characteristic rather than an individual characteristic because it is the knowledge itself that makes it causally ambiguous, i.e. some knowledge makes its cause and effect less visible. If seekers do not understand the causal context, then it is more difficult for them to find meaning and purpose in the knowledge sought (Massingham, 2012). The knower (who provides knowledge) may also find it difficult to explain the knowledge in an appropriate way. The following data examples provide evidence of underlying theoretical concepts.

First, the data (code: [3.2.1] Ambiguity as to choice of domain) supported several



existing theories of causal ambiguity. AR participants explained they were frustrated by their inability to understand which knowledge domains could provide a strong competitive advantage. The following quote illustrates how one AR participant did not know what domain was more important to his organisation: “[T]he most important focus for the organisation (may be) space research or ... petrochemical research. We are not sure ...”. This comment reveals a lack of strategic focus and clarity in terms of what knowledge is a source of competitive advantage to the organisation. This confusion means that AR participants have causal ambiguity because they do not know what knowledge resources the organisation wants them to grow. This finding supports Lippman and Rumelt (1982), who define causal ambiguity as not having the capability to comprehend the competencies on which competitive advantage is based.

Second, the data (code: [3.2.3] Basic knowledge as prerequisite for KT) extended existing theories of causal ambiguity. Data findings support that some knowledge domains (rather than some individuals) rely more upon background or subsidiary knowledge and therefore the seeker needs more prior learning/knowledge to enable them to understand cause and effect (e.g. management knowledge for researchers). For example, when engineers become managers and executives, they have insufficient management expertise and are likely to overlook causal ambiguities. Specifically, they fail to distinguish the differences between ‘cause’ and ‘effect’ when they contemplate on a given situation. This is a concern to many scholars, and the elements that contribute to causal ambiguity are unclear (Reed and DeFillippi, 1990; Simonin, 1999; King, 2007). The findings extend what Simonin (1999) argues in that causal ambiguity impedes the transfer of knowledge. The findings support that this phenomenon is influenced by background or subsidiary knowledge.

Third, the data (code: [3.2.2] Knowing the meaning of KT) revealed a new perspective about causal ambiguity. In this case, lack of strategic focus means that AR participants are often asked to work on many knowledge domains, whereas they may be more effective if they specialise in a few domains. Managers may direct staff to work on separate projects as individuals or in small groups because they do not know where to specialise. This contributes to our understanding of causal ambiguity because it explains a new outcome measure. It shows that causal ambiguity may

create inefficiencies and lack of appropriate knowledge domain specialisation.

In summary, the findings contribute to our understanding of causal ambiguity as a knowledge characteristic-level barrier to KT by confirming and extending existing theory about the input and output measures. A key finding is that, specific to the case of this study, the distance between the knower and the seeker plays a profound role in expanding the significance of knowledge ambiguity. Subsidiary knowledge was also found to influence causal ambiguity. As a new perspective, it was also suggested that a dispersed knowledge focus would add to causal ambiguity as a barrier to KT.

### 7.11.3 COMPLEXITY

This study argues that complexity is a knowledge characteristic level construct that may be a root cause for KT-related barriers. Complexity may be defined as interdependent competence that is embedded in routines, individuals and resources and which is possible to be linked to a particular knowledge (Zander and Kogut, 1996). The practical outcome is that seekers (those who need to know) find the knowledge being sought too complex (difficult) to understand. This means the focus here is about the complexity of the knowledge itself, not the individual or the context. As knowledge complexity deals with the difficulties in understanding the transferred knowledge and being able to obtain a tangible result from what is learnt, it may create a barrier to the KT process. In the context of KT barriers, the following data examples provide evidence of underlying theoretical concepts.

First, the data (code: [3.3.1.3] Bounded rationality of individuals) supported several existing theories of knowledge complexity. Based on the bounded rationality theory, the complexity of knowledge sometimes mandates multidisciplinary effort. This means that the inability to create teams to transfer complex knowledge may create a barrier to the KT process. The following quote illustrates how one AR participant found it difficult to transfer advanced knowledge as an individual: “There are efforts [KT activities] that cannot be achieved on an individual level ... In [engineering] research, there’s no way you can do research by your own nowadays.”

Underlying reasons for failure to set up multi-disciplinary teams were addressed in the literature and the data here confirms these theories. For example, building social capital and shared understanding was seen by Senge (1990) as a basic pillar to achieve objectives that are beyond the capability of the single individual. This means that because complex knowledge requires more than one individual, the KT process may be negatively affected if team building is weak, as suggested by Senge (1990).

Second, the data (code: [3.3.1.2] Accountability to participate) extended existing theories of knowledge complexity. Innovation as a KT output measure is a complex phenomenon that relates to demanding requirements on the side of the seeker to own creative and advanced thinking abilities. This is a barrier to KT because the seeker sometimes feels not ready to produce such output. The following quote illustrates how one AR participant as a knowledge seeker found it challenging to actively participate in international research with renowned experts:

The problem in this case [having to innovate within an external-internal KT system] is that you [the seeker] have to participate in the research activity [with the knower] and ensure that it will end up with patenting.

The above quote highlights the worry that the seeker would not be creative enough to work with world experts. Some seekers would therefore not agree to enter into innovative projects from the outset, thereby eliminating the KT activity. However, when I validated this argument with a world expert, he disagreed that experts cannot explain complex ideas to other researchers. The following quote by a US scholar interviewed in this study provides evidence that experts should be able to explain complex knowledge because they are excited about their work no matter how complex it was:

I think if you are an expert in an area, you can explain things very lucidly. I am always impressed by how people who are working at the very cutting-edge of a field can explain very difficult concepts to someone like me who is not in that area... I took some time before deciding to come here and do some collaboration. I went to the website of [organisation Y] and saw the courses outlines and research projects and they are a little bit behind. They know that because they teach textbooks and the fundamentals only. The fundamentals are dry. The really exciting part is the cutting-edge of knowledge where you really don't understand everything. The joy of science is seeing connections you didn't realise before and then seeing what that implies about something else. That's when everybody in my research group get excited. We go to the white board and someone says look at what that means and this makes everyone spontaneously participating. That kind of work is lacking here and seeming to them as complex.

This extends Schulz's (2001) theory. Schulz found complex knowledge requires individuals who are highly capable in innovation and creativity to participate in transferring it. This may be extended from an output capability measure where external experts must by passionate researchers to bring life to complex knowledge.

Third, the data (code: [3.3.1.1] Advanced technology IP Issues) revealed a new perspective about knowledge complexity. The data shows that a lack of IP ownership means that AR participants often find themselves challenged with classified knowledge that is essential for their understanding of complex knowledge (the needed knowledge requires basic knowledge, which is hidden/classified because it is IP protected). The following quote explains how one AR participant found KT difficult, with many complex knowledge elements hidden because of IP non-ownership:

I find IP issues to be the main issue [a main barrier to KT]. We [the legal department in Organisation X] are required to look after many IP issues that could prevent knowledge transfer due to non-ownership of knowledge.

Senior researchers may try to create the missing knowledge (that is IP protected) but it is considered an impediment to KT because it further slows the knowledge flow. This contributes to the understanding of knowledge complexity, as a KT barrier, being attributed with underlying IP protection elements. This provides a new contribution to complexity theory.

In summary, findings contribute to the understanding of knowledge complexity as a knowledge characteristic-level barrier to KT, by confirming its influence on input and output measures for KT. The data supported the need for teams and for collective efforts to transfer complex knowledge because individuals alone cannot handle complex knowledge. The data also showed that KT relies significantly on the accountability of researchers in handling innovative activities. The data therefore showed some relatedness between complexity of knowledge and innovation as a capability. Further, the data provided new perspectives on the relationship between complex knowledge and underlying IP within the process of KT and found that in some cases, such IP protected knowledge may be a barrier to KT.

#### 7.11.4 SPECIFICITY

This study argues that specificity is a knowledge characteristic level construct that may be a root cause for KT-related barriers. Specificity refers to an organisation's specific knowledge and capabilities that may be developed internally and are difficult to apply elsewhere (Pfeffer, 1994). Knowledge may be valuable within one context but of little use in another (Kluge *et al.*, 2001). This refers to the influence of the setting in which knowledge was developed. In some kinds of knowledge, there is inseparability between the knowledge itself and where it was created, and thus, specificity is a knowledge characteristics construct. Due to the difficulty in mobilising knowledge with the specificity factor, such knowledge is difficult to transfer. When KT attempts are made, both the knower and seeker find that the transferred knowledge is inapplicable or has been taken out of context. In the context of KT barriers, the following data examples provide evidence of underlying theoretical concepts.

The data (code [3.3.2.1] Expertise in managing KT distance) confirmed existing theories of knowledge specificity. The data findings suggest that specificity is associated with distance, which is one of the major KT issues for Saudi Arabia. AR participants found it difficult to contextualise knowledge transferred from overseas locations. The following quote illustrates how some knowledge was not transferred due to difficulties in contextualising what was seen to be too far to manage:

We asked them to provide us with case studies of other nations experiences in this field [KT policies] ... They gave us several options to choose from ... The US one was far and too difficult for us to accept or implement. It was too difficult to be applicable here.

This confirms the theory of Morris and Lancaster (2006) who identified the distance between the knower and seeker as an important condition for translating ideas because it is attributed with high specificity. This suggests that finding ways to reduce the geographical or spatial gap between the knower and the seeker may reduce the specificity of knowledge. For example, neighbouring regions may have a higher success rate in KT between them than regions far apart.

In summary, the findings discussed here contribute to the understanding of knowledge specificity as a knowledge characteristic-level barrier to KT, by confirming its significant influence on the stickiness of KT due to distance (Szulnaski, 1996). Although the data only suggested one specificity-related factor to KT barriers, AR participants identified this factor as an issue. This construct was considered a limiting factor to attempts at transferring distanced knowledge across national borders.

### 7.11.5 TACITNESS

This study argues that knowledge tacitness is a knowledge characteristic level construct that may represent a root cause of KT-related barriers. Tacitness is defined as hard-to-codify accumulated knowledge and skills that are gained from experience (Hakanson, 2007; Haas and Hansen, 2005; Nelson and Winter, 1982; Polanyi, 1966; Reed and DeFillippi, 1990; Szulanski, 1996). Scholars researching the area of tacit knowledge characteristics have found that tacit knowledge has impedance attributes relating to the KT process and such impedances may perform as knowledge flow blockages (Simonin, 1999; Szulanski, 1996; Winter, 1987; Zander, 1991). The practical outcome of this construct is that knowers and seekers face difficulties from an input as well as an output measure. From a KT input perspective, both the knower and seeker need to manage the tacit-tacit socialisation process (Nonaka and Takeuchi, 1995). From an output perspective, the seeker needs to externalise and contextualise the acquired tacit knowledge for it to be useful (Nonaka and Takeuchi, 1995). In the context of KT barriers, the following data examples provide evidence of underlying theoretical concepts.

First, the data (code: [3.3.3.1] Difficulty of expression) supported several existing theories of tacitness. AR participants regularly tried to illustrate the difficulty in expressing what they know as an output measure. They also observed the knower to face difficulties in explaining what they knew in a way that made sense to the seeker as an input measure. The following quote is one of many illustrations that show how AR participants struggled to explain a concept and failed to do so: “It’s [some sort of tacit knowledge] difficult to explain [pause], what I’m trying to say is that [pause], maybe I’ll try to think [pause] of an example [to explain it], later on.”

The AR participant was often unable to explain his point. This event reveals an inability to express tacit concepts that was due primarily to the tacitness of the knowledge being discussed. This creates a communication breakage in the KT process and supports the Tacit Triad model suggested by Polanyi (1966). He suggested that tacit knowing is difficult to express because it rests on two conjoint constituents: focal and subsidiary awareness, that are intrinsically linked via every person holding tacitness in his or her knowing. Difficulty lies in the switching mechanism between the focal and subsidiary mindsets. Polanyi's theory, supported by data findings, explained the two-level consciousness that causes difficulty in expression. In the example above, the respondent appeared to be seeking subsidiary awareness in his subconscious to find a suitable example, but failed to do so. The data supports Polanyi's theory that subsidiary awareness is a barrier to tacit KT.

Second, the data (code: [3.3.3.3] Personal ownership of tacit knowledge) extended existing theories of tacit knowledge. An important attribute of knowledge of tacit nature is its intrinsic relatedness to its possessor (Nonaka and Takeuchi, 1995). Tacitness ties knowledge to the individual where the knower, being part of the tacit triangle, represents an input KT barrier. The underlying concept is that knowledge is tied to the knower, which makes it difficult to separate them. This is considered a KT barrier because staff may decide not to use their tacit knowledge at work. For many different factors, a researcher may hold on to his knowledge without anyone having the ability to extract such knowledge. The following quote illustrates how an AR participant saw this challenge as a tacitness obstacle to KT: "There is no way [for the organisation or staff] to force someone internal here [holding valuable tacit knowledge] to give [away their] knowledge [to their internal colleagues]."

The quote above is about motives for KT. Not only is tacit knowledge difficult to separate from the knower, but this may also extend existing theory such as Szulanski's (1996) on stickiness, to the issue of whether the knower wants to allow this separation to take place. Therefore, if knowledge is difficult to separate because it is tied to the knower, then knowers may use that as an excuse if they do not want to

share. Hence, a link is established between personal motives and the issue of separating tacit knowledge from the knower.

Third, the data (code: [3.3.3.2] Unlearning tacit knowledge) revealed a new perspective about knowledge tacitness. A problem that is not well recognised in the literature is that there is a KT barrier not only when knowledge is tacit, but also when new tacit knowledge is to replace old tacit knowledge. AR participants have spent decades in some engineering areas applying the same tacit knowledge that became part of their subsidiary knowledge. The replacement process is considered a KT barrier because any effort to replace such old tacit capabilities with newly enhanced capabilities can represent a challenge to the seeker. This is an output measure KT barrier because it occurs when researchers try to use the knowledge transferred. In practical terms, new tacit knowledge becomes somewhat lost in its application where the seeker who learnt it cannot easily replicate it, so the seeker feels forced to go back to the old subsidiary tacit knowledge. This makes the KT process fail in terms of the output measure. The following quote provides evidence that researchers face this difficulty:

If you develop a project with a partner [from overseas] and you can't repeat it [you can only repeat what you were used to before] then this is not real development [and not successful KT]. I hope you agree with me.

There seem to be two coexisting dimensions in this context: (1) the ability to replace the old tacit knowledge with the new tacit knowledge so that going back to old knowledge is unnecessary, and (2) the capability of applying the new tacit knowledge immediately after acquiring it. If this capability is low it may indicate that some knowledge elements are missing, and prevents the use of the knowledge. This occurs most in the context of tacit knowledge because the issue here is the knowledge characteristics rather than the individual. This contributes to a new understanding of knowledge tacitness and its impact on KT activities.

In summary, findings contribute to the understanding of knowledge characteristic-level barriers to KT from a tacitness perspective. The data above confirms the influence of knowledge tacitness on the knower's ability to transfer knowledge efficiently due to difficulty of expression. The above data revealed monopoly issues



related to the refusal of knowledge owners to release their tacit knowledge (i.e. separating tacit knowledge from the knower). Another key finding is that the KT capability might be highly associated with the ability to replace new with old tacit knowledge by unlearning the old knowledge. Conducting a tacit-tacit transfer of knowledge seemed highly associated with the ability to unlearn previous tacit knowledge.

### 7.12 INDIVIDUAL-LEVEL BLOCKAGES

The individual-level analysis was the most complex and rich. Individuals aggregate to the organisational level but in themselves are complex beings. Although it represents only one of the five levels of analysis (knowledge characteristics, individual, organisational, national and international levels), this level of analysis emerged into a lengthy coding task that captured over 50% of the analysis content in this cycle. Individuals may become barriers to KT activities. This is especially true when their experience and understanding of KM is limited. In the following discussions, I follow the knowledge blockages analysis model of Figure 7-4 to explore the fundamental theoretical constructs that are believed to affect knowledge flow on the individual level at the case study organisations.

KT between individuals takes a considerable focus in the KM literature (Probst *et al.*, 2001). Both the knower and the seeker are individuals required to be socially motivated, committed and capable of participation. Themes relating to KT in this level of analysis include: (1) capability, (2) motivation, (3) psychological contract and (4) relationships. Further disaggregation into sub-constructs is presented with a theoretical discussion.

#### 7.12.1 CAPABILITY

In this study it is argued that capability is an individual-level construct that may be a root cause of KT-related barriers. Capability refers to the individual's ability to send, receive and internalise knowledge within the KT process. The individual capability construct is disaggregated into further sub-constructs. These sub-constructs are: (1)

absorptive capacity, (2) innovation, (3) skills, (4) communication, (5) social capital, and (6) work intensity. The literature review in chapter 2 suggested that the creation of a capable engineering workforce is the result of building engineering skills, communication efficiency, socialising individuals, innovative habits, focus on productivity, work intensity, and absorptive capacity. In this section, I will explore how the data findings and practical analysis, presented in Appendix E, link to theoretical models in the literature.

### 7.12.1.1 ABSORPTIVE CAPACITY

In this study it is argued that absorptive capacity is an individual-level capability sub-construct that may be a root cause of KT-related barriers. Individual AC is defined as the personal capability to assimilate knowledge while seeking it within the limits of the bounded rationality (Grant, 1996; Simon, 1991). Classifying AC as an individual capability is controversial as some consider it an organisational-level process. Lane *et al.* (2001) support defining AC as an individual capability because classifying it as a resource is problematic, since it treats absorptive capacity as a static resource and not as a capability. The concept of AC has been used in KT studies since the early stages of the field (Cockburn and Henderson, 1998; Lane *et al.*, 2001; Tsai, 2001). The practical outcome to this construct is that seekers require a considerable level of prerequisite knowledge as an input to the KT process. If seekers do not have the necessary level of knowledge to enable them to engage in the KT process, this will create a barrier to the KT process from the outset. In the context of KT barriers, the following data examples provide evidence of underlying theoretical concepts.

First, the data (code: [4.2.1.14] The coping ability between internal and external researchers) supported several theories of AC. The perception articulated by participants was that novel research required them to absorb knowledge too fast, which was a KT barrier for them. The following quote illustrates this issue: “We [organisation Y] share a lot of the blame [for KT inefficiencies] and the low speed [of KT] is from our side [the knowledge seeker, as opposed to the side of the knower].”

The above quote shows that there exists a difference between the Sending Transfer Capacity (STC) and the Receiving Transfer Capacity (RTC), which is resulting in the delay of the KT process (Simonin *et al.*, 1999). The data suggests that this has impacted KT from an output measure perspective. AR participants felt overwhelmed by external experts' STC. This supports the theory of Hamel (1991), who stressed the importance of aligning KT between the knower and the seeker. The knowledge compatibility of individuals in this regard is thus a factor to KT success, particularly in terms of time taken to share knowledge.

Second, the data (code: [4.2.1.6] Work pressure and [4.2.1.7] Pace of research activities) extended existing theories on absorptive capacity. From the knower's perspective, he or she must ask how can the knowledge seeker understand me? The knowledge seeker must ask 'how can I combine the new knowledge with my existing knowledge quickly before knowledge starts to decay?' This means that while the KT input side encompasses actions of the knower and seeker, the output side encompasses the actions of the seeker only in using the absorbed knowledge. The following quote illustrates this challenge as a KT barrier:

Yes [to absorb knowledge, you need] motivation, discipline, spending time, all of these. It is not enough to be motivated; you have to be disciplined, time persistent, working hard, all these together, but this is not available here.

The knower would not have a role in the above, which brings focus to the output side (knowledge usage) and specifically to the time interval between receiving and using knowledge. The above quote shows that work intensity and time are needed to retain absorbed knowledge. This is not happening in the situation described by the AR participant, which is a barrier to KT. The data findings extend the theory of the input-output model for AC by Zahra and George (2002) in that knowledge decays when not in use. Especially when knowledge is first acquired (when it is fresh in one's mind), the data showed that the time interval between seeking and using knowledge had a significant impact on AC (Massingham, 2012). If the knowledge acquired from the knower is not used quickly, the knowledge loses context and eventually cannot be assimilated. The seeker will fail to capture all of what the knower tried to transfer. Work intensity, in this context, explains the individual's willingness to use or apply the knowledge received immediately so that it is more likely to be retained.

Third, the data (code: [4.2.1.4] Impact of age on absorptive capacity) revealed a new perspective of absorptive capacity. Internal mature AR participants viewed younger researchers as sharing low absorptive capacity. They preferred to work with people of their age to avoid wasting time. The following quote illustrates how the AR participant linked the time taken to absorb knowledge with age:

It's obvious that we have young researchers who are starting their research careers and if the technology is difficult or complex then it will require them a long time to [reach the point where they are able to have this knowledge] be acquired and be applied.

The comment implies that if mature researchers were attempting to assimilate a new technology then it would be faster, which contributes a new dimension that relates age with absorptive capacity, thereby impacting on KT efficacy.

In summary, the findings contribute to the understanding of absorptive capacity as an individual capability barrier to KT by confirming its effect on knowledge seekers from an input measure perspective and the overall KT from an output measure perspective. The differences in the speed of KT between partners confirms an impact on AC, and thereby KT. In other words, if the seeker's capacity to learn (RTC) is too low, they will not be able to learn fast enough to keep up with the knower's capacity to teach (STC). The findings also extend theory on KT due to work intensity. A new perspective which relates AC levels to age was found as a possible KT barrier at the host organisations.

### 7.12.1.2 INNOVATION

Innovation in this study is an individual-level capability sub-construct that could have a root cause effect on KT-related barriers. Innovation is defined as the process of converting existing knowledge and ideas into a new benefit, which may be a new or improved technological product, an end user service or an internal business process (McNabb, 2007). Research centres at the Saudi research organisations realised the key importance of innovation to their businesses. When I was interviewing a research

centre director at Organisation Y, he felt my focus in the discussion should be more on innovation than on KT because he felt it was more important:

I see that you are asking me many questions about knowledge and knowledge transfer, but you have not touched enough about a very important thing; innovation. This is the heart of our work.

This indicates the participant's awareness of the significance of innovation as an output measure to KT efforts because innovation usually comes from individuals based on what the individual already knows (McDonough *et al.*, 2008). If individuals know little about a domain of interest, then it is reasonable to expect little innovation. This is why KT is as important as innovation to host organisations, because KT enables innovation. In the context of KT barriers, the following data examples provide evidence of underlying theoretical concepts.

First, the data (code: [4.2.2.4] IP support services as a motivator to innovation) supported several theories of innovation. AR participants explained that they feel discouraged from innovating due to the lack of innovation support services. Researchers will not innovate because the path to commercialisation is frustrating or in some cases does not exist. The data shows that the individual researcher is restrained from commercialising his or her research ideas independently, which is a demotivator to them because it acts as a barrier to the output of their KT activities. The following quote illustrates how research is held from being commercialised:

I'm talking about not taking research to the next level [commercialisation]. There is no spin off accomplishment yet ... but hopefully in the coming year because there is a great [individual] potential. A great, great, great potential.

As the researcher experiences frustration with the way his or her innovative output is controlled, they feel that IP support is an individual level demotivator. The data findings confirm that researchers feel inadequately supported by IP services to drive the innovation process forward. This supports how McDonough *et al.* (2008) called for an overall organisational 'strategic alignment' with individual innovation. The above finding confirms the need for this alignment down to the individual.

Second, the data (code: [4.2.2.3] Shortage of human resources) extended existing theories of innovation. In scientific applications, innovative solutions require an interdisciplinary perspective, which if not available, could be a barrier to the individual who has a KT output to innovate. The individual may see this condition as a barrier to his or her KT output and this may result in knowledge decay. This would affect the development of the individual as well in the long term. For example, when an individual does not have the opportunity to work with like-minded colleagues, the transferred knowledge to such an individual cannot be innovative because there are not enough other researchers to convert the knowledge into an innovation. The following quote by an AR participant illustrates how resources (manpower) in the sense of insufficient critical mass is causing a problem:

If we [Organisation Y] are opening the way [for external organisations] to collaborate here [to seek innovation], we don't have the manpower [needed for the innovation process]. Manpower is limited here ...

Having a certain number of specialists to build redundancy within the group (i.e. overlapping knowledge domains) seems to be necessary for the individual to be able to release their innovative power. The shortage of human resources creates a KT barrier. This implies that there are two steps to create innovating individuals: (1) having the right number of like-minded colleagues, and (2) allowing those minds to explore their collective creativity through individual-level KT. If the first is not available, the latter cannot materialise. This is supported by McDonough *et al.* (2008), who found that lack of overlapping knowledge impedes innovation activities. The data findings may extend the notion of McDonough *et al.* (2008, p. 55) “the less we know, the more we limit the process of innovating” to become *the less knowledge is overlapping between individuals*, the more we limit the process of innovating.

Third, the data (code: [4.2.2.2] Connection with the local industry) revealed a new perspective about innovation. In trying to understand innovation, McNabb (2007) explains:

[Innovation] ... implies something entirely new ... Innovation can also mean new uses for old or existing tools, materials, and/or processes. A primary goal of knowledge management in the public sector is to induce innovation in government agencies.

Innovation therefore requires new knowledge to make new things or improve existing things. Innovation is therefore an output measure to KT. The practical outcome of this construct is that seekers need innovation as a capability to exploit and create new knowledge from the knowledge they acquire. If innovation capabilities are absent from the seeker, then this can be a barrier to the KT process because the seeker will not be capable of making sense and applying what he or she has learned. AR participants found that innovation comes about from intensive KT from external experts. Most respondents found the intensity of engagement with external experts was low. The following quote illustrates how one AR participant links the success of KT with the local industry through realising innovation, which is currently absent:

You see, right now [pause] I cannot say we are working with them [local industry]. ARAMCO now is going in a different direction than us. They want to produce [solar] panels but we are mostly trying to study and do research. Our objective and mission is to really solve the problems that is coming with applying this technology.

The quote reveals that the innovation path of host organisations and the local industry are different. This is a barrier to KT because individual researchers from the two sectors cannot exchange knowledge because their organisations expect different outcomes from the KT process. This is therefore a barrier to the individual because people will not find meaning and purpose in seeking innovation from external KT in such conditions.

In summary, the findings contribute to the understanding of individual innovation as an individual capability-level barrier to KT, by confirming the importance of this measure as an output measure to KT activities, especially related to IP support. The findings also stress the importance of knowledge overlapping or redundancy (Nonaka and Takeuchi, 1995) between individuals. It is needed to create innovative output from KT. The data also suggests that individuals from host organisations need to find local industry researchers who have similar innovation-related objectives. A KT barrier to researchers occurs when the innovation focus of the local industry is different in scope from the focus of host organisations.

### 7.12.1.3 SKILLS

In this study it is argued that skills are an individual-level capability sub-construct that may be a root cause of KT-related barriers. Individual skills are defined as the practical element of tacit knowing (Polanyi, 1967). The practical outcome of this construct is that seekers require skills as an input measure to perform well in KT activities. As skills are related to tacit knowing, it is profoundly an individual-level capability. There is a barrier to the KT process when individuals involved in the process lack specific skills that KT builds upon. In the context of KT barriers, the following data examples provide evidence of underlying theoretical concepts.

First, the data (code [4.2.5.8] Benchmarking individual skills) supported several theories of individual skills. The data shows that researchers do not have self-assessment tools to benchmark their individual skills to inform them as to how well equipped they are to begin engineering research work. A US scholar engaged in external-to-internal KT with host organisations stated the following quote:

[T]hey [researchers at host organisations] don't have a good knowledge of the techniques required for handling these molecules. They don't have much activity in this area and so I encourage them to come to [the US organisation] and spend some time in my laboratories to practice those techniques

Given that many do know that they have a gap of some sort, they tend to lose interest in research because they produce little tangible results, while the root-cause is lacking some tacit techniques in experimentation work. As a result, their learning and KT declines because there is no input measure for their skills that could reassure them that they are capable of entering into the KT activity. This supports Hamel (1991) who found that it was important for the researchers to measure their skills position. The reason for such a measure is that without it, the recipient may be unable to identify, if not retrace, the intermediate learning 'steps' between the existence competence level and that of the partner. In such cases, the KT may be negatively affected. By identifying (measuring) the skill set of the seeker against a benchmark, the intermediate learning steps can be identified and provided to the seeker before the KT process to align with the skills set of the knower, removing a KT barrier.

Second, the data (code: [4.2.5.13] KM skills capability for managers) extended existing theories of individual skills. AR participants found soft skills to be as



important as technical skills such as engineering experimentation and testing skills. This distinction contributes to Nonaka and Takeuchi's (1995) distinction between technical and cognitive knowledge. Respondents, however, pointed to their supervisory staff as the most important influence in terms of having soft (KM) skills to make KT successful. This means that not all staff need KM skills – only the ones who supervise. The data shows that middle management can play a vital role in KT as 'knowledge engineers' (Nonaka and Takeuchi, 1995). The following quote shows how one AR participant wants to see KM experienced managers to lead their KT effort: "I would recommend a specialist person [in KM] to handle this one [managing KT activities]. I will explain to you why: because it [KT activities] needs experience."

This extends the work of Brown and Duguid (2001) who found a need for organisational staff to master both KM skills (soft skills) and engineering skills (hard skills) for a successful KT to occur. Although the data confirms this need, it extends our understanding to show that the selection of specific individuals to acquire the KM set of skills may be more economical and may provide the same expected outcome.

Third, the data (code: [4.2.5.15] Reconstruction of research) revealed a new perspective about individual skills. AR participants provided an insightful three layer model for acquiring technical skills: (1) live experimentation with the expert, which is the ultimate method in effectiveness of transferring skills, (2) oral discussions with the expert, which were considered effective, and (3) written documents such as publications, which were seen as ineffective. The following quote shows how oral discussions can replace live experimentation while written documents cannot:

[I]n publications all the time they don't mention critical issues. They keep it closed, even though they claim everything is there. Once you try to replicate what they are doing, you will find yourself in a really different world. People as they give you a talk, can provide you more information by the way, because they can tell you more tricks, but verbally. So, you should be wise to grasp it very very well and implement it as much as you can.

This comment shows that the seeker is satisfied with the oral method of transferring skills. To support this perspective, the knower may not be able (or willing) to codify his or her skills but may be willing to talk about it in oral words. Whether this is a capability issue or a strategic choice by the knower, it is critical to the seeker to

approach the knower in the most effective way. This new finding explains that technical skills may be better acquired via socialisation rather than codification.

In summary, the findings contribute to the understanding of skills as an individual-level barrier to KT, by confirming that skills are personal and subjective. Data findings suggest a need for clearly benchmarked measurements to allow individuals to measure their skills. Skills were linked with experience by proving that skills acquisition should not be sought only through short training seminars; rather, on-the-job training is a better option because it involves practice, repetition, and exposure to different forms of the same task. A new perspective was provided to suggest that the ability of researchers to reconstruct their research projects once they complete a KT activity was an important skill, and evidence to the success of KT activities.

### 7.12.1.4 COMMUNICATION

In this study it is argued that communication is an individual-level capability sub-construct that may be a root cause for KT-related barriers. Individual communication is defined as the appropriate sharing of information (Emery and Purser, 1996). Communication between individuals can be problematic, and weak communication is inappropriate for sharing of information, and hence, it is an impediment to KT. The practical outcome for this construct provides an input measure that could support KT activities. In the context of KT barriers, the following data examples provide evidence of underlying theoretical concepts.

First, the data (code: [4.2.3.1] Proximity, tools and allocation of resources) supported several theories on communication. At the host organisations, the distance between host organisations as knowledge seekers and knowledge providers is substantial. Having a day meeting requires weeks of preparation, visas, bookings, internal administrative paper work and approvals. One AR participant from Organisation Z stated: “In order for me to attend a conference in the US, I will need two months of preparation, at a time where a researcher in the US can attend it during his weekend.”

The above comment illustrates how the ability of researchers to communicate with external experts is difficult and limited. The data shows that a situation where communication is difficult implies a corresponding difficulty in KT. Similar propositions in several theories are supported by this finding. For example, it supports the view of Sorenson *et al.* (2006) who found that high-fidelity transmission gives proximate actors sufficient insight to receive and build on knowledge, whereas more distant actors fail. This finding confirms that physical proximity is a significant barrier to KT, particularly for external to internal knowledge flows, and emphasises the spatial dimension of KT.

Second, the data (code: [4.2.3.4] Frequency and depth of communication links) extended existing theories of individual communication. Reciprocity is a term used by communication scholars to explain how giving and taking knowledge enhances communication effectiveness (Rogers and Kincaid, 1981). It is based on social exchange theory, i.e. if you give you shall receive. Schulz (2001) argues that the increase in communication frequency and depth, resulting from reciprocity activities, increases knowledge flow speed. This implies that providing more information influences KT by increasing knowledge sharing (Schulz, 2001). This finding confirms the importance of communication in KT, and extends theory by emphasising the importance of reciprocity in developing quality communications that are necessary for effective KT.

Third, the data (code: [4.2.3.2] The individual authority) revealed a new perspective about individual communications. An inability to establish formal communication between individuals due to their limited authority to communicate with other individuals can eliminate KT possibilities from the outset. The frustration that individual researchers feel due to this constraint is considered an individual-level KT barrier. The following quote illustrates how individual researchers are not authorised to communicate with each other: “At the moment, there is no communication between individuals in research institutes [including host organisations] in Saudi Arabia because they don’t fall under one umbrella.”

The AR participant is implying that a researcher in one organisation in Saudi Arabia would not communicate with someone else in another organisation because they are not in the same organisation. Individuals would need to seek approval to do so, which is something researchers feel frustrated about and do not want to do.

In summary, the findings contribute to the understanding of communication between individuals as a capability-level barrier to KT, by confirming that distance between the knower and seeker influences individual communications. The concept of reciprocity was also found to extend our understanding of how individual communication enhances knowledge sharing. A new perspective also showed that individual authority may decide how individuals communicate. Based on their authority or position, they may tend to take different communications approaches. This includes frequency, depth and type of communication.

### **7.12.1.5 SOCIAL CAPITAL**

In this study it is argued that social capital is an individual-level capability sub-construct that may be a root cause of KT-related barriers. Social capital is defined as the “sum of actual and potential resources embedded within, available through, and derived from the network of relationships possessed by a social unit” (Gold *et al.*, 2001, p. 189). A social network is defined as a set of actors and relations which connect the actors together to form an idiosyncratic structure (Emirbayer, 1997). Actors usually are individuals who use their individual capability to build a social network to generate individual social capital (i.e. knowledge). As knowledge is the most important resource of social capital, it represents the knowledge generated from social networks at work (Massingham, 2012).

Individual-level social capital may be aggregated to the level of teams, departments, or organisations and may become available for transfer on these levels. The practical outcome of this construct on the individual level is that seekers can use their social capital to develop a larger base for communication, thereby increasing the input measures to KT. When individual social capital is small, a barrier to the KT process

emerges because it limits the nodes or connections that facilitate knowledge flow. In the context of individual-level KT barriers, the following examples provide evidence of underlying theoretical concepts.

First, the data (code: [4.2.6.1] Managing different generations) supports several theories of social capital (Gayen *et al.*, 2010; Fernandez *et al.*, 2000). The majority of host organisations are mature organisations with decades of stable numbers of staff and research capacity. Suddenly, however, these organisations began to hire researchers in large numbers and to expand their scope of research, resulting in an ‘old guard’ remnant of the previous period. This generation is similar to the baby boomer generations in the US and Europe. The data suggests the new and the old generations are fragmented into isolated ‘cohorts’ (Gayen *et al.*, 2010) and the previous ‘old guard’ are not able to connect within a social network of a younger cohort, hence affecting KT activities. The following quote provides evidence from a mature researcher who sees little value in socialising with young researchers:

Most of the researchers at this centre are young and they are still new in their field. They are still doing their masters, and in the future, they will be doing their PhDs ... Second thing is that most of them get their knowledge from the same sources that are not much different ... they have almost the same background [laughs]. In terms of knowledge transfer, it would not make sense.

Age created a barrier in terms of personal relationships and resulted in weak ties between people in the two groups. When junior researchers develop social networks in isolation from the social networks of mature researchers, an important knowledge source becomes absent, weakening the dynamics of the internal-internal KT. The reason for such weak ties between the two networks is the cultural divide and tensions that emerge from internal politics. As a result junior researchers start learning by doing instead of getting help from older researchers, which slows the knowledge flow. This confirms that weak network ties between the social capital of the knower and the seeker slows KT. The data also confirms that both cohorts are negatively affected by this situation in different ways. Older cohorts usually lose status from being less recognised and asked for advice, while younger cohorts lose the wisdom of older cohorts and the opportunity for effective KT. This data finding supports Gayen *et al.* (2010), who developed several theories on the impact of young cohorts and

older cohorts co-existing in an organisation, and suggested that such impacts negatively influence the workplace.

Second, the data (code: [4.2.6.2] Expatriate social isolation) extended existing theories of social capital in multinational organisations such as the host organisations in this study. Similar to the first finding on age cohorts, local researchers and expatriates working internally have little or no social networks in common, and so they are not able to establish their social capital. This is a barrier to individual KT. The reason for this barrier is the existence of isolated cultural islands (Schein, 1987). Another reason for this KT barrier is that expatriate staff are more serious in their work and fundamentally differ from local staff, who prefer more informal social settings, thus social orientations are different and difficult to align within a single network. The following quote shows the AR participant, who works at Organisation X as an expatriate staff, feeling isolated because socialising with locals seems unproductive: “I work here and sometimes I talk with them [Saudi researchers] but less than one hour in a day. I think I spend most of my time on my work and projects. I have many things to do.”

As an input measure to KT, this situation creates a barrier to KT because local researchers lose the opportunity to build their social capital from expatriate staff, which defeats the purpose of bringing in expatriate researchers to the host organisations. A highly ranked official from Organisation Y confirms this condition by stating, ‘I still see some loners, who are working in isolation’. The context of this quote was mainly about expatriate staff wanting to work in isolation from locals. The above comments imply that host organisations share the predicament of social isolation among their internal researchers, which identifies that the weakness among internal staff is based on the condition of their social capital, which creates inefficiencies in internal-internal KT processes. This extends our understanding of the effects that nationality bring to individual social capital within the context of KT.

Third, the data (code: [4.2.6.3] Social capital and trust) revealed a new perspective about conceptualising social capital. Social phenomena are very different in the West and the East. In order to understand the differences, it is important to understand the

difference between achievement and ascription. While achievement means you are judged on what you have recently accomplished and your track record, ascription means that status is attributed to you by birth, kinship, gender or age (Trompenaars and Hampden-Turner, 1997).

If we look at ascribed status versus attained status, we may find that the East has more of the first descriptor, while the West has more of the latter descriptor. The way staff in Saudi organisations use ascribed status for internal social capital may bring a new perspective to how social capital is understood. For example, they ascribe more status to Westerners simply because they are assumed to know more. In this sense, social capital has an ascribed status dimension. This is a major difference with the West because an individual will probably not be assumed to be knowledgeable simply because he or she is from a given country. The likelihood that people possess a status that they do not deserve is thus high in ascribed cultures, which may invalidate many socially related assumptions. The management literature focuses on Western societies. However, social capital in Saudi organisations differs in the way it is formed. The old adage applies: “It is not what you know, but who you know”.

When comparing between the Middle East and the West in how people create relationships, Westerners mostly know each other on the basis of business, friendship and perhaps family relationships. However, social networks in Saudi Arabia are formed on the basis of religion, ideology, gender and family relationships, which is far larger than the ones found in the West. There are variations of course in between Western countries themselves but the point is the overall perception. The ascribed status theory applies from a reverted perspective in Saudi Arabia because people may be assumed to be dishonest, illiterate or wise purely because of nationality or ideological attributes. The following quote illustrates how the AR participant perceives the impact of this issue on social capital in Saudi Arabia: “Let’s go back to the trust. I think some researchers here trust researchers from outside [western researchers] more than the local [Saudi researchers]”. Although trust builds on time in a relationship with stable and reliable interactions, this quote implies that local researchers trust western researchers more than local peers based only on nationality.

The quote above suggests that while the status ascribed to Western researchers was positive, it impacted on social relationships with local colleagues negatively because they would not trust them just because they were not fellow citizens. With this understanding, the way social capital is constructed may be better understood.

In summary, the findings contribute to the understanding of social capital as an individual-level barrier to KT, by confirming and extending existing theory about the input and output measures for managing different cohorts and the isolation of expatriate workers. A new perspective to enhance our understanding of social capital at host organisations was found to relate social capital to ascribed status versus attained status.

### **7.12.1.6 WORK INTENSITY**

It is argued in this study that work intensity is an individual-level capability construct that may be a root cause of KT-related barriers. This construct emerged from the data as a grounded finding theme. The initial model for KT barriers did not consider work intensity as a significant influence on KT at host organisations. However, the recurrence of this concept in the data validated its importance. In this way, the construct emerged from the data in a grounded theory sense. Work intensity represents the work effort and occupational commitments in precise time periods as the work circumstances dictate (Schulz, 2012). The practical outcome of this construct means that seekers will have the capability to absorb more knowledge in less time because they will intensify their individual knowledge-seeking pattern to a level that increases incoming knowledge. On the other hand, lower work intensities create a barrier to the KT process. In this context, the following data examples provide evidence of underlying theoretical concepts.

First, the data (code: [4.2.4.2] The push strategy) confirmed several relevant theories of work intensity (Schulz, 2012; Katz, 1978). The data shows a passive-aggressive situation in the individual-level work intensity sub-construct. Researchers believe that work intensity cannot increase due to push strategies because appropriate workflow routines do not exist. They feel that their disorganised workplace does not provide



them with a sense of control and this prevents high work intensity, despite management pressure. They feel that work intensity requires better workflow routines to allow a fast pace. The following quote illustrates this situation as a barrier to KT:

The interest is there [for KT] but the willingness and dedication is not. I think hard work and good preparation are important factors. We need to organise. We are not really learning from other countries experience to make the performance high... If you don't have a clear and detailed plan for the project and how to meet the targets then you will face problems.

This supports Katz (1978) who suggests that standardising workflow results in less stressful conditions, which may encourage increased work intensity. The data shows that there is a lack of established research habits that could streamline workflows and poor individual coping methods. There was a sense of frustration among respondents about how their organisation decreases their sense of control because it lacks suitable routines, behaviours, coping mechanisms, and work flows. This establishes a link between those measures and work intensity, all of which frustrate people and slow the intensity of their work. This finding extends theories on locus of control and employee satisfaction by suggesting that the more a sense of personal control (Rotter, 1966) and satisfaction (Locke, 1976) is established among staff, the more capable they will be of increasing their work intensity.

Second, the data (code: [4.2.4.1] Low dedication of local researchers) extended existing theories of work intensity. Work life in knowledge-intensive organisations is often described as stimulating (Ipsen and Jensen, 2011). Stimulation in this case implies interest, continuation, connectedness and intensity. Intensity in knowledge work may therefore trigger positive behaviour in the individual, encouraging them to be interested and stimulated, but on the other hand, it may produce stressed employees when they have little guidance on how to work intensively (Kinman and Jones, 2008; Ipsen and Jensen, 2011).

The above argument implies two things. First, that knowledge work should create stimulation. This can either take the form of personal outcome expectancy, which means researchers feel that their work matters or it can take the form of collective efficacy belief, which means that researchers feel that their work colleagues are capable. Second, it implies that the organisation does not provide sufficient guidance

on how to use that stimulation to work intensively. This can mean there is either too much autonomy or a lack of control. The absence of operating procedures or policies may contribute to poor guidance and stress.

The output measure here in the context of KT suggests that researchers need to know how to use their stimulation to engage in KT activities to produce creative work outcomes. The individual-level barrier in this case is the frustration that staff experience when their motivation and behaviours are affected by organisational failures. Such work intensity and productivity frustrations are considered individual-level KT barriers. AR participants observed that Saudi researchers simply do not know how to work more intensively, a product largely of ingrained work practices. This issue is inextricably linked to dependence upon foreign expertise and labour in Saudi research organisations.

Third, the data (code: [4.2.4.1] Personal financial conditions of researchers) provides a new perspective about work intensity. The following quote describes how KT activities are slow due to lack of work intensity: “[M]any people [researchers and support staff] don’t work hard. I think the people in [host organisations] are very rich and they don’t work hard because they don’t need to work hard”. The personal wealth of staff is not an organisational problem; rather, it is a good sign of national prosperity. However, it may create an individual-level barrier to work intensity because it ties to the intrinsic versus extrinsic reward debate. Work intensity in this case must be correlated with intrinsic rewards because the data shows that money does not really matter as a motivator for wealthy people. This may also link to national culture (i.e. high personal wealth) that lacks valuing intrinsic rewards. These interrelations suggests that the actual problem (i.e. root-cause KT barrier) is not work intensity but it may actually be lack of intrinsic rewards.

In summary, the findings contribute to the understanding of individual work intensity as a barrier to KT, by confirming that researchers tend to retaliate and engage in counter-productive practices when faced with push strategies toward work. Perceptions concerning the host organisation as a government or non-profit entity add up to individual unwillingness to engage in hard work, which is also linked to the stereotype in many developing countries including Saudi Arabia that government

workplaces are laid back environments. Another data finding relates to the socio-economic wealth of the region in that researchers feel a lack of motivation to intensify work habits.

### 7.12.2 MOTIVATION

It is argued in this study that motivation is an individual-level construct that may be a root cause of KT-related barriers. Motivation of individuals is defined as “those psychological processes that cause the arousal, direction and persistence of voluntary actions that are goal oriented” (Mitchell, 1982, p. 82). Motivation can be an individual-level barrier to KT because it affects the willingness of knowers to share their knowledge, and also the willingness of seekers to receive knowledge or learn from knowers. In this section, I will explore how the findings and practical analysis presented in Appendix E (Tables 4.3.1–4.3.5) link to theoretical models of motivation in the context of KT.

There is evidence from the data that the host organisations have a considerable number of researchers with roles and responsibilities that lack job enrichment. An enriched job is considered motivating when the abilities of the individual align with the responsibilities given. Under these conditions, the individual is able to engage and contribute to the assigned tasks. When the gap between ability and responsibility is significant, motivational factors cannot help because the placement of the individual was incorrect. A perfect alignment is not possible because business dynamics require constant changes to roles and responsibilities that require continuously changing abilities. However, when the gap is reasonably manageable, certain factors can help their alignment. When those factors are absent, barriers emerge which widen the gap and create problems, including KT issues. From the findings in the context of individual motivation, four sub-constructs emerged to influence the motivation of researchers to engage in KT activities: (1) leadership practices, (2) rewards, (3) recognition, and (4) personal interest.

### 7.12.2.1 LEADERSHIP

In this study it is argued that leadership is an individual-level motivation sub-construct that may be a root cause of KT-related barriers. Yukl (1999) defines leadership as ‘the influence exerted over other people in a group or organisation’. The practical outcome to this construct is that seekers are motivated to engage in KT activities if the leadership triggers motivating factors. In this sense, leadership is considered an input measure to this process. Leadership is a positive input for KT if it influences staff to adopt positive attitudes and behaviours – that is, teamwork and cooperation. In the context of KT barriers, the following data examples provide evidence of underlying theoretical concepts.

Staff felt differently towards their leadership, which implied that this construct is better placed as an individual-level barrier to KT. Some AR participants adopted a blaming tone when discussing who was responsible for the low level of expertise in their organisations. Others had a different view. Almost 80% of staff were critical of their leadership for reasons related to the leadership’s negative influence on strategy, culture, motivation and skills.

First, the data (code: [4.3.1.17] Inclination to micromanage) confirmed several theories about leadership’s influence on motivation. The data shows that KT activities that depend on motivated learning may be impeded by leadership practices. The following quote shows how an AR participant who is a research centre director feels about the leadership controlling his opportunity to learn: “... but I am too much controlled ... I feel as a senior researcher [that] too much control is counterproductive [to KT activities]”. This supports the findings of Marsick and Watkins (2003) who report that learning motivation is “mediated by leaders and managers who provide strategic leadership for learning” (p. 135). Other researchers at host organisations faces restrictions from doing research, as the following quote illustrates:

As I mentioned, there is no body who can carry the flag [to object being controlled]. There is a problem in [organisation Y] also, that we have good people who are teaching but they are not allowed to do research because his faculty administration wants to keep their soldiers around them.

This suggests that leaders are intervening on a micro-level on what researchers should or should not do. The faculty seems focused on optimising the parts (i.e. faculty), rather than the whole (i.e. the organisation) (Senge, 1990). Researchers want to unleash their abilities to teach, conduct research and engage with the community without having to seek approvals. Researchers provided evidence that some situations sometimes become tense and volatile, as the following quote demonstrates:

[T]here is a satellite around him [to control a senior researcher], bullying him because one VP who is very weak in his research, is blaming all the others [researchers] that they are doing the same thing for 20 years. Okay, if you [the VP] are good, and he [the senior researcher] is not, then at least do as much, do the same, let us start with this point. We will not ask the VP to be better, start like from the level of the people you criticize, and then move, but because they [leadership] are close-minded, there is more attack. Why not ask can we add more people? Let us start new areas. This is how you flourish. This is not happening. I am telling you, this is another problem. I am now a center director and if I wanted to go to a higher position, I would work short-term here until I satisfy everybody [in the leadership] to make another step up and another step up. Making people happy [in the leadership] to move up. This is also part of our problems.

The above quote illustrates the dissatisfaction of staff being bullied on a micro-level and devalued in terms of the quality of their work. Researchers are suggesting involvement and sharing responsibility in expanding the scope and scale of their research, which is termed in the literature as co-leadership (Kelly, 1988) and shared leadership (Ensley and Pearce, 2000).

Second, the data (code: [4.3.1.14] Alignment of distribution of responsibilities with set targets) extended existing theories about the influence of leadership on motivation. Researchers want to be world class but they know they are not, and they want leadership to tell them how far away they are from world class performance, and then help them bridge the gap. In order to do so, the distribution of responsibilities needs to be aligned with the targets of world-class benchmarks. However, responsibilities and targets were not clearly defined by the leadership. This allowed subjective judgments to emerge in assessing the appropriateness of responsibilities assigned to individual researchers. Conflicting views between individual researchers and their managers created motivational problems and frustrations as to who is right and what are the tools that provide objective measures of performance. This situation created a barrier to KT because researchers were no longer confident that their leadership could set their responsibilities appropriately. They felt KT responsibilities were not carefully

aligned with world-class benchmarks. The following quote describes the tension that individual AR participants felt towards their leadership:

I believe that the management of the [host organisation] should encourage institutionalising the practices that are being followed by world-class universities, and benchmark to what extent we have been following those practices... What we feel here is a [frustrating] bottleneck, in that the [host organisation] has not yet clearly identified the responsibilities of the different categories of manpower.

This left negative feelings among staff towards the leadership and consequently affected their motivation to build the internal capabilities of the organisation through KT. What is not clear here is to what extent metrics could affect the achievements of staff, if established. The data shows that AR participants take pride in their achievements but they do not have evidence to support their claims because the leadership did not institute any guiding metrics to measure achievements against world-class performance. At the same time, they feel frustrated that the leadership is not taking action on this matter.

This extends the theory of Argyris *et al.* (1985) who claim that individual employees usually assume that the leadership is responsible for undesirable results when they appear, and that desirable outcomes are caused by their own actions. The findings show that one situation in which this barrier occurs is when it is not clear as to who did what in the distribution of roles and responsibilities and in relation to the achievements made. When this happens, subjectivity emerges and as a result conflict affects the motivation of staff because their voice cannot override the opinions of their management. The problem is related to job design and a solution could be for leadership to clearly specify research performance expectations.

Third, the data (code: [4.3.1.23] Leadership requirements for collaborations) revealed a new perspective about the influence of leadership on motivation. Leaders are expected to wisely balance the interests of all stakeholders of an organisation. This means that not only should the leader consider fairness and honesty as a way forward but should also ensure that motivation is given sufficient attention. The data shows that imbalances in the actions of leadership towards different stakeholders could impact motivational factors even if those actions do not have a direct impact on the researchers. The following quote shows how a research centre director was

demotivated due to the leadership imposing fees on international organisations interested in collaborating, resulting in a decline in external-internal KT:

This is where I [local researcher] call them [leadership] crazy people. They will ask other entities [external organisations] to pay [for external-internal KT]. They [leadership] will accept to continue joint research [with external organisations] as long as they [external organisations] are putting money, and this is not right, because they [external organisations] are ahead of us, and we are behind them. We have to pay them [actually] until we reach them, so how come you [leadership] ask for money from their side to give to us? for the sake of what they are going to be giving you money?

The above event negatively impacted the motivation of the research team of a research centre in organisation Y. The new perspective here is that leaders must take into consideration that pleasing a group of stakeholders (in this case, the government) may result in demotivating their research teams. Although this is considered a new perspective for the organisation, there are relevant theories from economics on societal stakeholder balance such as the stakeholder theory and legitimacy theory (Deegan, 2009). Both stakeholder theory and legitimacy theory are part of the broader theory of political economy. The difference is that while legitimacy theory discusses the expectations of society in general, manifested as the social contract, stakeholder theory examines particular groups within society.

As a further step to examine these theories, the above arguments apply to organisations where different internal groups may have different expectations in terms of various social contracts. These social contracts need to be ‘negotiated’ with different stakeholder groups (Deegan, 2009). This is where the leadership needs to make critical decisions in balancing the needs of stakeholders. Even external researchers from overseas need to be understood. The following quote by a US scholar indicates that the matter of research collaboration goes beyond the physical value of money to a social emotion that scholars may feel obligated to maintain:

I don’t think US scholars are looking for higher pay [to come to work at host organisations]. I might be too romantic but I don’t think pay is really the issue to work with Saudi research organisations. I think they want research funding. They want to be able to do their science. We have to write a lot of grants and we have to satisfy a lot of funding agencies [in the US] and if you can make that easier [in Saudi Arabia] then that’s a great motivator.

The above quote shows that the external and internal stakeholders feel that the leadership at host organisations do not understand the stakeholders involved and have

not negotiated a social contract with them in terms of expectations and perspectives. The quotes above show that stakeholder needs are out of balance; with some stakeholders e.g. government, having more influence than others e.g. external and internal researchers. Linking leadership with the need to balance stakeholder interests may explore a new theory of leadership's role in KT motivation.

In summary, the findings contribute to the understanding of leadership as an influence to researchers' motivation to engage in KT activities. The findings show that when the leadership is inclined to micromanage, this decreases motivation of staff towards KT. The findings also extended existing theory by highlighting the importance of setting targets for motivating staff and of aligning the distribution of responsibilities with those set targets. In the context of KT, the findings provide a new perspective to motivation by highlighting the relationship between what the leadership asks the external partners to commit to and the motivation of internal staff. The findings show that when staff feel that the external partners are not fairly dealt with, their motivation decreases.

### 7.12.2.2 REWARDS

In this study it is argued that reward is an individual-level motivation sub-construct that may be a root cause of KT-related barriers. Rewards are defined as “all types of benefits, from cash payments to working conditions” (Sandelands, 1994, p. 46). The practical outcome to this construct is that seekers who trust that they will be rewarded will perform better in KT activities. The outcome of this construct is therefore an output measure. In the context of KT barriers, the following data examples provide evidence of underlying theoretical concepts.

First, the data (code: [4.3.5.3] Reliability of management towards rewards) supports several theories of motivational rewards (Senge, 1990; Eisenberger *et al.*, 1990). The following quote by one AR participant guides this discussion:



... they [the management] did not pay us [as promised] because the budget was cut. I was motivated [to participate in KT activities] because I wanted to learn not for the money [which was not paid].

This discussion is about non-monetary rewards, in this case learning. This may extend theory on personal mastery by Senge (1990) in the context of intrinsic rewards. Senge examines the potential of people by understanding their ‘subconscious mind’, ‘will power’ and ‘sincere desire to serve’. The data suggests, for example, that to motivate staff in this culture, learning is more useful than material rewards. Leadership was essentially expected to show staff that they care about their growth and learning.

Although some findings suggest that some researchers see lack of monetary rewards as a barrier to motivating staff to share knowledge, the majority of AR participants were significantly more interested in other sources of motivation as discussed above. The data showed that staff wanted managers to uphold their promises. However, if managers did not, then this might not by default incur demotivation towards KT. This is illustrated by the following quote:

The funding [promised/already approved] may stop. Like two years ago when they initiated one mega project, most of the other projects were stopped and funding went to the mega project but we still worked on our other projects [without any monetary rewards].

The above quote indicates that the dissatisfaction of researchers despite the budget cuts and the broken promise did not alter their determination to continue the KT activity because the motivator was intrinsic. Another AR participant stated: “[W]hat I am after is the knowledge itself. Being rewarded is something secondary”. The intrinsic reward in this sense is that getting funding is a measure of intrinsic reward for research performance not for the money itself as a physical commodity. This attitude by researchers confirms that monetary rewards are not the in itself the goal but rather may indirectly nurture intrinsic rewards, which then increases motivation (Kasser, 2002; Myers and Diener, 1996).

Second, the data (code: [4.3.5.1] Penalties as negative incentives) extended existing theories of motivational rewards. Penalties, defined broadly as negative incentives, may be as effective as rewards. It seems that individual managers at the host organisations were more interested in implementing punishment than reward. This

might be due to current frustrations about the behaviour of some staff or it might be a cultural factor that encourages punishment. AR participants point out in the following quote that punishment is needed perhaps more than rewards to motivate people to work as desired by the organisation:

We [organisation X] have a problem with the [reward] system. The system doesn't really reward [researchers], it does sometimes only [provide positive] reward, but it doesn't punish enough so that people perform at their best.

From an individual perspective, the frustration that this participant feels is that he is not able to rely on an effective reward system that includes punishment to control the behaviour of his staff. This is seen by the AR participant as an individual-level barrier to KT. However, in the context of behaviour towards KT, which is essentially aimed at producing innovative research at host organisations, it might be inappropriate to punish people for not sharing knowledge because the process of KT and innovating may in itself be reliant on autonomous behaviour and freedom. This view is supported by a US scholar who feels that KT should not be imposed on people rather invited to:

I am an academic so I don't really like to have requirements. I believe in academic freedom. I would hope that most of my colleagues, if not all of them, would be stimulated by discussing their knowledge and their research with others and gaining from their reactions and suggestions and input so I don't want to require it but I think it's an expectation.

This confirms the theory of Hayashi (2013) in this regard where he suggest in the following quote that the institution should primarily act as a stimulus to individuals:

Many companies have an incentive structure that unwittingly discourages innovation with strong punishments for failures but relatively weak rewards for successes. Managers should consider instituting the reverse: weak punishments for failures and strong rewards for successes, because failures are an integral part of the innovation process.

The findings show a need for punishment. This extends the theory of Trevino and Brown (2004) who found that organisations have a moral responsibility to use punishments to enforce moral behaviour. This discussion is about the consequences of non-compliance with desired KT behaviour; that is, not sharing knowledge. The KT barrier seems that the Management is confused on the use of positive and negative reward systems so that staff act favourably towards KT.

Third, the data (code: [4.3.5.4] Authority of frontline managers to reward) reveals a new perspective about motivational rewards. The data shows that frontline managers had the most positive relationship with staff in rewarding positive KT behaviour. However, frontline managers have limited authority over incentives, which spread the problem from demotivated staff to demotivated managers. The new perspective here is that lack of reward could extend beyond the demotivation of staff to the demotivation of their supervisors. The following quote illustrates how a research centre director felt helpless and embarrassed because outstanding researchers who deserved more than non-monetary rewards did not get them: “We don’t have the tool for money rewards. We can give them something else like travelling”. The effect of this is that the demotivation of staff can diffuse to both staff and managers.

The above quote reveals that managers felt rewards were a burden that caused problems for them in front of their well performing staff. This contributes to our understanding of rewards. It shows that the impact of a reward is not limited to the demotivated employee because he or she is not given a reward; rather, it may create problems along the management chain beyond the employee to higher management levels since they feel incapable of intervention. This significantly impacts the motivation of the organisational workforce as a whole. The new perspective here is that the motivation barrier can diffuse to both staff and managers. This is especially applicable to public sector organisations like the ones in this research.

In summary, the findings contribute to the understanding of rewards as an individual-level barrier to staff who are expected to engage in KT activities. The findings show that staff rewards are not simply monetary. Motivation is not about give rewards to staff and receive better performance in return from them. Rather, it is about understanding the needs of the employee and fulfilling those needs through appropriate means. Also, the results show the importance of reliability when promising rewards. A new perspective on the effects of lack of rewards was found in the link to the limited authority of frontline managers. In addition to the limited bottom-up knowledge flows, the leadership was not able to make decisions on rewards.

### 7.12.2.3 RECOGNITION

It is argued in this study that recognition is an individual-level motivation sub-construct that may be a root cause of KT-related barriers. Recognition is defined as a basic social acknowledgement of human worthiness that underlies forms of social participation that present the individual as being accepted as a member of a community (Honneth, 2008). The practical outcome of this construct is that seekers will be accepted in their organisational community based on their performance. This is an output measure of KT activities. Recognition creates a barrier to KT if both seekers and knowers feel they will not be appreciated for positive KT behaviours, such as teamwork and cooperation. An example of inadequate recognition is if a positive KT behaviour occurs but goes unnoticed by the organisation. In this way, staff become demotivated and therefore lose interest in the KT activity. In the context of KT barriers, the following data examples provide evidence of underlying theoretical concepts.

First, the data (code: [4.3.3.2] Researcher's Legitimacy as decision makers) confirmed several theories of recognition. Recognition was found to be one of the important motivating factors for employees because it supports employee job enrichment (Herzberg, 1982). Hackman and Oldham (1980) developed a widely accepted model of job enrichment that is consistent with Herzberg's model. They established a link between recognition as a job enrichment-motivating factor in which involvement in decision-making is paramount. This concept links to empowerment and democratisation in the workplace. Some associations were detected in the data findings to support theories which link recognition with decision-making. Since KT is about building internal capability, it implies a change from a given state to another. Change thus requires shared understandings, which can be realised through collective decision-making. This concept links to shared mental models (Senge, 1990). The link between recognition and decision-making signifies the importance of this construct to KT activities. The following quote illustrates how lack of involvement in decision-making is a barrier to KT at the case study organisations:

[I]f you [as a research engineer] deserved to be involved in a project, then you must have been qualified, trained and everything. So, you should be involved in such decisions [relating to KT activities for that project] as well.

The quote illustrates the need to complement being involved in research projects, and being qualified, with being recognised accordingly and thus involved in decision-making. The data supports the theories of empowerment and shared mental models discussed above. This means that the lack of empowerment and shared mental models becomes an individual-level barrier to KT.

Second, the data (code: [4.3.4.1] Time factor in developing recognition) extended existing theories on individual recognition (Honneth, 2008). It has been argued that individual recognition motivates individuals to engage in KT activities. When an individual is recognised for sharing his or her knowledge, it is likely that they will continue and increase this sharing behaviour. However, there are underlying root-cause barriers that delay this effect. In the following quote, the AR participant illustrates the time needed to build this recognition that may eventually motivate individuals to share their knowledge:

Still I'm not sure [who is recognized for sharing knowledge] ... I don't know all of them [individuals with high recognition]. It is a new [organisation] and we have to wait for another two or three or may be five years to know who is really serious and who is productive [in KT] and who is not.

This illuminates how time is an important input in the construct of recognition. Staff may require a significant amount of time to build such recognition. This may take too long and decrease motivation, thereby affecting KT activities. For example, in the period during which such recognition is built up, individuals may face being ignored until they prove themselves. This could be a barrier to KT because it undermines the motivation of some individuals. This extends the findings of Honneth (2008) who argues that recognition is highly related to social interaction and knowledge exchange. However, he did not discuss the time factor that may influence this relationship. The data suggests that the time factor often acts as a demotivator. The data also indicates that building social networks improves KT activities. Further research on how to accelerate building recognition may support KT activities through the motivating effects recognition can bring to the individual.

Third, the data (code: [4.3.4.3] Loss of recognition as a result of staff attrition) reveals a new perspective on individual recognition. The data suggests that the reputation of each internal member matters to the team, which builds what I call *collective*

*recognition.* The following quote shows how collective recognition impacts an individual:

Yes, we [a few recognised researchers] have experience, but we lost now some of our glory, because many of our [well recognised] researchers retired. We are left with a couple of them, so this is another problem [for the collective recognition of individuals at organisation Y].

This suggests that the recognition of each internal member within an international network is not only reliant on his or her individual reputation, but also on the collective recognition of the team they work with. When the collective recognition platform is weakened by staff attrition, the individual recognition is affected, and individual motivation is affected and consequently, KT activities face motivational barriers.

From an individual perspective, recognition is about status that is used as a platform for the social network to share knowledge. Losing this status within a social network affects KT activities because they become less important in the network and as a result receive fewer opportunities for KT. In this way, individual reputation becomes a root-cause barrier to KT. This theoretical perspective offers the extra dimensions of external reputation (relational capital) and collective reputation.

In summary, the findings contribute to the understanding of individual recognition as a possible individual-level barrier to KT by confirming its negative impact when it is not provided. The findings show that involving staff in KT-related activities is one of the effective ways for recognising their contribution. Another key finding is that time plays a negative role at the early stages of KT because managers do not yet know who is contributing well to the KT effort. A new perspective to recognition was found to relate to collective recognition, which may decrease with staff attrition.

### 7.12.2.4 PERSONAL INTEREST

It is argued in this study that personal interest is an individual-level motivation sub-construct that may be a root-cause of KT-related barriers. In congruence with the work intensity sub-construct, personal interest emerged from the data as a grounded finding theme. Personal interest is defined as some sort of spirit, mindset and social phenomenon that drives personal motivation for engaging in what staff members feel is appealing. The practical outcome is that when seekers become attracted (personally interested) in engaging in KT activities, a positive input measure is realised. An opposite feeling such as personal disinterest may create a barrier to the KT process, and create an employee who resists seeking knowledge. In the context of KT barriers, the following data examples provide evidence of underlying theoretical concepts.

First, the data (code: [4.3.2.1] Researchers' individual interests) supported several theories related to the impact of the personal interests of employees on knowledge strategy. The data shows that AR participants believe that academic departments allow researchers to spend their time on scattered research areas based on their personal interests that neither support targeted organisational knowledge nor organisational research goals. The following quote shows that the AR participant finds this is an impediment to closing the capability gap: "The research in here, is basically ... if you come to it, people are trying to do research based on interest, not on need."

This is an important finding because it magnifies a major cause of misaligning knowledge strategy and organisational strategy. It also indicates an inadequate focus on filling a specific capability gap. This supports Grant (1996) who stressed the importance of aligning knowledge activities with business strategies. Personal interest is important for innovation and creativity. However, there must be a control that balance personal and business objectives to create the alignment that Grant (1996) advocates. Allowing misalignment will result, as per the data, in KT failure.

Second, the data (code: [4.3.2.8] Interest in searching for new knowledge domains) extends existing theories of personal interest in the context of KT. Some researchers

were found to be conservative in that they wished to pursue the knowledge they possessed without accepting that knowledge may become obsolete and may require renewal. The following quote represents data collected from a research centre director to illustrate this barrier:

I have people [senior researchers] here working with us and are experts for let's say around 30 years but he is an expert in one particular subject. If you want him to open a new dimension, you will always feel he is hesitant and he doesn't want to really go there.

Lack of interest in finding new knowledge dimensions as well as resistance to accepting the value of knowledge renewal has become a barrier at host organisations. This extends our understanding of the development of personal interest over extended periods of time. It seems that it is not a good strategy to prevent rotation of work tasks because it may lead to the above behaviours. This provides an extended understanding of how the personal interests of staff evolve over their career paths. Their willingness to change in their senior years versus their early years of employment seems to be a function of their alignment with knowledge strategy. This may be called career alignment. The more advanced a researcher is in his or her career, the less willing he or she tends to be to adjust to the organisational knowledge strategy. This extends the theory of Grant (1996) mentioned earlier.

In summary, the findings contribute to the understanding of personal interests as an individual-level phenomenon that may become a barrier to KT. The findings show that personal interests were usually driven by disconnect between organisational interest and personal interest. In this sense, a problem of misalignment seems to be the root-cause for this KT barrier. Misalignment means people are developing capability (i.e. research knowledge) in areas that may not fit the organisation's knowledge strategy. In this case, personal interest may act against a KT shared vision.

### **7.12.3 PSYCHOLOGICAL CONTRACT AND EMOTIONAL RELATIONSHIPS**

In this study it is argued that psychological contracts and emotional relationships are individual-level constructs that may be a root cause of KT-related barriers. The theoretical development on psychological contract and emotional relationships



requires exploring theories from the human behaviour sciences. All the constructs presented in this section address issues that underlie knowledge flow blockages. Therefore, this section is not intended as an analysis of psychology or human behaviour – it only deals with those aspects that are relevant to KT barriers. Knowledge flow, based on data findings, was found to be blocked when researchers were not satisfied, not able to stay in the organisation for a long time, not committed to their job, not loyal to their organisation, or not able to trust their leadership. Therefore, the data suggests the following sub-constructs for theoretical development: (1) employee satisfaction; (2) employee longevity; (3) employee commitment; and (4) employee trust in executive managers.

The findings confirm that these sub-constructs, when they are weak, directly reduce KT effectiveness and they are barriers to the organisation achieving its knowledge strategy and filling its capability gap. In this section, I will explore how the data on psychological contracts and emotional relationships links to theoretical models from the literature. The findings from the data are presented in detail in Appendix E (see Tables 4.4.1 to 4.4.5).

### **7.12.3.1 EMPLOYEE SATISFACTION**

It is argued in this study that employee satisfaction is an individual-level psychological contract sub-construct that may be a root cause of KT-related barriers. Employee satisfaction is defined as “a pleasurable or positive emotional state resulting from the appraisal of one’s job or job experience” (Locke, 1976, p. 1311). The input measure of KT activities means that seekers will be able to experience the stability necessary for them, over the long term, to build their organisational knowledge base (OKB) to address identified capability gaps (Massingham, 2012). On the other hand, unsatisfied employees are likely to perform poorly in KT activities. This may be because sharing knowledge is a personal attribute that is difficult to impose. Within the context of KT barriers, the following data examples provide evidence of underlying theoretical concepts.

First, the data (code: [4.4.4.1] Staff equality) supports several theories of employee satisfaction that affect KT activities. Researchers were very sensitive to equality in employment and career privileges. The data suggests that case study organisations may have policies, systems and processes that discriminate in an unjust manner between researchers. The resulting dissatisfaction was perceived by AR participants as negatively affecting the willingness of individuals to share their knowledge on the internal-internal level and on the external-internal level. The following comment was made in the context of KT barriers:

Sometimes, you find two persons doing the same work, and one of them getting higher salary and more raises while the other gets less ... I was placed on the civil services payroll system for five years before being transferred to the academic system. By then, I already did several projects without benefits.

The above comment illustrates how lack of equality affects employee satisfaction. This inequality is a mistake and creates fundamental problems in providing the rewards or recognition necessary for KT to succeed. The case study organisations did not understand that many staff resented the inequities in their organisations. Their resentment was more about being treated as inferiors in their day-to-day work, when they really wanted to be treated as equals, and to contribute properly in the capacity of their roles as scientific researchers.

This supports the findings of Herzberg (1982) who found that employees were demotivated because of unfair company policies, incompetent or unfair supervisors, bad interpersonal relations, unpleasant working conditions, threats to status, and job insecurity. The data findings confirm that Herzberg (1982) may be right in linking those factors to employee satisfaction, which for the case of this thesis, impacts KT activities because they will see that their priority is to address those problems rather than to contribute to KT.

Second, the data (code: [4.4.4.4] Foreign experts insidersness) extended existing theories of employee satisfaction (Senge, 1990). The AR participant described how some staff felt dissatisfied due to a sense of *outsiderness*:

[M]any of the expats [internal members at organisation Y], let me say it clearly, and it's not me, they [the expatriates themselves] say out loud that we are not happy about that policy [visas, government matters and the way they are treated differently].

This extends our understanding of insidership. Insidership is about organisational boundaries, where people are granted membership when they become an employee. It creates a sense of shared understanding and the mental models necessary for KT (Senge, 1990). However, the data suggests that membership does not automatically grant insidership; rather, expatriate staff find it difficult to become insiders. This sense of 'outsidership' among expatriate staff is a barrier to KT because it is a root cause of employee dissatisfaction, which, it is argued, is a barrier to KT activities.

In this context, the reasons expatriate outsidership occurs were found to be linked to an array of underlying causes. These include the way they were treated in relation to travel arrangements, bringing their spouses and families to Saudi Arabia, changing employer and taking on high positions in the organisation. None of these matters applied to citizens. The fact that expatriates are hired as experts to support internal staff to build expertise puts them in a powerful position as internal knowledge providers. However, the sense of outsidership distances them from actually engaging in internal-internal KT because of this barrier. These *knowers* do not feel socially absorbed into the organisation, and the data suggests that this is impacting KT activities.

Further research is needed to link the individual-level analysis discussed above with a national-level analysis to identify further underlying root causes from a systemic perspective to see the 'big picture' suggested by Senge (1990). This is especially true when discussing government regulations because they may actually provide some national benefits that I do not identify in the discussion above. The balancing of the systemic forces would need to be contemplated to reach for a wise conclusion in the overall assessment of this KT barrier.

Third, the data (code: [4.4.4.3] Employee status) revealed a new perspective about employee satisfaction. Not only do employees need fairness and equity in policies and procedures as mentioned in the previous theoretical contributions, but staff seem to

seek socio-political equity as well. The following quote provides supporting evidence from the data to suggest this need:

[P]ersonally, I don't feel happy if I feel I am working with someone who is a dictator in his position, his ideas or his opinion. Things are debatable and nothing is for granted and so that's very important because that's going to influence the knowledge flow.

The degree to which team members are accepted as equal partners in the above quote links to the concepts of heterogeneity and homogeneity (Stone, 2001). Heterogeneity measures the extent to which a network membership is inclusive or exclusive. Inclusive (heterogeneous) networks welcome different types of members and are tolerant of different views, which is what the researcher above is seeking. Exclusive (homogenous) networks, allow membership only to people who are similar.

Researchers seem to be divided over whether homogeneity or heterogeneity is a more positive influence on social capital. Given the underlying logic of the LO, which is to embrace change and learn from experience, I support the view of Stone (2001) in that heterogeneity is more appropriate than homogeneity, although homogeneity may be helpful for increasing trust. A balance in synergising the benefits of both may be the best fit. On the one hand, employees with high heterogeneity are more willing to accept different people and their views into their group, and are more valuable for KT activities. On the other hand, there may be trust issues and lack of shared mental models that could impact other KT areas.

In summary, the findings on employee satisfaction suggest significant barriers to KT. Understanding the inner feeling and psychology of staff may contribute to the understanding of employee satisfaction as an individual-level barrier to KT. The data confirms that there are employee satisfaction issues that directly affect staff performance in KT activities. These issues include staff equality, the need to accept expatriate staff as inside members, and sensitivity to the status of each employee within a homogenous or heterogeneous structure.

### 7.12.3.2 EMPLOYEE LONGEVITY

It is argued in this study that employee longevity is an individual-level psychological contract sub-construct that may be a root cause for KT-related barriers. Employee longevity is defined as the length of time that an individual has been working in the same job (Katz, 1978). Longevity creates barriers to KT because knowers are less willing to share if they do not see a future in the organisation (Massingham, 2012). Under such conditions, they will have less interest in helping others and contributing to the organisation's future success (Massingham, 2012). In the context of individual KT barriers, the following discussion provides a theoretical development in this area.

The data (code: [4.4.2.1] Staff turnover impact) extended existing theories of employee longevity. There are three points under longevity that may extend existing theory. The first is the impact of staff longevity on social networks. This impact raises the negatives of social capital loss. Since social capital is an input factor to KT, the decrease in the number of people who can help (i.e. when people leave the organisation) is considered a barrier to KT. The following quote illustrates how mature researchers feel unwilling to transfer their knowledge to younger researchers because they believe that young researchers are likely to have low job longevity:

[T]hose [young] skilled people move to other institutions, they move outside of [organisation X]... it's almost [that] the whole [job] cycle [for young researchers] is sometimes 2 to 3 years. So basically, once you get him trained, he's out.

By linking organisational knowledge loss with employee departure, an opportunity to extend social capital theory in the context of KT emerges.

Second, is that even if young staff left temporarily for a higher degree then it is considered by senior staff as a negative event to internal-to-internal KT because their internal research projects are interrupted. This interruption of work made mature researchers resent young researchers. The following quote illustrates that young researchers are seen as temporary and unreliable to work with:

I think its [majority of knowledge flows] from people who we are cooperating with [outside organisation X]. Most of the researchers at this center are young and they are still new in their jobs. They are going to be doing their masters, and in the future they will then be doing their PhD, so the interaction is low with them. The biggest pool of knowledge for research ideas comes from interacting with colleagues from other

universities, other research institutions in Saudi Arabia, and from, you know, from conferences where I meet with [mature] colleagues from abroad.

The root-cause here is that young researchers are clearly not seen as the future. The above quote implies that young researchers have low value until they return with a PhD and spend many years to prove their stability. By then senior researchers would have retired and valuable young age energy would be lost due to this resentment.

Third, from the above two points, the exit of some younger cohorts impacts the ones who stay from a KT perspective. The disappointment of mature staff resembles an individual-level motivational barrier that affect internal-to-internal KT activities. Despite the fact that some young researchers do leave permanently or temporarily, the majority of young employees do stay but consequently become isolated by core knowledge workers (i.e. internal mature researchers) simply because other young researchers have left the organisation. The root cause of this isolation is related to the mental models of senior staff, rather than an objective reality. This is considered a strategic internal-to-internal KT barrier because it impacts the future generation of engineering research organisations in Saudi Arabia. A cohort related trust issue that is linked to job longevity is currently causing KT to slow or stop between experienced and inexperienced researchers at host organisations.

By applying a double-loop learning approach, a reflection on the reasons for young researchers to leave in the first place reveals: (1) that young employees who leave might not feel comfortable with continuous research challenges and may want less demanding work, or (2) that young employees who leaves are under-utilised and want to engage in higher intensity workplaces. This implies that not all employees who leave would have benefited the organisation if they had stayed. However, young researchers who do stay should not be affected by the attitude of others. As Senge (2006) explains in systemic thinking theory, the balancing loop may help to *stabilise* the system. This means when an employee leaves the organisation, senior staff should examine the reasons rather than automatically be disappointed. The isolation between senior and young researchers might ultimately create young cohorts with what I call *passive* job longevity. As a result, they adopt lower-value routinised and habitual work due to the detrimental effect of remaining framed as suspects for leaving.

In summary, the findings contribute to the understanding of job longevity as a double-edged construct for KT activities, by confirming that when people leave their organisation, the reasons behind this decision may have benefits to both the organisation and the employee. The impact of staff turnover therefore should not be always taken negatively but should be examined objectively. By carefully designing long-term learning, the organisation should retain the best staff rather than target all the staff. In such well planned conditions, it would be likely that the employees leave are a result of a balancing loop systemic filter.

### **7.12.3.3 EMPLOYEE COMMITMENT AND LOYALTY**

Employee commitment and loyalty are individual-level psychological contract sub-constructs that may be a root cause of KT-related barriers. Employee loyalty is defined as the commitment and steadfast allegiance to an organisation, and to beliefs, practices and relationships that mutually benefit both parties (Smith and Rupp, 2002). Employee loyalty links to job longevity and employee satisfaction as if they were three angles of the same triangle that result in the fourth dimension of the psychological contract, which is employee commitment. Employee commitment is defined as the individual-level attachment to work in a specific vocation as an act of commitment, trust and pledge to the workplace (Merriam-Webster, 1999). Commitment and loyalty can be seen as two faces of the same coin.

In the data findings, it was difficult to find unsatisfied employees who were loyal and committed to their organisations, or to find employees with high loyalty who had a low job longevity profile. The practical outcome of this construct shows that seekers will implement a knowledge strategy and fill the capability gap considering this as part serving their own interests, because when it is genuine, loyalty provides mutual benefits. In the interviews of this cycle, the passion of some AR participants was evident when they were committed and loyal to their organisations. This pattern of passion associated with loyalty occurred across the interviews. Loyalty and commitment therefore influence the inner feelings of internal staff. Disloyalty and

lack of commitment on the other hand create a barrier to the KT process because staff begins to emotionally disconnect from work activities, including KT. The KT barrier in such cases is the unwillingness to share knowledge or to learn. Disloyalty does that because there is little commitment to the organisation. As a result, such individuals do not want to help the organisation. In the context of KT barriers, the following data examples provide evidence of underlying theoretical concepts.

First, the data (code: [4.4.3.2] Knowledge domain loyalty) extended existing theory about employee loyalty. Many senior researchers expressed detachment and lack of loyalty to their research responsibilities, not their knowledge domains. The following quote illustrates these feelings:

I will not by any means be sacrificing my career. I am an academic and not an administrator. So I'm doing this [research centre director position] as part of some of the job. You see, you are a mixture of so many things, so, no, we are doing teaching, we are doing ... I am very active in the department by the way in the Mechanical Engineering department because this is my field and my position is there. And in a minute, I can be gone from here. I mean this is a temporary assignment.

The above quote provides evidence that loyalty is not an all or nothing phenomenon. It suggests that loyalty is likely a situated KT barrier, which implies that loyalty may appear to be specific to a role (i.e. role-related loyalty), rather than to the organisation (i.e. organisation-related loyalty). The following quote also illustrates how research administrative responsibilities seem to suffer low loyalty because they are seen as temporary as compared to traditional teaching responsibilities as sustainable roles:

"... I [a research centre director at organisation Y] am an academic. I came from academia [referring to teaching]. When my term [as research centre director at organisation Y] is finished here, I have to return to my department faculty [to teach]..."

The above quote suggests that research administrators disconnect from research activity once they return to their faculty departments. In KM terms, existing theories suggests that KT could be affected by loyalty to the organisation, loyalty to a role, or loyalty to a discipline (Smith and Rupp, 2002). This extends the research of Smith and Rupp (2002) to enable disaggregation of the loyalty construct into situated levels. This may contribute to distinguish the type of loyalty or in some cases, disloyalty that may impact KT activities. For yet unknown reasons relating to sustainability of role, most research centre directors at host organisations are not loyal to their administrative positions; rather, they insist that they are more attached to their



academic departments and to classical teaching. This places KT in their mental models as low priority while they manage a research centre for 2 years.

Third, the data (code: [4.4.1.4] Commitment of knowledge providers and industry users) revealed a new perspective about employee commitment. Within the internal-to-external KT process, the commitment of staff at the local industry may become a major barrier. Researchers at host organisations reported difficulties in sharing knowledge with the local industry due to low commitment at an individual level to engineering research. The following quote provides evidence to illustrate low employee commitment at local industry research facilities:

I [researcher at organisation Y] did some work with some entities [at a local industry research department] during summer, and what I found was that there are a lot of research subjects taking place in the facilities [of the local industry research department], but when you go to the labs you don't see something running, why? The answer comes from the researcher [local industry employee]: I am not willing to repeat my Ph.D. and sit in the lab and do the experiments. I need more labour to work with me. So, this is the sort of things they [local industries in Saudi Arabia] have inside. So I think some of them [local industry staff] are shuffling papers.

The AR participant felt that the low commitment from researchers at local industries creates a barrier to host organisations establishing internal-to-external KT processes. The above quote provides a new perspective on the barriers that internal researchers may face during engagement with the local industry. A researcher at a local industry was quoted stating that:

Our [a local industry staff member] focus is mainly operational. We as a research department try to troubleshoot operational issues for our industry because new engineering inventions require huge capabilities. The [organisation Y] is focused more on basic areas of research, you see.

The local industry seems to see low value in any internal-to-external KT with the host organisations. As the local industry was quite negative towards host organisations, a few underlying root-cause perspectives on this position may help understand why this situation occurs. First, researchers at local industries may find that their organisations have not prioritised engineering research as crucial aspect of their organisational strategy because it was too difficult; therefore, the research output was not expected to be rewarding. Second, researchers at local industries might want to work with overseas experts, rather than the local host organisations to increase their chances of

producing commercially viable output. They may not see host organisations as qualified knowers; therefore, they feel demotivated to work with them.

The commitment of external knowers to external-to-internal KT, on the other hand, was also examined. Some external knowers perceive that affiliating with host organisations may affect their credibility as scholars in their field because some Saudi research organisations try to gain credibility through joint listing publications rather than through actual research collaboration. This decreased the commitment and loyalty of external knowers to the external-to-internal KT process. As evidence to this finding, a world-renowned chair professor from the US was interviewed in this study who confirmed this issue as the following quote stated:

[T]he issue of collaborating with [organisation Y] was then controversial because of a Science article that attracted the attention of US institutions. Going forward, I need to change the arrangement to remove the joint listings of affiliation with [organisation Y]. The door has been closed on these kinds of joint affiliations so that we do not become listed in the ISI as joint affiliated with [organisation Y] in Saudi Arabia. We can collaborate with [organisation Y] but in publications we have to fully affiliate ourselves with our US institution. This is a tricky situation that has come up because of some of the activities of some universities in Saudi Arabia.

The above quote illustrates how the commitment of the knower to the external-to-internal KT has decreased from formally recognised joint publications to become limited to collaborations in lab work. This implies that the tacit to explicit knowledge conversion process as part of the external-to-internal KT system was lost. The remaining driving force for commitment was explained in the following quote:

...[W]e [a group of US scholars] have this romantic idea that we could impress upon young people outside the United States the excitement in [engineering] and maybe move them into [engineering research]. This is in large part what explains my commitment to collaborating with [organisation Y].

The above quote illustrates the complexity of understanding what drives commitment at the side of the external knowers. It also indicates that environmental politics may affect individual commitment as for the visiting scholar above who was due to external issues prevented from expanding his engagements with host organisations.

In summary, the findings contribute to the understanding of commitment and loyalty as individual-level barriers to KT, by confirming their impact as input measures to the three KT systems (i.e. external-to-internal, internal-to-internal and internal-to-external

KT). The findings show that loyalty to a knowledge domain or a specific role such as teaching may be a barrier to KT for the internal system because the researcher in this case only wants to work within the sustainable role, rather than the temporary. A new perspective on commitment is the importance of validation of what host organisations do and what the knowers (overseas experts) and seekers (local industry) expect from host organisations to maintain their commitment to KT. Overseas experts and the local industry expressed concerns about the actions that host organisations take in relation to KT.

### 7.12.3.4 TRUST IN EXECUTIVE MANAGERS

It is argued in this study that employee trust in the executive management is an individual level psychological contract or emotional sub-construct that may be a root cause of KT-related barriers. Employee trust in the executive manager is defined as the employee's willingness to be vulnerable to the actions of the executive manager based on the expectation that the executive manager will take actions to fulfil important commitments to the employee, irrespective of the employee's ability to monitor or control these actions (Mayer *et al.*, 1995). In practical terms, individuals will be more willing to engage in positive KT behaviours if they feel that executive managers will act on the outcomes of their work. When they do not feel this way, they lose trust in their management and a barrier to KT emerges. In the context of KT barriers, the following data examples provide evidence of underlying theoretical concepts.

First, the data (code: [4.4.5.2] Qualification of leadership to support KT needs) supports several theories on trusting executive managers. When management shows a lack of understanding of research management from a contemporary point of view, researchers tend to lose trust in their leadership, especially when it comes to KT because it takes a lot of their effort and time. Most current leadership at host organisations in Saudi Arabia are scientists who lack management qualifications including in the KM field. Researchers feel that it is not acceptable that scientists are assigned to manage their organisations without this background. They feel that having leaders who know little about international KT practices can create great KT barriers.

Within the context of identifying KT barriers that need to be addressed, the following quote illustrates the view of the AR participant on his management:

I believe that we [Organisation X] should develop leaders in research ... the directors of the research centres, and the executives here are researchers who haven't been exposed to academic training on management [of research organisations].

The above quote indicates that host organisations are experiencing KT barriers from a strategic vision perspective, which negatively influences the daily work of normal researchers and their KT activities. This is causing them to think that their KT effort is not working because they do not trust that their leaders are qualified to make KT succeed. The following quote provides further evidence to confirm this perspective:

An administrator [for Organisation Y] may be necessarily who should be much experienced on how to handle the external world. So in this case [the case of managing KT] if we have a specialist [an management expert], a trustworthy one, then he can guide us better.

The absence of someone to 'guide' them was seen as the root cause of their KT barriers. The effect was that it caused a trust issue to emerge, which then reflected on a self-esteem and confidence in the KT activity as a whole. This supports the theory of Grant (1996) on knowledge strategy, which emphasises that knowledge processes are complex and should not be managed in an ad hoc fashion. Failure rates are high and this can only be avoided if an accurate strategy is created and well communicated throughout the organisation. Staff must trust and believe in their leadership if they are to be successful in KT. This perspective extends the theory of Grant (1996) in that a poor KT strategy may not only impact the success of KT but also the individual and emotional relationships between staff and their management.

Second, the data (code: [4.4.5.1] Avoiding to approach the leadership) extended existing theories of trust in leadership. Schein (2009) suggests that the basis for trust is helping. He claims that leaders should *humbly* help their employees in order to earn their trust (Schein, 1990). However, what if the leadership knows little about KT and how it can bring benefit to host organisations? In return for the help the leadership should provide, employees would help leaders succeed in managing the organisation. When organisation members and the leadership help each other, they begin to develop trust, and consequently their communication improves because the content of

communication becomes reliable (i.e. I trust what you say is true, therefore, communicating with you makes sense and is useful to my work) and consequently the collective performance also improves (Schein, 2009). A highly ranked AR participant stated that it is the researchers who are distancing themselves. He states that,

We [a research support department at Organisation X] never experienced a request like that [request for help]. They [researchers] might fall in traps but would not inform us [to request for help].

When trust is absent, it is expected that employees will tend to avoid communicating with the leadership because they do not believe it will bring benefit to their work or solve their problems. The following quote shows their avoidance:

I think as per the culture of the [Organisation Y] and being an expat, I will be more of a loser if I feel that I should take an action [ask for help] ... Here the culture does not permit that [does not encouraging questioning].

When encouraging questioning is not promoted by the management, trust issues arise. Lack of trust seems to be an underlying reason for weak communication between staff and leadership at the host organisations, a view which is supported by Schein (2009). The leadership should be *humbly* 'asking' employees for help because it is likely that they know more than leaders do about effective KT activities and the sharing of experiences, and this is what Schein calls 'the humble enquiry' (Schein, 2009). By humble enquiry, he means helping without offending and helping based on trust in a reliable relationship. In the above descriptions of trust, help and asking for help encapsulate many forms of knowledge sharing processes that are likely to be relevant to the host organisations and to the problem of AR cycle 3.

In summary, findings contribute to the understanding of employee trust in executive managers. Data findings show that trust of staff in their executives was influenced by the qualifications of executives in being able to support KT needs and the ability of staff to approach their leadership. The perceived low qualification of executives in KM has been shown to be a barrier to staff performance in KT activities, which resulted in them avoiding asking the leadership for advice or support. KT therefore, faces the threat of losing its identity and direction.

## 7.13 ORGANISATIONAL-LEVEL BLOCKAGES

This section examines the organisational-level sub-constructs and their effects on knowledge flows. The goal is to understand the underlying reasons for these effects as well. An organisation is defined as “a structure for grouping people and other resources to achieve a common purpose” (Sharp and McDermott, 2001, p. 11). As stipulated in chapter 2, an organisation is defined by its purposefulness, its responsiveness, being a system, having a functional division of labour, and its control function (Ackoff, 1971). These elements are realised in real-life organisations through organisational culture, policies, processes, systems, and resources.

Organisations compete by using those elements to increase the capacity to learn, especially via the four systems that influence learning: strategy, structure, slack, and ideology (Meyer, 1982). In doing so, however, there are barriers that impact KT as part of the learning process. In the following theoretical constructs, AR participants raise issues that are, in many instances, congruent with existing organisational theory. In some cases, data findings extend or provide new perspectives to the understanding of organisational constructs in the context of KT barriers. These constructs are: (1) culture, (2) systems, (3) processes, (4) policies and (5) resources.

### 7.13.1 ORGANISATIONAL CULTURE

It is argued in this study that organisational culture is an organisational-level construct that may be a root cause of KT-related barriers. A culture is defined as the “shared beliefs and practices of people in the organisation” (McDermott and O’Dell, 2001, p. 13). Organisational culture is an emergent product of collective historical learning in an organisation that serves as an *ideological* filter to direct the organisation’s attention (Marsick and Watkins, 2003). The practical outcome of this construct is that seekers will be able to align their KT activities in congruence with their cultural norms and values, thus avoiding conflicting attitudes and behaviours to fulfil the knowledge strategy. Cultural norms and values may represent a barrier to KT because it guides the organisational behaviours and attitudes necessary for KT, such as sharing, cooperation and teamwork. When the cultural norms are to resist sharing and

cooperation, KT declines. Similarly, when the organisation's work is carried out individually instead of through teamwork, the organisation loses substantial opportunities for KT activities. This means that a negative organisational culture may affect many aspects of the organisation and create barriers to the KT process. In the context of KT barriers, the following data examples provide evidence of underlying theoretical concepts.

First, the data (code: [5.2.3] Lack of trust between staff) supports several theories of organisational culture (Minkov and Hofstede, 2011). Researchers seem to lose the feel for collectivism, which brings many barriers to working in teams, and thereby to KT. The root cause seems to stem from several factors such as lack of trust, internal rivalry, over-reliance on reciprocity exchanges and to some extent disconnection from the organisational mission. One of the issues mentioned above is supported by the AR participant who provided the following quote regarding an output measure to the relationship that exists at Organisation X between staff at different hierarchies:

Let's go back to the trust [issue]. I think some researchers here [in Organisation X] trust researchers from outside [overseas research experts] more than the local [Saudi researchers working in the same organisation].

Collins (2010) states that trust is a foundation for constructive conflict, personal accountability and achieving collective goals. However, trust may be seen as a positive expectation that the other will not act opportunistically. In this way, the above lack of trust may develop into further underlying problems. The following quote sheds some light on the possibilities that result from mistrust as a cultural norm:

Even for car parking. Even for this small thing, they [staff in Organisation X at all organisational levels] are fighting [about] who is taking this place [parking lot]. It [these rivalries] is under the table. This is the main problem.

Under such conditions, it is difficult to promote knowledge sharing. The barrier is therefore cultural because people act based upon selfishness. This supports Hofstede's (1980) theory of individualism-collectivism, which found that when people are individualistic, they tend to undermine the collective interest as a result.

The internal competition represented by recurring events of fighting for resources (e.g. parking spaces) implies the possibility of the existence of a reciprocity

phenomenon at the host organisations. Such conflicts confirm emotions of self-interest as suggested by the reciprocity theory (Aronson, 1997). This theory suggests that people will assume that others will treat them in the same way as they treat them. The cycle taking place at host organisations seems to suggest a negative cycle where people are treating each other destructively. This cycle continues in a reciprocal fashion. The impact on KT is as destructive because one may find that internal-internal KT processes are almost absent. Within the theory of planned behaviour (Fishbein and Ajzen, 1975), the personal agency (perceived behavioural control) may influence the attitude of researchers at host organisations when they feel in need of knowledge. The efficacy belief of researchers in being able to receive support made them refrain from even asking for exchanges of knowledge. The following quote provides evidence of the condition explained above:

They [internal staff/researchers/scientists] might fall into traps [problems related to international research issues and working with overseas experts] but would not inform us [to as for support from relevant departments].

To summarise the above discussion, trust, individualism and reciprocity are rooted in social exchange theory (Smith et. al., 1989). The barrier to KT in this context seems to be that staff at host organisations are not able to find the right fit between the costs and benefits of knowledge sharing. In the sense of an aspiration towards having an LO culture, trust can be the most powerful restraint to improving the learning and knowledge environment in the organisation (Senge, 1990).

Second, the data (code: [5.2.8] The culture of departments) extended existing theories of organisational culture. An organisation may contain a subset of islands comprising different, but not necessarily conflicting, micro-cultures (Schein, 1990). By islands, Schein means that they take different approaches to defining who they are and how they work without confronting each other. This problem relates to KT activities when such cultural islands enter into rivalries in the form of internal tensions. Subset cultures may be based on background, history, occupation, ethnicity, rank, or even teams as internal sub-social networks (Schein, 1990). The data findings confirm the above theory about cultural islands, which may be extended as an impediment to KT. The following quote is an illustration of how cultural islands may be a barrier to internal-to-internal KT processes:



[Cooperation] between institutes in practice is not strong ... for example, this [a system for communication and data processing] is already applied in some centres, but I can't access this. [Cooperation] from centre to centre and institute to institute is not available. Maybe in the future, but I am not sure about that.

Success at host organisations in KT activities will significantly depend in part on their ability to act cohesively in a unified culture. The cultural islands theory can be extended to become a basis to work out the alignment of vision about what to do, how to establish shared meaning about intentions, and how to increase the capacity to work together across many different kinds of boundaries. Cultural islands may be preserved while removing the barriers that specifically impede KT. The reason for preserving those islands is subtle, since organisations cannot control their culture in the same way that they control policies, processes, and systems; rather, they can only influence culture. In order to enable the organisation to influence the organisational culture to support their KT activities, host organisations will have to attempt their aligning strategy with its culture without confronting cultural islands.

Third, the data (code: [5.2.5] Gender issues) revealed a new perspective about organisational culture. While the data did not report any internal-to-internal KT barriers due to gender segregation, the data suggests that external-to-internal KT is affected by a conservative attitude towards the gender of external experts (i.e. not allowing female overseas experts to work at host organisations with local researchers). The KT barrier starts as a cross-cultural (international) level KT barrier where overseas entities (the knowers) feel that their female experts are unwanted by Saudi institutions, which creates a KT problem. It is also an organisational-level KT barrier because staff (the seekers) feel completely restrained from learning from female experts, which creates a KT problem. The following quote provides evidence by a local researcher at organisation X that the gender of external experts is impacting knowledge flow to Saudi researchers:

I believe our culture will have or can have an impact on [the] cooperation [of Saudi organisations] with experts from outside [overseas] especially when it comes to [collaborating with] ladies. That's an important issue.

This view from a local researcher represents the internal (or seeker) of the external-to-internal KT system. In the following quote, a US scholar engaging in external-to-internal KT activities (or knower) validates the above view:

Well, something that is very strictly cultural is the strict lack of women on campus. About half of my research group [in the US] are females. They [host organisations] are missing a real opportunity from having a very talented group of people by being so strict about permitting women in [organisation Y]. This hurts [organisation Y] in recruiting international experts and missing on half of the community's abilities to be recruited as scientists.

The above quote refers to the uniqueness of Saudi Arabia as a nation that perceives gender segregation as a form of religious respect to the female and male biological differences. Gender segregation in host organisations stems beyond cultural thinking to religious thinking, which proves that its rationale is coming from the religion rather than from organisational culture per se. There is evidence that men and women of the early Muslim companions have shared their knowledge and engaged in intellectual exchanges but were consistently conscious about respecting the boundaries of professionalism. While the gender related barrier seems to be the content of religion, the root-cause may be related to the mental models of both the seeker and the knower. This contributes a new perspective to the understanding of the cultural issue of gender in Saudi organisations.

In summary, the data findings in this section contribute to the understanding of organisational culture as a possible organisational-level barrier to KT, by supporting existing theories, extending others and providing new perspectives. The findings contributed to the understanding of lack of trust between staff, the culture of departments and gender issues as possible root-cause barriers to KT.

### 7.13.2 ORGANISATIONAL SYSTEMS

In this study it is argued that organisational systems are an organisational-level construct that may be a root-cause for KT-related barriers. A system is defined as a collection of interrelated moving parts or components that work together to perform a complete function or purpose (McNabb, 2007). This means that seekers in organisational systems can enhance the KT activities as an input measure. On the other hand, inefficient systems, such as organisational legal systems, commercialisation systems and research collaboration systems, create a barrier to the KT process. In the context of KT barriers, the following data examples provide evidence of underlying theoretical concepts.

First, the data (code: [5.6.16] System bureaucracy) supports several theories on organisational systems. Data findings show significant effects coming from hierarchies in systems, which may represent a barrier to knowledge acquisition and integration. AR participants provided many examples, which can be seen in Appendix E. The following quote illustrates how host organisations suffer chronic bureaucratic symptoms:

[I]t [paperwork/approvals] takes a long time. Many times, I'm talking as an individual not as a director, you give up [pause] you give up and you don't want to do it again [pause] definitely. But until when? If you fight for this, and then you fight again for that, and then again you fight for this, until when can you fight? Because if the system as I told you, even the financial is there [available], but when you want to spend the resources and the way how to spend them ... Ah, oh, well bureaucratic is not the leadership only but the one below as well [middle management].

The repetition of the word 'fight' occurred in the above quote four times, which implies a serious frustration level. This supports the findings of Grant (1996) who argued that when managers know only a fraction of what their employees and subordinates know, and when tacit knowledge is not transferrable vertically, while bureaucracy is enforced, then the power of hierarchy becomes a threat to knowledge activities. Even worse, in the case of host organisations, bureaucratic restrictions are enforced not only among top management but also at the middle management level.

This means frontline managers unavoidably face a lot of KT blockages across the organisation, created by inflexibility, tight control and slow decision-making. Bureaucratic control thus extends to horizontal flows where 'knowledge engineers' who facilitate KT are contributing to bureaucracy, thus leaving 'knowledge practitioners' as per the above quote to suffer. Such conditions would probably not endure what Nonaka and Takeuchi (1995) call 'middle-up-down' management because knowledge flow is blocked both vertically and horizontally. This supports the view that such barriers to KT activities make it difficult to have an efficient KT system within an array of inefficient controlling systems.

Second, the data (code: [5.6.3] Legal system, code [5.6.12] Systems for research collaboration, code [5.6.15] Research commercialisation systems) extended existing

theories of systems sub-components. One system that relates to this study is KM systems that manage knowledge efficiently and connect knowers with seekers. However, masking irrelevant systems with a KM cover usually undermines such systems and misleads organisations. In simple terms, this means that the organisation believes that it has a KM system or activity, but it does not. Rather, it deludes itself with the KM title. For if it is clear what the organisation is doing, it can save significant investment and avoid misleading and disappointing its stakeholders. For example, Lindval and Tus (2002) found that many tools advertised as KM systems address document management rather than KM. The failure is usually realised in such cases when the organisation unknowingly has already invested significantly in the so-called KM system. From the data findings, this concept may be extended to include a wider scope of other situations that substantially degrade the purpose of KM and the targeted systems (i.e. the departments of the organisations such as IP, HR or finance) that are expecting value from KM. The following quote illustrates this idea:

And I think what we need is to have a real office where can spend time with the researcher to discuss the idea first of all, and to put it together and evaluate it very well and then get the patent and try to commercialise the patent. By the way this is not easy, okay, it is difficult because out of 1000 maybe we can commercialise one.

However, the managers responsible for ensuring that the above office is erected deny that there is no *real* office. Rather, they claim it is in operation and doing its job but the researchers are not making use of it because they have not approached them properly. The following quote illustrates this mindset against the previous data quote: “[I]f they want to benefit then they can come to us and request information. We would be ready to help.”

Now, the above data proves the point that the case study organisations name systems that are actually not doing what they are claiming they do. A third participant discussed his experience when he did approach the office where he found that they were incapable of helping him and had to send his work overseas for review: “I think [Organisation X] transferred this agreement to an attorney in the USA, to improve the agreement. It took around four months to finalise in discussion, emails, meetings”. The above comments extend our understanding of organisational systems by highlighting the importance of analysing the sub-components of an acclaimed system where its functions are verified and validated against its functional claims.

Third, the data (code: [6.6.18] Logistics systems and code [5.6.13] Lack of cohesiveness in local systems) revealed a new perspective about organisational systems. Within a systems thinking context, systems cannot function in isolation from their external environments (Senge, 1990). Systems always need to be properly fitted within other systems (Senge, 1990). The following quote illustrates the impact of systemic *deviations* on KT activities at all external-internal-external KT levels:

If you compare and benchmark [Organisation Y] with other peer research institutes or universities, say in Europe, Canada or USA, they have certain systems. For example, for them, getting certain materials related to their instruments or chemicals or supplies or accessories is much easier. Getting the manpower, for them, is much easier. Getting the help from other experts is even much more easier. For us, everything is not easier.

The data suggests that inefficient external and internal logistics directly affect KT as a systems barrier. The data shows that the systems that serve researchers (logistics support) are not capable of meeting research needs. This creates a barrier to KT. This is also supported by the US scholar participating this AR cycle who has been engaging for 3 years in an external-to-internal KT activity. He stated:

[T]he most serious frustration for doing modern engineering which makes it the worst thing about working here [in organisation Y] is the incredible delay in getting equipment to the extent that sometimes it takes as much as a year to get a simple piece of equipment from the time you order it. In the US, will come the next day. In Saudi Arabia it is at least 100 times longer, and this means people will be sitting around, not doing anything. It seems there is plenty of money but it also seems that there is bureaucratic system in place. This is a major barrier for people doing science.

However, the new perspective is that the problem is not due to such systems per se; rather, it is due to how logistics efficiency is perceived in the organisation. For example, if the organisational norm was that an order would take three months for delivery, then a response time of two months would be considered efficient. Efficiency benchmarks are therefore essential when the organisation wants to deviate from prolonged system norms. Benchmarks contribute to how sustained norms translate into system functions in what can be termed as *cultural-system integration*. The new perspective is that cultural acceptance of poor system performance for example with regard to logistics, creates KT blockages. To illustrate this, the following quote presents a snapshot of another cultural norm that is impacting on learning systems and is claimed by the AR participant to feed in the corruption of organisational systems:

We faced a problem that the way of learning in China compared to the way of learning in Saudi Arabia is different. Arabic people, especially the Saudi people, such as our fresh graduates, have been doing the spoon-feeding way [in learning] and this is not the Chinese way. Some of us expect [spoon-feeding] especially the fresh graduates ... When they come, they expect the Chinese to give them homework and give them books to read and something like the spoon-feeding way but the Chinese just give us broad lines and ask that you do it by yourself ... so this was very difficult for some people here. Some people just gave up, they just stopped. [they said:] I cannot do this in that way so I will stop.

The reflective thinker will find that the two quotes above have in common a cultural norm that may result in poor quality system output measures. Rather than the design of the system itself, the people component of the organisational system, represented by the cultural norms at the case study organisations, may actually be the main reason for this KT barrier.

In summary, the findings contribute to the understanding of organisational systems as a possible organisational-level barrier to KT, by confirming its eminent impact on KT activities. The findings show a relationship between KT barriers and systems with excessively bureaucratic procedures, poor research commercialisation systems and inefficient logistics systems.

### 7.13.3 ORGANISATIONAL PROCESSES

It is argued in this study that organisational processes are an organisational-level construct that may be a root cause of KT-related barriers. Organisational processes are defined as sets of logically related tasks performed to achieve defined business outcomes (Davenport and Short, 1990). At an organisational level, learning and KT are collective, interactive and interdependent knowledge processes that produce an increase in the OKB (Marsick and Watkins, 2003). Collective learning leads to processes of collective capacity that are much more powerful than individual processes but when they are impeded, this causes a barrier to obtaining powerful KT results (Marsick and Watkins, 2003). The practical outcome of this construct is that seekers will be able to practise KT from within organisational processes as an input measure. In the context of KT barriers, the following data examples from Appendix B provide evidence of underlying theoretical concepts.

First, the data (code: [1.1.7] Attract Partner organisations) supports several theories of organisational processes in relation to KT. In establishing new research relationships, the data findings show that host organisations did not differentiate between commercial transactions (paying fees) and collaboration (purely scientific) arrangements. This is a KT barrier because commercial transaction arrangements drain the budgets of host organisations but involve minimal financial risk on the part of the knower who considers such arrangements to be business opportunities. The following quote provides evidence that researchers overlook the fact that they are knowledge seekers, and paying a fee to the knower for the KT process:

We [Organisation Y] sit down with our colleagues and partner from [world renowned research organisation], as collaborating partners. It's [the research partnership arrangement] not something like 'you teach me how to do this' ... They and we will start doing research and learning together and advance knowledge together and so on.

The above quote relates to an agreement where Organisation Y is paying an overseas expert organisation for a research partnership arrangement. When host organisations overlook the fact that the way such arrangements should be managed is fundamentally different from a scientific collaboration they might, as the AR participant describes, fall victim to low ROI while the knowers make financial gains. The data shows that AR participants feel that KT is not going well at their organisations. The following quote provides evidence on the KT performance:

If you want me to evaluate this thing [the external-internal KT process], we [Organisation Y] share a lot of the blame and [the] low speed [is] on our side more than the outside party... because the knowledge transfer was mostly done without the involvement of Saudi technicians or Saudi researchers.

It seems from the above comment that limited value is gained from the external-internal KT investments because (1) there are inefficient management practices that impede such arrangements and (2) most of the research is conducted by the overseas partner, leaving the Saudi researchers with the minimal learning opportunities. The organisational processes responsible for such arrangements resemble a KT barrier because they give the impression that the Saudi partner is paying the money while the overseas expert is doing the research, and hence, there is limited KT. These findings support the theories of Mowery *et al.* (1996) who found that transaction cost arrangements were unlikely to be successful for KT processes. They found that equity governance structures were a better arrangement for ensuring the viability of KT

processes. The root cause barrier was that disclosing knowledge from transaction-based processes involved a lot of IP management complications. Dyer and Singh (1998) and Williamson (1991) suggest eliminating IP concerns through equity arrangements.

Second, the data (code: [1.1.5] Attracting scholar visitors, code: [3.4.5] Willingness of the knower to cooperate and code: [1.3.1] Awareness of the knowledge marketplace) extended existing theories of organisational processes in relationship to the academic governance of external-internal KT processes. AR participants supported the significance of having scholar visitors to strengthen the substance of the KT process. However, there are underlying KT barriers to this process. The visitors claim that when they arrive to Saudi Arabia, they spend little time engaging with Saudi researchers. This is a root-cause problem that undermines the objective of this process. As the following quote by a visiting expert illustrates, he spends most of his time learning by doing with few formal organisational processes that promote successful KT activities:

Yes [I interact with Saudi researchers] but not often. I work here [in the laboratory] and sometimes I talk with them [with Saudi researchers] but less than one hour in a day. I think I'd spend most of my time on my work and projects. I have many things to do and if I need to contact them then [pause] ...

The above quote indicates undermining the role of the expert as a visiting scholar to interact more frequently with local researchers, which implies a KT barrier that impacts the internal-to-internal KT process. The quote also implies little empathy from the expert for the needs of the seekers as if he does not mind that KT is not taking place, despite the fact that this is the reason for him being offered this position. This latter barrier is complicated and core to this study because it touches on the social relationships between the knower and the seeker. The literature suggests numerous reasons and theories for experts to feel unconcerned to the defects in the KT processes. Table 7-3 below lists some of the important views.



	Root-cause for experts limited empathy to adopt a knowledge sharing behaviour	Relevant theory/perspective	Author
1	Absence of sheer selfless empathy and altruism on the expert side towards the knowledge seeker might be because: (i) There is little personal similarities (ii) The expert might not like the seeker so he or she does not empathize with him or her	Altruism	Batson (1991)
2	The feeling of being in a hurry to finish more work because the expert feels he or she has is experiencing a lack of time issue	Rush factor	Darley and Batson (1973)
3	The expert might not be satisfied in his or her job or the experts' mood is not good	Personal mood	Cialdini <i>et al.</i> (1973)
4	The expert might: (i) lack support from top management (ii) lack participation in KT decision making processes (iii) Fear of defeat after KT process is complete	Management effect	Van Aken <i>et al.</i> (1997)
5	The probability of achieving the KT desired result is low and the goal itself (the result) is not attractive to the expert	Expectancy-Value	Porter and Lawler (1968)
6	The expert has a low intrinsic knowledge shareability attitude	Value Frequency Model of Knowledge Sharing (VFMKS)	Boughzala and Briggs (2012)
7	The incentives the expert receives are less fairly comparable to the ones received by the seeker perhaps because Saudi researchers receive lucrative benefits not provided to expatriate staff.	Equity theory of Motivation	Adams (1965)
8	The expert did go through a goal-setting process backed by the organisation with an incentive for achieving this goal	Goal-Setting theory	Locke <i>et al.</i> (1968)

**Table 7-3: Analysing visiting expert behaviour towards internal staff**

A new finding to the above table comes from the data. One way to ignite this interest is intrinsic reward found in academics. The following quote by a US expert visiting host organisations provides evidence:

[W]e are professors, we enjoy working with students and one of the most rewarding things in my life is having 150 students go out from my labs as post-docs to become independent and successful. So, they [host organisations] are missing out on that opportunity. This is what really propagates the knowledge and the excitement of engineering.

Host organisations rely on research staff to conduct research rather than on research students. This makes the relationship between the knower and the seeker competitive at host organisations. However, having the overseas experts work with post-doc students can enhance the interaction significantly as the quote above indicates. It is evident that the data actually resembles the tip of the iceberg. For it is not possible to decide which of the above factors applies to a given individual. Further research is necessary to identify which of the root-cause factors from the above theories may be extended to the case of the visiting scholars in this study. However, this study highlighted a capability gap in organisational processes in terms of attracting visiting

scholars for internal-internal KT and encouraging them to propagate their knowledge in the internal-to-internal KT system.

Third, the data (code: [1.3.2] Attributes of internal researchers) provided a new perspective on organisational processes. By turning the focus to the attitude of the knowledge seeker, the findings show that the organisational processes did not take into consideration the capability and awareness of internal researchers in identifying their knowledge gaps. Organisational processes also did not contain guidance on the steps for engaging with external or visiting experts. These findings indicate a barrier to KT because internal researchers would not be in a position to have an objective assessment of themselves without the organisation instituting a gap assessment process. This means that the organisation faces a difficulty in prioritising important knowledge. This confusion will impact their relationship with the experts because they don't know what knowledge is most important to seek. The following quote from an organisation X participant provides evidence to illustrate this issue:

I know that my masters from Sydney University just gave me an introduction to the fundamentals ... My master was very specific so when I came here I understood the language but I found there are still many things that I don't understand ... I had minimal supervision to help me [identify my gap]. None of the regular researchers who are working on the project was asked [allowed] to contact the external organisations [to engage with external experts].

There are two barriers in the context of the above quote: the first is the lack of gap identification. Another researcher at Organisation Y described how the knowledge gap identification could cause unnecessary barriers and this also supports the previous quote:

Some people do it [KT] the hard way where they try to write their proposals [for example] independently and just submit it and then see what they are doing. Those people probably experience rejection once or twice or more than that. They do it the hard way ... [they should] ask before doing things.

The second barrier processes for knowledge seekers to engage with experts are unclear. Chaotic processes seem to take place, which mislead the KT process and cause knowledge flow inefficiencies. The new perspective in these issues is that knowledge seekers have been able to detect these barriers before their organisations, which indicates that the absence of bottom-up management could bring many blind spots for the top management and create inefficiencies that are familiar to staff.

In summary, the findings contribute to the understanding of organisational processes as a possible source for organisational-level KT barriers, by confirming the impact of several aspects of organisational processes on KT activities. Chapter 6 demonstrated that organisational processes are the actual carriers of knowledge processes, which are the essence of KT. In addition to the findings of chapter 6 on KT processes, the findings in this section show that organisational processes have significant effects on employee loyalty and commitment, from both positive and negative perspectives (Hawkins, 2000). Examples of such barriers were related to how host organisations attract partner organisations, how the knower becomes willing to cooperate and the capability of internal researchers to engage in KT processes.

### **7.13.4 ORGANISATIONAL POLICIES**

It is argued in this study that organisational policies are an organisational-level construct that may be a root cause of KT-related barriers. An organisational policy may be defined as a dynamic sustainable optimisation of action in response to certain technological, economic, and institutional constraints (Bauer and Wildman, 2006). Although this definition implies control measures as an input to KT activities, policies may also serve as a guiding mechanism to help organisational members benefit from the policy and to help decision makers to enhance their KT performance (McNabb, 2007).

The practical outcome to this construct is that seekers may align their KT activities with the organisational strategy that the policies were built upon. On the other hand, organisational policies may hinder many KT activities by limiting the creativity and autonomy of researchers. The ubiquity of organisational policies that are actually governmental and apply to all governmental agencies makes this section unique. Therefore, in this section, I will select the minority organisational policies that are purely internal, while the majority of organisational policies that follow the holistic governmental policies will be discussed in the following sections under the national-level KT barriers. In this context, the following data examples provide evidence of underlying theoretical concepts.

First, the data (code: [5.3.5] Policies on risk management) supports theories on organisational policies. While a similar data finding (code: [3.2.3] Basic knowledge as prerequisite for KT) was discussed from a knowledge characteristics perspective, this finding focuses on the organisational-level risks involved as a KT barrier. Research and development (RandD) work is extremely risky and may result in no returns. Risk is involved in attempting to predict the success of research in terms of commercial viability as well as KT returns on the OKB. Host organisations only pursue those projects that will result in patenting and commercial benefits. Despite that, there is still a risk that those choices will result in little KT effectiveness to build the OKB. This focus is considered a barrier to KT. In this fashion, host organisations target external organisations that are already close to achieving success with their research. They do not want to spend time and energy trying to develop this knowledge on their own, preferring to buy the knowledge generated and then join the remainder of the project. The AR participant quoted below justifies the beliefs of the host organisations by stating:

The problem is therefore, they [external organisations] will not object to starting with us on anything from scratch. The problem from our side is that if we take this risky path, then, would this cooperation result in obtaining a new technology or something tangible and useful? This is the gamble. We don't know. We would have to pay a lot of money, establish the research, fund it, and then we might gain nothing, and that's the main hurdle in making these decisions. The problem is that there is a high possibility that big research efforts can have no results at the end. This may mean an inability to justify all the money spent and this could cause problems for the executives with the government.

The quote above indicates that policy guidelines on how best to evaluate make-versus-buy risks are focused on generating tangibles (i.e. technology) rather than intangibles (i.e. knowledge). The root causes of this problem relate to two issues. The first is the use of the traditional risk decision tree (Adams, 1995 cited in Massingham, 2010). It seems that staff are uncertain about the outcomes of undertaking entrepreneurial research where they do not have policy guidelines on how to assess the risks involved. The risk is the unwanted event, (i.e. no tangible outcome), which will result in the government being dissatisfied. The executive management does not know the likelihood and consequences of this happening, so they are reluctant to take the risk. Second, there is the actual trade-off decision between an internal make-or-buy from the knowledge marketplace. This is a KT barrier from an organisational policy perspective.

In the context of KT, partnerships that start with a substantial knowledge gap between the external partner (already in an advanced stage in the research area) and the researchers at the host organisation (little background on the research area) face many KT barriers. This knowledge gap makes it difficult for internal researchers to follow the research activity and cope with the KT strategy. A chain of interrelated KT risks is anticipated to occur from such partnerships as described in Table 7-4.

	Risks occurring in a time sequence scenario	Anticipated consequences
1	Internal researchers begin to experience a poor AC and a feeling of being detached from the research activity because they have little background in the previous stages of the research project.	KT slows down and internal researchers panic because of the need to show results to management
2	The external partner finds internal researchers are not able to cope and informally decides to continue the research more independently, despite continuing meetings, discussions and formal updates as formalities.	External partner benefits from funding but not from the researchers. Researchers do not complain about the KT because they need the expert to produce the results quickly
3	Both the external partner and the internal staff realise that the knowledge gap is increasing and is difficult to reduce at this stage because it would take too long to transfer knowledge to the internal staff to add value to the research activity.	External partner retains their knowledge power, while internal staff remain silent to please their management with some research results.
4	The research project produces some IP, which is registered as per the partnership agreement between both parties.	The external partner expanded their OKB, produced tangible results and accumulated funds/profits from the transaction, while the host organisation executive management is pleased with the IP and publicising an achievement. Internal staff silent.
5	Government feels satisfied with results and continues to allocate budget to host organisation. Host organisation is encouraged to repeat the partnership scenario.	External partner is aware of what works and the way business should be. KT becomes a slogan.

**Table 7-4: Risk events scenario for partnering with an external expert**

As the above risk scenario illustrates, when this situation continues to the end of the project, external partners would have benefited from the transactions made. Little KT would have taken place in those situations because the project loses its purpose from a KT perspective. When host organisations focus on generating IP per se, regardless if the working minds were from organisation A (i.e. overseas experts) or B (i.e. local researchers), then the research might render from the efforts of organisation A, as opposed to AB.

One underlying root cause for such occurrences is that the knower did not integrate internal researchers in their project. Instead, they continued research development at

the same speed regardless of the KT element. This supports theories of risk management that recommend “decreased clustering effects, better differentiation and reduced cognitive bias” (Massingham, 2010). To support knowledge activities, Massingham (2010) proposes the knowledge risk management model. In this model, managers are provided with a way to reduce the subjectivity that is inherent in traditional methods of risk assessment, and they thus become able to anticipate KT barriers. The above findings confirm that host organisations have not adopted effective models and are highly vulnerable to KT-related risks.

Second, the data (code: [5.3.6] Auditing policies) extended existing theories of organisational policies in relationship to KT activities. The host organisations are knowledge intensive; however there is no clear policy on what to audit and benchmark for input or output perspectives. This represents a barrier to KT because it affects clarity of direction and sense of purpose. The following quote illustrates this issue, which is resulting in deficient policies:

[C]urrently, we don't have any indicators that are based on clear surveys ... however, we are measuring the advancement in terms of knowledge use and KT by the number of papers that we published, by the number of people who are doing research, or capable of doing research and by the services that we perform, for example, for companies.

It may be noted that all the measures in the above quote are statistical and quantitative except the element of measuring the capability of doing research. The AR participant in a later part of the interview, as well as other AR participants, failed to provide evidence of a policy-based measure for such capability testing. Instead, it seemed as if this was carried out through the cognitive bias of supervisors and managers, which means there is a consistency problem across the organisation. Fairness issues among staff and lack of confidence in organisational policies may arise. Lack of accurate standardised policies that benchmark KT system inputs such as LOC performance (i.e. how good or bad are we at KT?) and KT outputs (i.e. how good or bad is our research performance?) create a barrier to KT activities at an organisational level. This finding may offer a way to extend the lead benchmarking and performance measurement model of Anderson and McAdam (2005). They suggest ‘upstream’ and ‘change domain’ measures but do not clearly identify which measures benchmark the input of the KT systems and which measures benchmark the outputs of the KT

systems (i.e. the external-internal-external systems). The barrier created by blurring the difference would add confusion from an accountability perspective at the host organisations. The leadership should be accountable for the input measures and the researchers should be accountable for the output measures.

Third, the data (code: [5.3.9] KT related policies) revealed a new perspective on organisational policies as a possible barrier to KT. The staff at host organisations see that organisational policies rely on policy makers who are the decision makers at the organisation. However, they see that they are seldom involved in the decision-making process whether through periodic feedback or process improvement activities. Researchers therefore blame management for failing to provide effective policies that support the implementation of KT activities. This means if there are problems in organisational policies that are creating knowledge blockages at the organisation, then it is the decision-makers who are likely to be able responsible for them. However, why do decision makers create KT barriers? It seems that this is due to incorrect decision-making approaches, which eventually produce ill-designed policies that do not take into account the negative effects they may produce on KT activities. The quote by the AR participant supports the suggestion that lack of policies on teamwork is causing a barrier to KT: “there are no clear rules to encourage people to work jointly”. This provides a new perspective to KT barriers because it shows that rules and policies can have a direct impact on the social, structural and relational architecture of people in the organisation.

In summary, the findings contribute to the understanding of organisational policies as a possible organisational-level barrier to KT. The findings show that learning from best practice is paramount to public policy reforms to reduce risks associated with KM. The findings also show a relationship between the performance of KT and auditing policies. A new perspective revealed that KT-related policies were isolated from the involvement of staff, which, it is suggested, cause KT problems at the implementation stage.

### 7.13.4 ORGANISATIONAL RESOURCES

In this study it is argued that organisational resources are an organisational-level construct that may be a root cause of KT-related barriers. Organisational resources are defined as tangible and intangible productive assets owned by the firm (Grant, 1996). The practical outcome of this construct is that knowledge seekers will be more capable, through their acquired knowledge, of using organisational resources more efficiently as an output measure for KT activities. As these resources are used as infrastructure enablers, their absence or low quality creates a barrier to the KT process (Gold *et al.*, 2001). In the context of KT barriers, the following data examples provide evidence of underlying theoretical concepts.

First, the data (code: [5.5.2] Lack of administrative and research human resources) supports several theories about organisational resources. Research requires a large amount of human resources and support services. Skilled administrators, managers and consultants usually provide these services at every stage of the research life cycle. Host organisations, however, have shortages in human resources, which distract researchers from their main work, forcing them to do administrative work as a result of this shortage. KT is affected because a lack of administrative support is taking them away from their KT activities. This problem is a quantitative, human resource problem; rather, it is due to the scarcity of quality administrative staff, which means the problem is the difficulty of finding people with the necessary knowledge, rather than the difficulty of finding people *per se*. The following quote illustrates this dilemma facing a research centre director at Organisation Y:

I spend at least on a daily basis between two and three hours minimum doing secretarial jobs because the way I want the job to be done, even writing certain memos, I don't feel confident to assign to my secretary.

The AR participant is really talking about a lack of lower-level activity support which means expert staff waste time doing things that add less value for their organisation. The limited time valuable experts have means that when they spend time on less valuable activities, the organisation loses higher value work from the internal expert as a consequence. The following quote by a US scholar who participated in external-to-internal KT to host organisations provides evidence to lack of research students to support the internal experts who are not able to produce the volume of research needed to put host organisations in a competitive global position:



[G]raduate researchers are essential to achieve high standing in world rankings because you need to produce a lot of research and this needs lots of people doing research in the laboratories. They don't have so many [graduate student] here [at host organisations]. That's why they have research institutes here because the research here is mostly by staff and not by students. The norm in the US and the world is to have students doing most of the research not research staff. It is particularly hard for experts to work without students

The above quotes validates the claims of internal staff that human resources are not sufficient to become competitive as research organisations. Several theories confirm that the loss of the critical value that knowledge workers possess outweighs the savings on necessary staffing that seem to be economically justifiable to the management teams at the host organisations (Wernerfelt, 1984; Wiklund and Shepherd, 2003; Priem and Butler, 2001; King, 2007).

Second, the data (code: [5.5.14] Lack of willingness to spend for basic resources) extended existing theories of organisational resources. The Knowledge Based View (KBV) of the firm suggests that knowledge is the most important resource for competitive advantage. This might be true but this view undermines the backbone of engineering research – that is, the technical equipment necessary for KT. If the orientation of the host organisations is to conduct research for the purpose of innovative engineering outcomes, then working with experts and having intensive intellectual and social interactions will not make up for a shortage of physical equipment, laboratories and engineering materials. The following data was quoted from a research centre director who worked 15 years in engineering research. He explains how spending for resources is essential:

It is a must to change [spending practices]. This is dynamics [resource adaptation] ... This is the [current] culture [tending to prevent spending], but if we are creating the vision, trusting people and being generous [more spending for more resources], then this will take you to the lead. But [when you say] I have big ambitions and a big vision and still I [the leader] am greedy from one side, it doesn't work this way.

The AR participant illustrated how the mental model of the leader could devalue the abundance of wealth if not properly invested. This quote extends our understanding of the socio-technical context in which spending on technological resources may be linked to social mental models (Leonardi and Barley, 2010). From a personal mastery perspective (Senge, 1990), individuals may decide whether the organisation cares enough about their personal growth and learning by its willingness to invest in necessary technology and equipment. This extends what previous studies found in

that KT can be implemented through its human resources to achieve success. The following quote shows that KT was deeply affected even when human resources were sometimes available, due to lack of physical infrastructure:

We need to interact with world-class leaders [best engineering research institutions] but at the same time how did these people become world-class? The ingredients that they had are not present in the infrastructure here. So, how do we interact with them? Even if they would like to give us [knowledge], they will not be able to ... They want things to be done in two days, here I don't think they can be done in two months [due to infrastructure shortages], and this will be a source of demotivation for them.

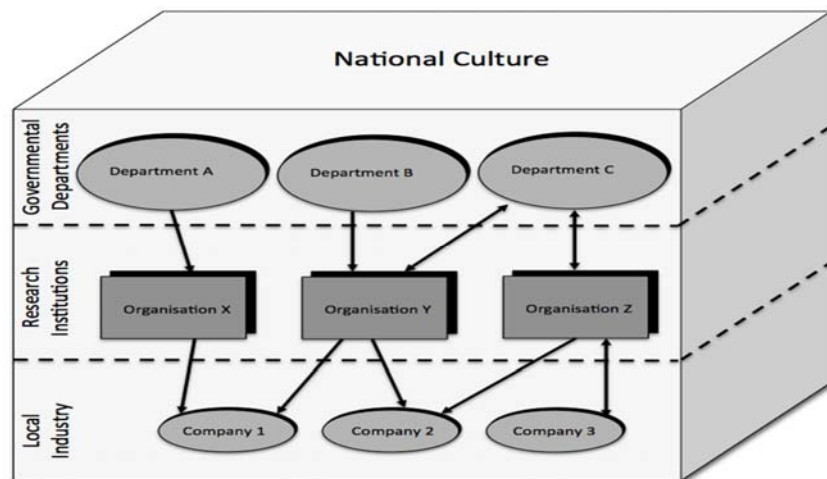
There is a minimum expectation of overseas partners that needs to be sustained as an important element for the success of any KT initiative on the external-internal KT level. The data suggests that organisational resources may have an important role in fulfilling this need. In summary, the findings contribute to the understanding of organisational resources as a possible organisational-level barrier to KT. The findings indicate that lack of willingness to spend on resources, lack of administrative human resources and the disappointment of external experts at the way internal resources are managed, are the major root-cause barriers to KT.

### 7.14 NATIONAL LEVEL BLOCKAGES

This section analyses the Saudi national-level to uncover the effects of the domestic environment on knowledge flows. The national level of analysis was an emerging theme in this AR cycle. Recurring codes under this theme emerged and elevated its importance. Therefore, the constructs in this section are grounded in data findings as shown in Appendix E. The national-level themes emerged from three control dimensions. First, the government centrally controlled national policies and resources. Second, the government distributed its control over systems (i.e. agency departments) to ministries, which to some extent listened to local organisations. Third, the government had very little control over the national culture. This means that the host organisations were centrally controlled, as is the case with all other governmental agencies, in terms of policies and resources. However, they had promising flexibility in terms of systems and internal processes. For example, host organisations had little control over finances and human resources policies; however, they had flexibility in

deciding how to mobilise their knowledge activities. On the other hand, neither the government nor the local organisations had control over the national culture.

The interaction between these three control levels is illustrated in Figure 7-12. This form of interaction is an idiosyncratic national phenomenon in Saudi Arabia, which seems to influence how things are done at the national level (i.e. domestic inter-organisational relationships) as well as at the internal organisational level (already discussed in the organisational-level construct). Given that Saudi Arabia is seen by many as a developing country (Porter, 2008), it was appropriate to investigate relevant literature on how governments in developing countries react towards their local organisations and vice versa.



**Figure 7-12: Modelling the national level analysis (author's interpretation compiled from the literature)**

The figure above illustrates how most of the previously discussed constructs on all levels share the influence of national factors. Different national policies, processes, and resources are visible between host organisations and government, between the government and local industry and between host organisations and the local industry. As can be seen, the overall volume represents a national culture which can only be influenced but not controlled, by other national measures such as policies, processes, systems and resources.

Business activity in developing countries is attracting growing interest in business studies, however, it has been found that business studies concerning developing

countries have fundamental differences with their counterparts in developed nations (Hansen and Schaumburg-Muller, 2010). Data findings, in general, support this understanding. Development studies, a stream of research concerned with how developing countries interact nationally with their local organisations, is devoting an increasing amount of attention to the role of firms in facilitating economic and social development (Hansen and Schaumburg-Muller, 2010).

In terms of KT barriers, national-level barriers may be seen as those impediments imposed on the case study organisations beyond their internal control authority. The practical outcome of this construct means that seekers are influenced by national factors as an input measure to the KT activities in a way that significantly influences the output. The following data examples provide evidence of underlying theoretical concepts.

First, the data (code: [6.2.3] Governmental accountability policies) supports several theories about national policies and resources. The following quote illustrates how the AR participant feels that change – and intervention – needs to come from the government to hold the executives in Organisation X accountable for the actions they take in relation to KT activities:

It's a difficult question. I think there is a solution and that is to ask or to put everyone accountable, to ask these bosses, directors, why do you do this? and why do you do that? In Saudi Arabian organisations and [Organisation X] is one of these organisations, there is no one behind this. There is no one asking the big bosses why are they doing things like this.

Neoclassical economists have long maintained that even if there were a theoretical basis for massive government intervention, it would still be advisable to forego such intervention. If the government intervention failed, it would be worse than the failure of the host organisations (Bhagwati, 1982). On the other hand, the so-called 'structuralism school' discusses fundamental inefficiencies in the allocation of resources, and prescribes massive state intervention that allocates resources and hands-on industrialisation policies (Prebisch, 1950). Data findings support the latter school of thought by strongly urging for government intervention to overcome various KT barriers. This means that AR participants not only address their needs to their organisations but may also approach the government.

If staff were not able to approach the government then the possibility of a sustained lack of accountability to stakeholders may affect staff perceptions of the

organisation's mission and goals. Therefore their motivation in terms of finding meaning and purpose in their work may be affected. When staff see problems and the government does not intervene in order to address them this gives a sense of lost direction. Host organisations and the government are not taking positive roles on policy activation. In the area of development studies, strong interventions were seen as prerequisites for big push (Rosenstein-Rodan, 1943), linkage formation and overcoming dependency (Prebisch, 1950).

Second, the data (code: [1.1.1] National research coordination – Appendix B) extended existing theories on national systems. The significant role the Saudi government needs to play in guiding the progress and growth of engineering research organisations is the role of national coordination (Hansen and Schaumburg-Muller, 2010). Within this role, the government supports staff at host organisations to communicate freely and autonomously among their peers in the local level (i.e. beyond organisational boundaries). An AR participant recounted that whenever he approaches a researcher from another national institution, it is difficult to receive immediate positive responses due to the communication process being informal. Unless formal channels exist and a system on a national level is erected by authoritative entities on both sides, researchers have no effective communication. He says: “At the moment, there is no communication [on the individual level] between research institutes in Saudi Arabia because they don't fall under one umbrella.”

The extended concept from the previous point is that not only should government provide policies and resources but also it must mitigate information and system imperfections by making available trustworthy information about local industries to guide their strategic planning activities (Hansen and Schaumburg-Muller, 2010). The engineering research organisations have consumed 25 years of governmental support in the form of funding and infrastructure, but have offered minimal tangible contributions to the national economy in return. Therefore, the data calls for governmental systems to synergise local abilities.

The inability to establish formal communication systems between local research organisations could eliminate KT cultivation from the outset. Without official sanction and without the implementation of clear lines of authority supported by

powerful coordination systems, KT within host organisations may be frustrated. The government is the only entity that can implement a national coordination system in the context of KT activities on the internal-to-external level.

Third, the data (code: [6.1.4] Community habits; [6.1.6] National education system; [6.1.7] Changing values) revealed a new perspective about national level culture. On the macro scale of nations, organisational culture is considered a micro-culture, while national culture is described as the macro culture (Schein, 1990). The forces in national cultures are much more complex than those in organisational cultures due to the significantly larger number of variables that influence them. Data contributed to a new perspective in that there is some sort of relationship between micro-cultures and macro-cultures. The new perspective here is that contrary to the tendency to assume that organisational culture is in some way driven by national culture, the host organisations are allegedly struggling to diverge from the national culture. This is not the case in developed countries where organisations build on their national culture in which people attach great importance to high quality education, work focus, discipline, creative thinking, and a sense of achievement. This discussion does not discount the rich heritage of the Arab nation, as supported by the following quote:

I mean, from the Islamic point of view, if you look at openness, transparency and KT as a Moslem, these values are part of the teachings of the religion, but as people living in this area, I think some opposite values exist. That's a recent characteristic of Arabs.

Thus, I am highlighting transparently the acute dilemma in the lifestyle of the nation in which people are provided with low quality education, a low focus on work productivity, lack of discipline, lack of creative thinking, and a sense of short-term achievement. The following quote illustrates this trait as observed the AR participant:

I think its [KT] not effective in [Organisation X] because many people don't work hard. I think the people in [Organisation X] are very rich and they don't work hard because they don't need to work hard ... I think it's not the knowledge, it's the habit of the people.

The new perspective in this discussion suggests that host organisations need to find more result-oriented approaches to detach from the pseudo-acute national culture. Such approaches must implemented in a way that allows them to pursue the LO status. Such divergence is to depart the defects that the organisation cannot intervene in. On the organisational level across the nation, the following data provides an

example: “It [the education system] is not like Australia where you have to create your own project or even give an idea ... This is not currently in our [Saudi] universities”. On the individual level across the nation, the following data provides another example:

For example, a person had good education, but in his family he never learned how to be thankful to others and how to appreciate others, how to care for others, he didn't learn it. For him, it will be very difficult; you will see that when he is in his profession, he would reflect actually what he attained from his family. It's very difficult for him to change, even if he was in a different society for a number of years, it's still difficult. Why? These are ingredients. If someone developed them during his grooming then it is very difficult for him to adapt at a later time of his life.

In addition to its national cultural dimension, the above quote also refers to social structure. An abundance of evidence shows that the host organisations have been vulnerable to the ubiquity of those national symptoms. The national culture has affected most of the organisations' functions including their KT activities. The challenge of diverging from national culture is considered a significant KT barrier.

In summary, the findings contribute to the understanding of possible national barriers to KT. The findings indicate that lack of willingness to spend money on technological resources, a lack of administrative human resources and the disappointment of external experts at the way internal resources are managed, are major root-cause barriers to KT.

### **7.15 INTERNATIONAL-LEVEL BLOCKAGES**

This section analyses global-level blockages to uncover its effects on knowledge flows of the international arena as a knowledge marketplace. As with the national level in the previous section, the international level of analysis was an emerging theme in this AR cycle. Recurring codes under this theme emerged as well since the majority of host organisations' inter-organisational engineering KT was taking place at an international level (i.e. the external-internal KT was mainly from overseas organisations). The practical outcome to this construct means that seekers will be able to be exposed to international experts as an input measure. However, because there are many barriers to this happening, analysing underlying reasons that resemble

barriers to the KT process is legitimate. In the context of KT barriers, the following data examples provide evidence of underlying theoretical concepts.

First, the data (code: [7.1] International legal barriers; [7.4] Governing law) confirmed several theories of international KT theory. AR participants advocated that the most difficult part in international KT practice is establishing a business relationship. The difficulty of the legal aspect was confirmed by AR participants, which supports what Faems *et al.* (2007) found in that the success of the initiation stage relies on legal KT clauses. The following quote illustrates the underlying challenges of this discussion:

[The] biggest problems related to this issue [KT] are legal barriers. Maybe we can overcome translation challenges but ... you get so many legal barriers. Legal barriers are the number one problem in international cooperation, in my view. For example, in the Russian agreement, there are purely legal matters that have been delaying the agreement for the last four years ... If you put conditions from your side, and at the same time, you are the party who needs the knowledge, then the agreement will be rejected by the other party, which we don't want.

As the host organisations are governmental, equity governance structures were difficult to enforce to resolve the legal issue. This is also supported by Mowery *et al.* (1996). AR participants suggested the presence of specific contractual clauses to mutually protect the relationship. The US expert interviewed in AR cycle 2 (see chapter 6) also asserted that he dedicated significant attention to the governing agreement before commencing KT activities as a knower providing knowledge to the staff members of Organisation Y. He also met with the provost of his university in the US and discussed the legal details of his arrangement with Organisation Y to ensure ethical, business and academic standards were maintained. Without those clauses, KT on the external-internal level would face substantial barriers.

Second, the data (code: [7.3] Political issues) extended existing theories of international KT perspectives. The initial issue for KT in relation to politics is how are international experts and their organisations willing to provide Saudi researchers with engineering knowledge. The following quote by a US scholar illustrates the position of one of the most known US institutions in the world:

I think [a leading US institution] expects that we [US scholars] will communicate and transfer knowledge to the world and this is our responsibility as an educational



institution, not to keep it [engineering knowledge] within [the US institution]. I mean what benefit is it to mankind that way? I even don't think that they [the leading US institution] expect financial benefit. I guess our institution is a really special place. I worked there for 40 years and I can imagine some other institutions [in the US] to come to [organisation Y] to transfer knowledge for money. I guess it is a cold way of saying it, but I think there are organisations that are motivated by money to transfer knowledge

International KT consists of two critical steps: the disclosure of knowledge by the '*expert partner*' and the acquisition of knowledge by the '*novice partner*' (i.e. knowledge seeker) (Hamel, 1991; Zahra and George, 2002). Therefore these two steps require *willingness* from the expert to release knowledge and *ability* from the seeker to acquire knowledge. The willingness of the knower is the focus here since in most of this thesis (see chapters 5 and 6) assumes that the knower was willing to release knowledge as the above quote suggested. However, by including a 'what if' scenario that the knower was *unwilling*, a different perspective may emerge. The following quote provides evidence of the significance of this KT barrier occurring:

[W]ould India give you everything? No it wouldn't. Even if you offer to pay double, they would not accept. It's political sometimes ... For example, Japan has expertise in some technologies but it is known by experienced specialists that they would not give these technologies away. So it is useless to go to Japan ... Signing an agreement with Japan would be weightless ... You may be able to buy the IP for commercially based knowledge but it is not possible to get strategic knowledge even if we wanted to pay for the IP because it's not for sale. The French wanted to retain their nuclear power technology IP ...

International knowledge providers are powerful because they have the knowledge, while host organisations try to *balance* this power with money (i.e. as a customer). The latter quote extends our understanding to the knower willingness in three ways: (1) in non-transaction based relationships, the knower will be more willing to engage if host organisations produce tangible scientific results in order to sustain a long-term relationship with the external experts; (2) in transaction-based relationships, the knower will be more willing to engage if the host organisation has a clear knowledge strategy with benchmarks and metrics to gauge progress; and (3) in the legal development of an agreement for both scenarios, the knower will be more willing to engage if the host organisations initially create trust to sustain long-term international relationships by being transparent about the intentions behind the collaboration. However, by comparing the different views, it seems that external-to-internal KT is more contextual than generalisable.

Third, the data (code: [7.10] International culture issues) revealed a new perspective about international KT theory. The context in which host organisations are acquiring international knowledge is challenging, not because of being located far from the source, but because of the reality of being receivers of knowledge. Host organisations experience difficulties in establishing knowledge process *channels* because there are no business processes that are already established to embed knowledge processes within them, as is the case with internal KT. The establishment of new business processes to establish channels for knowledge processes is cumbersome, as explained by the analysis of the blockages mentioned earlier. To overcome these barriers, host organisations are employing significant financial incentives that go beyond scientific incentives to attract international research organisations as well as individuals.

In summary, the findings contribute to the understanding of possible international level barriers to KT. A key finding is that financial gains to external providers continued even if there was little scientific gain to host organisations, which suggests that some sort of ‘learning substitution’ exists in the relationship (Levinthal and March, 1993 cited in Schulz, 2001). While financial gain continued in favour of overseas experts, the seekers were disadvantaged. Since the findings show that host organisations continued such relationships while having little control over them, it was acceptable to external providers to continue to dominate the relationship since it makes them the ‘substitute learners’ and sustains their financial gain. Such failures are not unique to host organisations since general failure rates of such activities are reported to be high on a global scale (De Laat, 1997). However, the irony in the case of the host organisations is the continuation of those relationships and the continuation of the associated expenditures even when failures continue to occur.

### 7.16 SUMMARY OF KEY FINDINGS AND REFLECTIONS

There were 269 knowledge blockages identified in AR cycle 3. These blockages had varying degrees of severity and varying implications for KT processes taking place at host organisations within the external-to-internal, internal-to-internal and internal-to-external KT systems. Figure (7-13) illustrates the categorisation of these blockages as

well as the qualitative assessment of the problem underlying each sub-construct using a color-coded scheme.

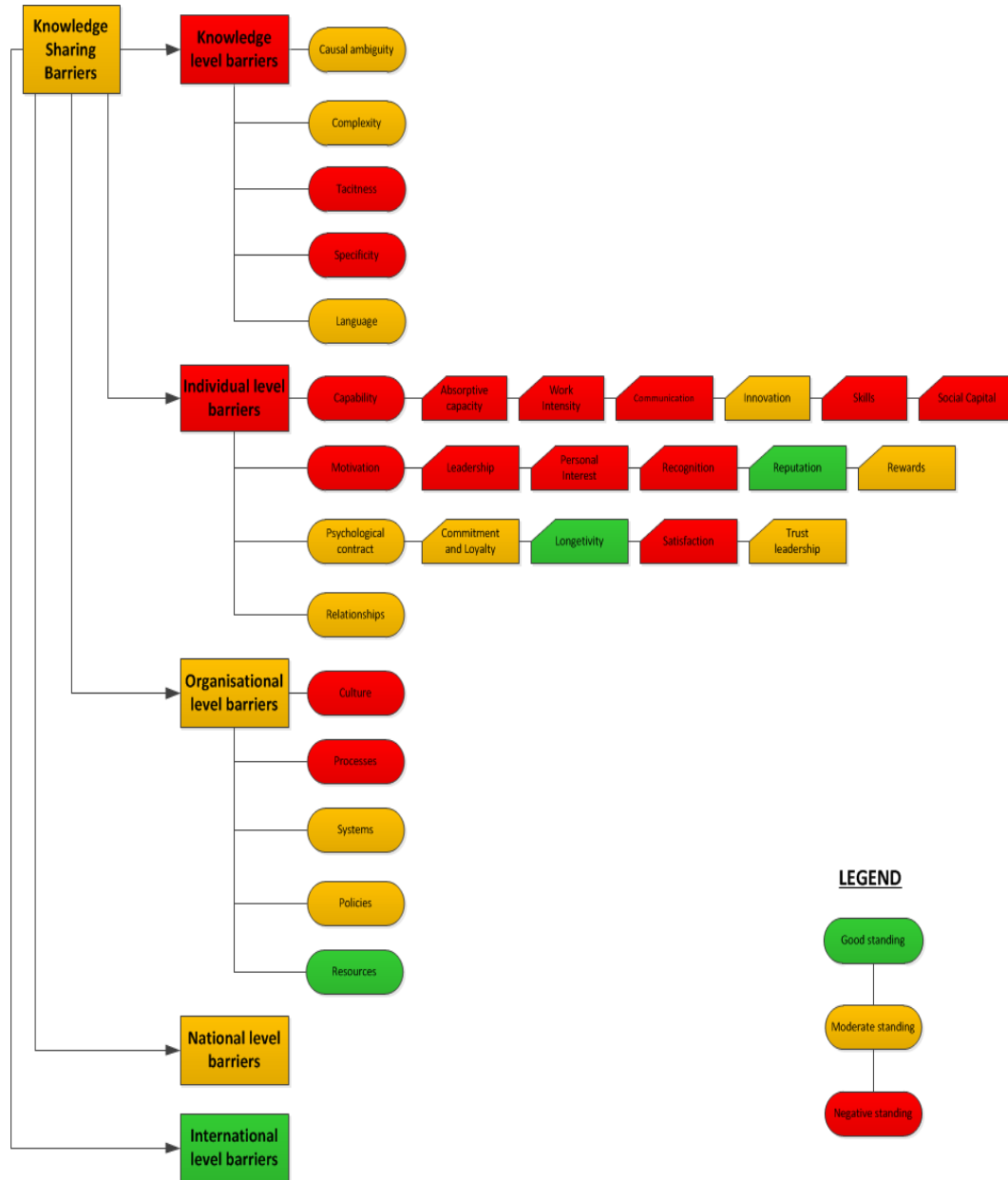


Figure 7-13: Color-coded assessment of the sub-constructs KT barriers identified in AR cycle 3

### 7.17 CYCLE 3 – PHASE 6: “REPORTING”

As Figure 7-14 below illustrates, this section describes the sixth phase of AR cycle 3. In this phase, I will present the segment of the AR journey that explains how reporting took place in this particular cycle.

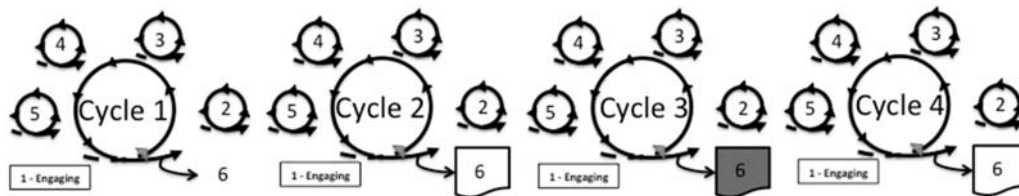


Figure 7-14: Cycle 3 – Phase 6: “Reporting”

The analysis revealed 269 knowledge blockages at host organisations. Each knowledge blockage had underlying phenomena that required explanation and discussion. It would not have been useful to the leadership to be given a list of blockages per se, rather, reporting detailed information on each knowledge blockage with sufficient analysis to validate the data findings was more useful to them. Condensing the knowledge blockages from a 912 barriers to 269 barriers while explaining to the leadership the process that took place for condensing them was appreciated as a sign of intention to avoid the exaggeration of the problem. This was an important step for maintaining trust and confidence in an AR project of this scale. The report submitted was 313 pages in total and included color-coded diagrams according to Appendix E, which represents the condensed version of the report.

The academic version of the analysis presented in this chapter was not submitted to the host organisations. However, Organisation X and Organisation Y expressed interest in receiving the final version of this thesis on the basis of their interest and active involvement and desire to benefit from the study. Although, the use of the theoretical analysis from the practitioner’s perspective is questioned by some scholars (Walsh *et al.*, 2006), the host organisations’ expressions of interest in receiving the academic version of the project may be justified by the fact that they represent academic institutions. This is a special case in which the organisations undergoing the study are themselves from academia. If this study had been conducted on industrial organisations or business oriented companies, this interest might not have surfaced.

## 7.18 CONCLUSION

Qualitative research studies usually do not follow the notion that data follows theory as an approach to deductive reasoning (Saunders *et al.*, 2003). Although all interviewees followed the same guideline questions, the way the analysis, reflections and theoretical development combined the views of AR participants was non-linear and required a significant level of deductive contemplation. The transcription efforts were substantial. The conversion of 17.5 hours of voice into text resulted in 425 pages of raw data. This text was thematically coded based on the knowledge blockages model of Figure 7-4. However, the process of coding was iterative and modifications were made till the final analysis was realised (Gibbs, 2007).

The process of coding had a twofold purpose: one was to reconstruct reality on the situational behaviour of knowledge and people within the host organisations as accurately as possible. AR participants and I acknowledged that a false representation of reality would lead to misleading analysis and reflections on possible knowledge blockages. I have highlighted how the espoused theories of people could influence this task during the interviews (Argyris, 1987) and thus, this matter was raised with each AR participant before each interview to focus on describing accurately what was actually happening. Secondly, based on an interpretative research epistemology, those reconstructions of reality were linked with previous research findings in the literature to contribute to the KM body of knowledge. This provided an opportunity to establish possible theoretical generalisations where further research can make sense of KM and test these generalisations within future research contexts.

Blockages in the flow of knowledge can have serious consequences (Davenport and Prusak, 1998). Most obviously for the host organisations, blockages negatively affect the learning curve of the organisation as they mean staff cannot get knowledge to those who need it when they need it. Often the result is that staff will waste considerable time repeating their search for knowledge or they will give up trying to do something they do not know how to do by themselves. Therefore, the BPR method

identified wastage points (i.e. it identified waste or blockage locations but not the blockage phenomena themselves which were explored in this AR cycle). These process *nodes* carrying the flow of knowledge at the three research host organisations amplified how work is done, and provided an important insight for uncovering the internally available business process performance.

An important distinction between this chapter and the previous chapter is the greater detail provided in analysing the KT phenomena at the selected research organisations. This chapter essentially deepens insights into the problem and clarifies reflections that are useful for comprehending what barriers are present and why they occur within the KT process explained in chapter 6. By identifying the barriers to KT within and beyond the organisations' boundaries using a conceptual framework that classifies types of barriers into different levels of analysis, I provide a theoretical contribution to the body of knowledge.

Since it is knowledge that is being transferred, it was logical to start the "analysis and reflection" phase with the barriers, which occur at the knowledge characteristics level. I introduced each major construct with a brief definition from the literature. Further details on each construct can be found in chapter 2 as the brief definitions in this chapter represent a summary. I aimed to find the emerging findings for each construct in the context of the previous literature. I have also added a qualitative assessment to indicate the significance of each knowledge blockage using a color-coded indicator.

As sub-item findings were organised to unpack its underlying impact, I was able to generate conceptual summaries that relate those findings to relevant theory. This eventually led to significant theory development, which was presented in the body of this chapter. For example, I analyse the AC construct using the input-output model of Zahra and George (2002) and see how well defined it is in the literature based on the findings of AR cycle 3. Another example is about tacitness and complexity where the three steps model that uses a gradation from simple to complex is applied to the findings. The identified theoretical models in the literature were therefore used to organise the barrier tables. This helped this AR cycle to argue that the findings may support an existing theory on each identified topic. In case where an existing theory was not possible to fit within, a claim is made to making a new theory.

For example, when trust emerged as a barrier to KT in chapter 7, it was possible to know from chapter 6 where in the organisation it occurs and how it becomes significantly influential to KT processes. This is a profound lens for viewing KM through a concept or idea which provides abstract diagnostic assessments to produce a detailed response that describes the problem, the solution and most importantly, where in the organisation's various processes are applied. I look back to chapter 6 and value its contribution in providing context and applicability to the study findings and solutions.

In summary, the most significant KT barrier on the knowledge level was *knowing the meaning of KT*. This KT barrier created misconceptions and limited use of KT activities. On the individual level, the most significant KT barrier was *the limited individual authority*. As the case-study organisations were all governmental, the issue of individual misuse of authority created many individual level KT barriers. On the organisational level, the most significant KT barrier was *culture*. This barrier created many issues for KT improvement that required change in how work is done and how people should behave. On the national level, the most significant KT barrier was *coordination*. Most governmental agencies lacked the capability to coordinate their activities to enable KT. On the international level, the most significant KT barrier was *politics*. In many situations, the knower is willing to provide KT to Saudi research organisations but their governments may not allow that to take place.

# CHAPTER 8: THE MANAGEMENT FOCUS GROUP

## AR CYCLE 4: PART 1 (VALIDATION OF FINDINGS)

*“Sometimes a group or community recognizes that it collectively needs help, but someone must articulate the need and bring it to public consciousness. A relational helping process can then be created.”*

*(Edgar Schein, 2009)*

### 8.1 BACKGROUND: DECISION-MAKERS AND SYSTEMIC THINKING

Previous AR cycles contributed to this study through changes in awareness. Indeed, change in the awareness of individuals in the study of KT was valuable and translated into rational consciousness where AR participants became more informed and willing to take action. Evidence confirms that real-life interventions took place at the host organisations. The findings from previous cycles confirmed that new consciousness levels emerged into an interest to (1) *formalize* the articulation of the problem and to (2) *search* for the solution. It was not possible to start implementing the solution process without acknowledgement from management of an articulated problem. The collective formal acceptance of the problem required that decision-makers meet in one room, exchange their reflections and provide their final feedback on the previous



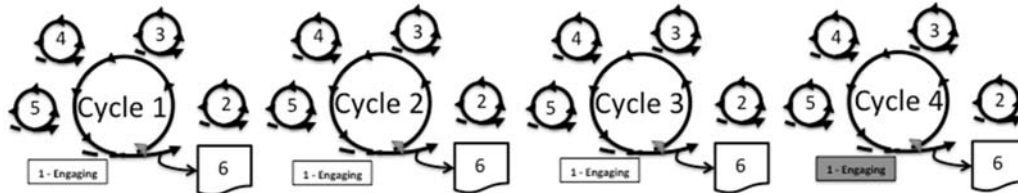
cycles.

When previous reports were submitted to the management at each host organisation for their reflection and possible interventions, I conducted observation sessions to search for evidence of possible interventions. However, these reports had little pragmatic effect. Formal changes in policies and processes after each submission were not detected over periods of six months. Moreover, I did not receive formal acknowledgement of the content of submitted reports. The absence of such feedback was a gap. As an AR researcher, I was hoping that my reports and collective reflections with AR participants would result in a thinking shift among decision-makers and possible changes in actions. Besides the changes in awareness mentioned earlier, formal changes attributed to the submission of previous reports were not visible. This justified the need for a further AR cycle.

AR cycle 4 links both the *formalisation* process with the *search* for the solution process as a means to link reflection with action. This link was made through (1) collective feedback from executives on all previously identified diagnostic reports to systemically articulate the problem as a whole and reach formal consensus, hence, *shared understanding*, and then (2) converting such formal *shared understanding* into a pragmatic workable solution that emerged as a result from the formalisation process. While the “taking action” phase of this cycle represents the formalisation (and validation) process, the “analysis and reflection” phase represents the emergence of the suggested solution. The formalisation process is presented in this chapter and the “analysis and reflection”, where the solution emerges, is presented in chapter 9. The “reporting” phase of this cycle comprises submitting the suggested solution to the overall KT problem in the form of a KT change initiative solution.

## 8.2 CYCLE 4 – PHASE 1: “SITUATION ENGAGEMENT”

As Figure 8-1 below illustrates, this section describes the first phase of AR cycle 4, the final AR cycle in this thesis. In this phase, I will present the segment of the AR journey that explains how the situation engagement took place in this particular cycle.



**Figure 8-1: Cycle 4 – Phase 1: “Situation Engagement”**

Since little interventions to the KT problem were detected after the submission of the three diagnostic reports (based on the findings presented in chapters 5, 6 and 7), this new AR cycle was to examine the response of executives to validate the study outcomes. Although KT was revealed as a major problem at host organisations by this thesis, the leadership found it challenging to respond appropriately to those discoveries. The source of this challenge was controversial. Some AR participants believe that governmental organisations, including the host organisations, do not respond quickly to performance issues, which is supported by a historical trend.

It is also important to consider the situational context of the findings. The host organisations are affiliated to some degree with higher education and learning. It is therefore confronting and counter-intuitive to suggest KT is weak at research organisation, i.e. knowledge factories. Therefore, it was reasonable to expect some level of disagreement or objection to the findings of the management reports that KT was a problem. I met with some executives at host organisations to explain this situation and engage them to recognise the necessity of this AR cycle so a KT strategy can be developed after validating the findings in the previous three reports.

To executives, seeing an opportunity to engage to reverse problematic KT situations was non-linear and non-intuitive. The absence of a *shared understanding* and

*systemic formulation* of the problem, especially among executives, complicated the situation and inhibited collective action. Such action required a process consultation to facilitate the emergence of a KT strategy (Schein, 1990). This serious gap suggested formulating a MFG that could stand as a bridge to bring executives together to contemplate on previous diagnostic reports to facilitate the emergence of a *shared understanding* of the KT problem.

In order to facilitate possible action for change, a bridge between personal and shared understanding was needed to consider how to connect the three separate findings, i.e. based on chapter 5, 6 and 7, in a way that executives could see the nature of the problem in a way that they could take action. The complexity and scope of the findings perhaps meant executives could not see the wood for the trees, to use an analogy, and this 4<sup>th</sup> AR cycle aimed to provide this perspective. I approached the executives who received the previous AR reports with this view and established an initial agreement to proceed to the next phase of defining this AR cycle.

To organise the logistics for this AR cycle, a time commitment from executives was necessary. The approval from executives at host organisations to commence AR cycle 4 was the most difficult to achieve among all the cycles so far because it involved time commitment from highly influential, highly paid, executive leaders. While maintaining deference, my approach was to emphasise the importance of bringing decision-makers together to discover how close they were as leaders, to the findings of the three submitted reports. I encouraged vice presidents and their delegates at each host organisation to allow me to facilitate a focus group for them to help uncover the distance between them on the findings of previous cycles. Each host organisation was not aware of the other organisations as their identity was confidential. However, they did know that parallel activities were carried out at similar organisations within Saudi Arabia. The response was an initial acceptance at all three host organisations, which allowed me to commence formulating the design for the focus group meeting. Their acceptance was based on an expectation that if they validated the problems identified then the next research activity would be to find solutions. They were informed that as part of this AR cycle, an initial KT strategy would be developed after the validation part of completed (see chapter 9). This was a motivator to commitment. The next phase was to formulate a focal definition to begin the validation process.

### 8.3 CYCLE 4 – PHASE 2: “EMERGING DEFINITION”

As Figure 8-2 below illustrates, this section describes the second phase of AR cycle 4. In this phase, I will present the segment of the AR journey that explains how the emerging definition was formulated in this particular cycle.

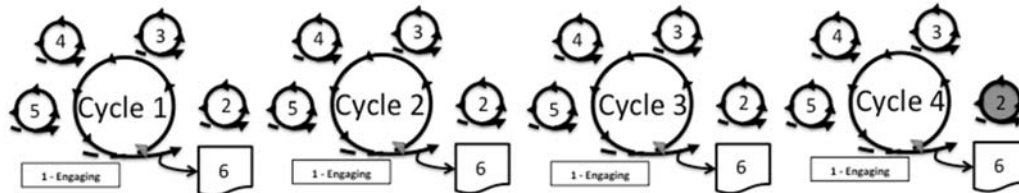


Figure 8-2: Cycle 4 – Phase 2: “Emerging Definition”

By formalising KT problems, I aimed to bring personal changes in awareness towards a collective organisational understanding. It was therefore unavoidable to seek management approval to formalise the findings. From a methodological perspective, formalising previous findings provides validation to this thesis, especially that the findings, if validated by the three host organisations, may be accepted as an industry benchmark for Saudi research organisations (Gibbs, 2007).

In dealing with experienced executives, I needed to *define* my role as a researcher (Schein, 2009). My objective was to help the leadership understand how to modify their mental model on KT to enable a *shared understanding* for implementing a successful intervention (Senge, 1990). To help them shift focus from traditional business trends to become more conscious of what really matters to their context and actual need, I followed the model of Figure 8-3.

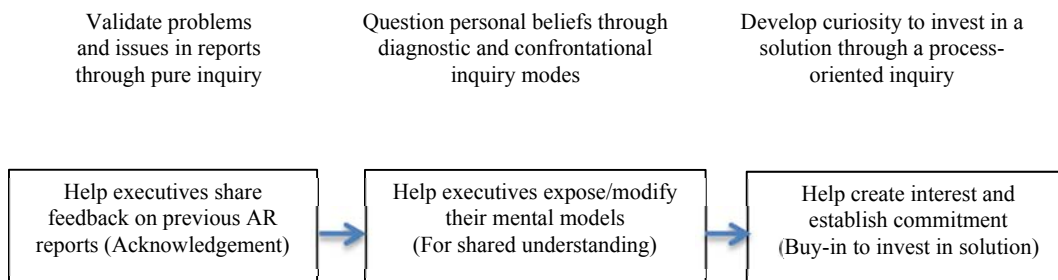


Figure 8-3: Management Focus Group (MFG) model (author’s interpretation compiled from the literature)

It is therefore appropriate to define the MFG as *the process consultation space where dynamics of helping is used to ameliorate the understanding of participants to become more homogenous and action-oriented* (Schein, 2009). I did so by guiding the construction of the focus group questions with the following philosophical enquiries:

- (1) Why does this AR cycle matter?
- (2) What do executives take with them after attending the MFG meeting?
- (3) How do they, and I, measure the effects of the MFG meeting over time?
- (4) What else need to be done after an MFG meeting is complete?

As will be described in the instrument description section of this cycle, the way problems were discussed with the executive management at each host organisation stemmed from a systemic approach (Senge, 2007), double loop learning (Argyris and Schon, 1987) and reflective dialogues (Senge *et al.*, 2007). In doing so, decision-makers represented the different parts of the system where their presence in the focus group contributed to constructing the whole (Senge, 1990). My contemplations on the relationships between those parts in the “planning for action” phase helped to identify their systemic interdependencies. I wanted to develop an ecology for rethinking the system as a whole during the “taking action” phase. This process provided the AR participants in previous cycles with a voice in the sense that the MFGs allowed their feelings and perceptions to be heard by executives. The challenge was to engage the executives in listening to this voice and to develop shared mental models about what participants were saying.

AR cycle 4 involved leaders to reach (1) an acknowledgement on previous diagnostic reports to decide what exactly required action for change, (2) a planned exposure of the mental models between executives in an open environment to widen their level of shared understanding and (3) buy-in of their interest and commitment to invest in possible solutions as part of a KT strategy. Cycle 4 is thus not focused on discovering new issues in KT as much as to triangulate, and hence, validate previous data findings (Gibbs, 2007), and bring leaders closer to each other to take real-life action (Senge, 1990), thus realising “practical wisdom” suggested by Polanyi (1967) and practical use of action research to change reality and solve real-life issues by starting with an initial KT strategy (Freire, 1985).

## 8.4 CYCLE 4 – PHASE 3: “PLANNING FOR ACTION”

As Figure 8-4 below illustrates, this section describes the third phase of AR cycle 4. In this phase, I will present the segment of the AR journey that explains how planning for action took place in this particular cycle.

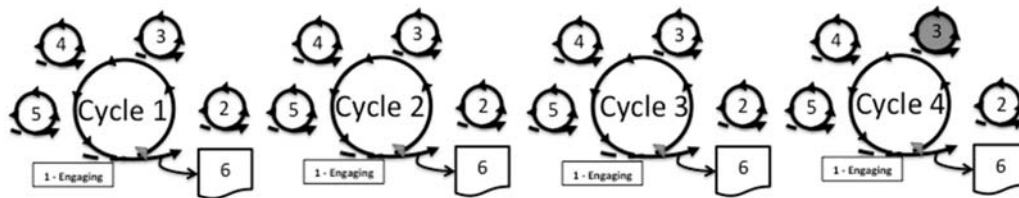


Figure 8-4: Cycle 4 – Phase 3 “Planning for Action”

Given the sensitivity of executives in voicing their opinions, I anticipated, and planned for, the existence of many contradictions between their espoused theories and theory-in-use (Argyris, 1987). The challenge was how to deal with such contradictions. The host organisations had long been criticised for adopting unilateral strategies, which was perceived by earlier participants in previous cycles as a major issue. By bringing the mental models of leaders to engage, new modes of inquiry may emerge. The provision of free space was essential for higher modes of inquiry (Schein, 2009) and for asking deeper questions to enhance the chances for success. In managing such reflective discussions and mental models, I planned for powerful questions to be posed to ignite new thinking levels and identify opportunities for change. Open-ended high gain questions that encapsulate identified barriers in systemic islands were the most appropriate. However, identifying powerful questions cannot be a purely planned task (Senge *et al.*, 2007).

The quick response to emerging dynamics in the helping process was profoundly influential. I had to learn to embrace the theories and models explained in the definition phase to enable myself to respond spontaneously to powerful responses. The key in this cycle was to engage the leadership. Whether it brings consensus or only learning, the momentum of change will grow and surface (Senge *et al.*, 2007).

### 8.4.1 HOW DO WE OPERATIONALISE THE MANAGEMENT FEEDBACK?

The inability to attain a shared understanding is considered a central reason for change effort failures (Argyris, 1990; Senge, 1990). In the literature, KT projects report failures when discussing and framing shared understandings is not possible (Gray, 1989; Hardy and Phillips, 1998). This cycle therefore, adopts a dialogue-based approach to operationalising feedback and action expected from each MFG meeting.

In presenting various issues to management, I utilised a “recipient design” for narratives (Sacks *et al.*, 1992), which tailors the story behind each problem to address relevant points for the specific participants’ attributes. Executives were expected to integrate their enquiries with the narratives and express how they felt about the outcomes of previous cycles. The purpose of narrative is to use the past to inform the present and future (Linde, 2001); however, a shared understanding of the past is necessary to make a difference for the future. Otherwise, the past may be a source of conflict and political struggles. Forester (1989) suggests four attributes to constructive dialogue leading to agreement: the dialogue must be comprehensive, sincere, legitimate and accurate, as opposed to involving debate, persuasion, or negotiation. Failure to meet the suggested criteria could result in unproductive dialogue with no agreement in the MFG meetings.

### 8.4.2 PARTICIPATING ORGANISATIONS

Organisations X, Y and Z agreed to participate in a confidential focus group for executive-level leaders or their approved delegates. The time commitment was an issue as the participation of executives was initially restricted to one hour. However, when the agenda was circulated, there was consensus that one hour was insufficient. The final arrangement was to have a two-hour MFG that could be extended based on the wish of the participants based on the development of the meeting at the time.

### 8.4.3 PARTICIPATING INDIVIDUALS

The targeted individuals were executives who were selected based on their influence in their organisations (Leigh, 2006). This meant that it was essential to include senior ranks within the executive level but if an executive would delegate a subordinate then that would be accepted. Table (8-1) provides additional information about each MFG.

Organisation	MFG Participants	Level of Management	Hours committed	Quotes coded
Organisation X	9	Senior scientists, front line research directors for research	2.25	47
Organisation Y	5	Vice presidents, senior steering committee commissioner, deputy director for research	2	97
Organisation Z	5	Nanotechnology senior scientists, deputy directors for research	2.5	231
Total	19	--	6.75	375

Table 8-1: Executives participating in AR cycle 4

The majority of participants had been members of their organisations for more than 15 years. They had sufficient knowledge about the history and context of the issues discussed in addition to their decision-making capacity to make change.

## 8.5 INSTRUMENT DESCRIPTION

In support of the notion that management systems must be *home grown* (Senge *et al.*, 2007) and unlike previous AR cycles, the research design of this cycle excluded the participation of external participants (i.e. US experts or local industry). Only internal members with a proven commitment were accepted. In doing so, there were positive opportunities free discussion on the organisation's people, culture, market, technology and even history.

The design of the MFG instrument was based on focus groups guidelines. Focus groups are an increasingly popular form of triangulation in qualitative research (Gibbs, 2007; Veal, 2005). A focus group is a small group discussion in which participants respond to a series of questions focused on a single topic (Gibbs, 2007). In this setting, I was more of a humbly helping facilitator to the reflective dialogue rather than an interviewer as was the case in AR cycles 2 and 3.

Focus groups usually have between 5 and 12 participants (Veal, 2005; Marrelli, 2008). The designs of the three MFG meetings at organisations X, Y and Z were identical to support the reliability of the findings, however, the reflective dialogue and the dynamics of the meetings varied. This added richness to the data collected from each MFG and allowed a better understanding of the engineering research industry as



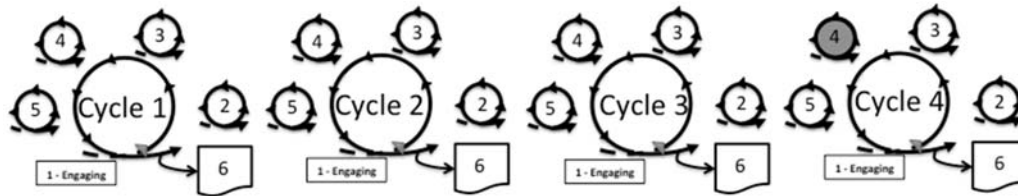
a whole in Saudi Arabia. The next challenge in the design, besides aiming to achieve consensus, was to ensure that executives of higher rank would not dominate the MFG. Such situations may be very sensitive at high management levels and may also become political in some way. My interventions were made to change the topic tactically, to direct a new topic to another member and then maybe return to the previous topic for it to be addressed by members who were not able to discuss it in the first round. This also required significant tacit skills to administer.

The micro-design of each MFG meeting was based on pre-planned prioritisation of the topics in the reports of AR cycles 1, 2 and 3, which contained hundreds of issues that were impossible to discuss, within the time constraints. Therefore, my design took in consideration the likelihood of an unavoidable cut-off point due to time limitations. Another design element was to carefully group issues systemically so that more issues (sometimes three or four issues) could be discussed at once.

An important methodological perspective in the design of the MFG instrument was to encourage the emergence of data that creates a basis for grounded theory (Glaser and Strauss, 1967; Strauss and Corbin, 1994). By allowing the generation of theory from data as opposed to previous research that only tests existing theory, I was able to fill a gap represented by the scarcity of theory on the context, culture and unique case of the engineering research industry in Saudi Arabia. I argue that this work could stand as a basis to build a new body of knowledge about a specific local industry that has long been overlooked in Saudi Arabia. The management feedback on the findings of the previous chapters provides a legitimate source, and a new body of knowledge to what KM researchers should expect in anticipation of conducting change programs in a KM context within a Saudi organisation. This particular part of the thesis provides a basis to testing the grounded theories mentioned above. It also provides coherence to the nature of the problem and the reactions possible to solution-based theories. This thesis will not be able to address or quantify the body of knowledge claimed but rather provides a starting thread for theory development to expand upon.

## 8.6 CYCLE 4 – PHASE 4: “TAKING ACTION”

As Figure 8-5 below illustrates, this section describes the fourth phase of AR cycle 4. In this phase, I will present the segment of the AR journey that explains how action took place in this particular cycle.



**Figure 8-5: Cycle 4 – Phase 4: “Taking Action”**

Reflecting on the MFG discussions in this chapter follows a narrative style to capture the context and flow of data as it emerges (Geiger and Schreyogg, 2012). Issues raised for each AR cycle are interlinked during each MFG meeting to sustain the systemic thinking approach and coherence in examining the KT phenomena. The MFG at organisation X was the biggest in terms of participants with nine participants. However, managing the discussions was had difficulties in maintaining order. Participants were not able to complete their arguments as others would intervene with opposing views. I applied group management techniques similar to the ‘talking stick’ and the ‘six thinking hats’ to allow speakers to express their views in an organised way while sustaining the motivation of others to listen and contribute (Goel, 2012).

The Vice-President, among other executives and senior staff, attended the MFG meeting at organisation Y. This allowed the feedback discussions to reveal highly political issues and expose the reactions of executives under these conditions. The least represented organisation was organisation Z where only delegates were present. The attributes of this meeting were that it included non-Saudi individuals, which enriched the views and allowed a multinational-level perspective.

In order to provide a theoretical perspective to AR cycle 4, I used a grounded theory approach (Neumann, 2006) to normalise the participants contributions into potentially generalisable reflections that could be used for further testing. The responses followed either negative or positive patterns. Table 8-2 defines these classification:

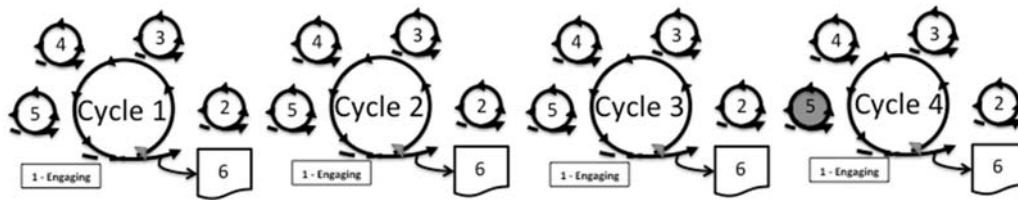
Code	Negative Patterns	Positive Patterns
1	<b>Denial pattern:</b> The majority of participants completely rejected the validity of the finding. Example: “I don’t agree [to the finding] because for 27 years I have been here and most of the people [employees] I meet, if you ask them what is the main job for you, they [will] say transfer of technology.”	<b>Approval pattern:</b> The majority of participants completely approved the finding and supported its truthfulness. Example: “We [Organisation Y] do enough but it is difficult for people overseas [international experts] to understand us [Saudi research organisations]”.
2	<b>Defensive pattern:</b> The majority of participants did not accept being confronted with the finding but did not completely deny its accuracy. Rather, they provided justifications to rationalise the finding. Example: “They [Organisation Y] do care about how many papers you produce”	<b>Factual pattern:</b> The majority of participants approved the finding as a fact that did need their personal support. Rather, they were on the positive side of a neutral pattern. Example: “[we only have] annual reports with statistical information about IP development”
3	<b>Emotive pattern:</b> The majority of participants expressed indirect partial acceptance of the finding but had no clear position about it. Rather, they emotionally engaged to diverge, expand, reflect or discuss their feelings about it without providing a definite response. Example: “Technology transfer is a joke. You know, technology cannot be transferred. The only way is to steal it.”	<b>Complementary pattern:</b> The majority of participants felt pleased with the finding and provided support to it. Example: “We agree that the government is always with overseas research collaborations and supports it financially and so do we as management”
4	<b>Suspicious pattern:</b> The majority of participants were accepting the finding but conditioned their acceptance by addressing their concerns about the validity of the data (whether staff did actually say this or staff did rate this measure with this, hence, trusting the results). Example: “Once a researcher submits his or her research finding, it is no longer his or her property”	<b>Constructive pattern:</b> The majority of participants responded rationally to the finding and tried to discuss it in a constructive way. Example: “We [management] understand that we need to develop our researchers to work with overseas researchers better”
5	<b>Peculiar pattern:</b> The majority of participants were negatively peculiar about the results and felt cautious about fully accepting the finding. However, they were closer to accepting the finding than to rejecting it. Example: “put yourself in the place of one of the researchers here. The only way to get in contact from within [Organisation Z] to outside world is either by training or conferences.”	<b>Curiosity pattern:</b> The majority of participants were positive and curious to know more about the finding and further details on underlying data. Example: “We are interested to know the outcome of our research hubs that we established in several cities in Saudi Arabia”

**Table 8-2: Negative and positive pattern classification for responses in MFG meetings**

The first negative and positive classification patterns – namely, denial and approval patterns, had the most significant impact on the findings as they represent acceptance and rejection of findings from the perspective of management. Although disapproval did not imply that the finding was incorrect, it offered a perspective of the reactive response of management from an AR perspective. This may be extended to reflect on reasons for denial or approval to further understand the context of the problem. In the next phase these classifications guide the reflections and provide a framework for the analysis to generate the grounded theoretical perspective to AR cycle 4.

## 8.7 CYCLE 4 – PHASE 5 (PART 1): “ANALYSIS AND REFLECTION”

As Figure 8-6 below illustrates, this section describes the fifth phase of AR cycle 4. In this phase, I will present the segment of the AR journey that explains how analysis and reflections took place in this particular cycle.



**Figure 8-6: Cycle 4 – Phase 5 (Part 1): “Analysis and Reflection”**

The following sections provide a summary of analysis and reflections on the three MFG meetings. However, each section is not a summary of a single MFG meeting because each meeting actually discussed the results of all three AR cycles, but for a particular host organisation. To merge the findings of these meetings, Section 5.1 describes the different views of all three host organisation’s management, particularly for AR cycle 1. In the same way, Section 5.2 describes the different views of all three host organisations’ management, particularly for AR cycle 2. Section 5.3 describes the different views of the host organisation’s management for AR cycle 3. In other words, each section contains particular parts of the three meetings.

### 8.7.1 MANAGEMENT FEEDBACK ON THE RESULTS OF AR CYCLE 1

The feedback on AR cycle 1 of this study was sought from the leadership of Organisations X, Y and Z to obtain their views on the outcomes of the management report that they had received earlier. This feedback was classified as approval, denial or a subset of either one as illustrated in the previous phase in the pattern classifications of Table 8-1. In each of the three focus group meetings that took place in this study, I started with seeking feedback and impressions on the LOC report for the organisation because the main objective of this study is to know how close the host organisations are to being learning organisations. This AR cycle was the most

factual because it was based on an online survey and the results were numerically informative. Within the context of management feedback, the following data examples provide evidence of underlying theoretical concepts.

### 8.7.2 FEEDBACK ON THE ‘PURPOSE’ MEASURES OF LOC

The management response (Negative pattern [code 1/Denial]: Learning and KT not being central to organisational objectives) was generated in response to the finding that there was a general perception of staff towards their organisations as being far from them being an LO because learning was not a central objective. In this segment of the focus group meeting, I offered a brief review of the LOC report that was submitted a few months before this meeting to the host organisations. I explained to participants how the report evolved and the outcomes that emerged. I explained how the development of the LOC report was helpful to feed in subsequent AR cycles that took the research forward. Therefore, the LOC measure was a cornerstone of the study as a whole.

AR Cycle 1 report was about assessing the host organisations against the LO best practice. Data findings showed that many researchers did not feel that learning and KT were central to their organisational objectives. The following quote illustrates how executives at Organisation X opposed this finding: “We [executive management at Organisation X] don’t agree. One of the main points for us is technology transfer and know how. That’s a major point [for us].”

The comment above was then supported by another participant who aggressively felt that this finding was not only incorrect but also disappointing and meaningless. He said:

I don’t agree [to the finding] because for 27 years I have been here and most of the people [employees] I meet, if you ask them what is the main job for you, they [will] say transfer of technology.

This finding was fundamental to the organisation, yet it was denied, perhaps because it provides evidence of failure of the KT outcomes. It may be argued that the more the finding is a higher-level construct such as a vision or direction, the more likely it is

for denial to come from the executive management. The reason may be twofold: first, it may be due to the finding directly impacting the executive role from an accountability perspective, and second, it may be due to an organisational culture of denying the existence of problems. I suspect that the reaction was a misunderstanding about the language used to describe the problem. For some of the case study executives, KT was defined in terms of the fundamental activity of a research institute, i.e. transfer technology. They failed to grasp that KT, as defined by this study (see chapter 6) is much more than technology transfer.

In the above situation, I struggled to establish a shared mental model amongst some executives about the nature of the problem, because they could not see the difference between the organisation's core work activity – technology transfer – and KT as a capability. Indeed, any research organisation could argue that its staff create and share knowledge. However, the results in my study showed that the host organisations did not do this satisfactorily. This came as a shock to the executives. However, when I moved the discussion to a more operational level (rather than the strategic level of technology transfer), the executives became more accepting; perhaps because the operational perspective is mainly the responsibility of middle and frontline managers. A similar pattern was detected at organisation Y.

The management response (Positive pattern [code 2/Factual]: Learning and KT not central to the organisational objective) was perceived differently by organisation Z. After providing the participants with a similar introduction to the focus group held at organisation X, the executives were very supportive of the findings, to the extent that one participant said: "I would even rate us less". This allowed me to explore knowledge sharing as an intrinsic practice in organisation Z. Executive participants agreed that knowledge sharing was not clearly articulated through internal communications and that it was usually informal and autonomous, as the following quote suggests: "[W]e [only] share general knowledge ... if you need specialised knowledge, then you have to go to conferences [outside Organisation Z]. You need to speak with international experts."

This indicated a lack of focus and direction since general knowledge in an engineering research organisation is seen to have little value to IP, innovation and commercialisation.

### 8.7.3 FEEDBACK ON THE 'ENABLERS' MEASURE OF LOC

The management response (Negative pattern [code 1/Denial]: KT activities not present to support KT efficacy outcomes) was generated in response to the previous finding where the host organisations were found to be far short of being learning organisations. The discussion turned to whether there were serious KT activities to support the claim that KT can generate results. An manager from Organisation X said:

I don't agree [that there is no KT in place]. We've done our efforts. Things [KT activities] are becoming much better than before. I have been [in Organisation X] since 1987. We can evaluate the change as being positive but in the past it was completely different.

The comment implicitly acknowledged that the KT situation was poor, which is considered sub-level approval. There were little evidence to clarify the time span of this past and whether it was the recent or far past. Also, the quote does not at all state that KT activities are effective at present; rather, it compares the present to the past without providing an assessment in relation to the aspirational goals. This response indicated a positive attitude but had no measures to validate it. It implies an optimistic view that may inspire a more effective KT direction. Both Organisations Y and Z generated similar responses, which may suggest a national cultural dimension to seeing current low performance in a positive way by comparing it with worse scenarios from the past.

The management response (Negative pattern [code 1/Denial]: Technology not used to support KT activities) was generated in response the finding that technology was not effectively used to support KT at host organisations. As technology is a recognised enabler to the LO, some researchers claimed in AR cycle 1 that there were no knowledge base systems that were comprehensive enough to use for finding their peer researchers in the kingdom, or to find specialty experts. There were no knowledge bases for specialised researchers. An executive from Organisation Y thought that it

was ridiculous to link particular areas of knowledge to individuals in a knowledge base because people could find out about their peers by searching an ABI inform data base and find who published what in a given area; hence, why should we invest in a knowledge base? He said:

[Organisation Y] publishes about [X] hundred journal papers per year and this is open literature. Anyone can put [Organisation Y] or Google even to find huge listings of researchers. There is nowhere in the world where there is a database of research after this Internet explosion. Now, there are databases of journals which based on the subjects that...

The executive actually denied the existence of knowledge bases in organisations to manage internal knowledge resources. I realised that the executive had little knowledge about competency mapping, or expert's yellow pages, despite knowledge audit activities. Given the sensitivity of confronting a participant within a group of executives as in "you did not even hear about this", I opted to record his response and move on to the next topic, as this response in itself had rich data and speaks for itself. When I asked executives at Organisation Z about knowledge bases to support KT, the executive responded by saying: "It will not help. Every day there are hundreds of papers."

The management response from organisations X (Negative pattern [code 2/Defensive]) and Z (Negative pattern [code 3/Emotive]) on the technology issue was still negative. The following quote provides evidence as a recurring theme of misunderstanding what KM in that IT systems can only serve as management of information systems (MIS) rather than knowledge management systems (KMS):

[W]e got this [new] system which complicated our issues and killed everything...It is an electronic portal that works as an e-government application for [organisation X] only. It governs everything you need from administration to research. Before, everything was so smooth we can finish things quickly but now with this system it is killing everything. People are not aware of it so if they go to purchase something then they have to go through this system but they don't know how to use it. The people were invited to a 2 days training but most of them did not attend this training.

There seems to be some sort of shared ignorance between the three organisations about the role of technology in supporting KM activities. The view on technology is still based on its role as a system for managing information, rather than knowledge.



The management response (Positive pattern [code 2/Factual]: lack of KT processes to evaluate KT practices) was generated as a response to the finding that there were no clear organisational processes that aimed to evaluate or benchmark current KT practices. It was acknowledged that benchmarking, as a process to enable KT, was lacking at the three organisations. Planning and performance measurement processes for KT as a practice did not exist in the KM sense. This was taken positively from as a fact, although most participants were not willing to discuss underlying reasons. Some participants mentioned trivial processes such as that they had “annual reports with statistical information about IP development”. This was a brief segment of the meeting.

The management response (Positive pattern [code 1/Approval]: Weakness in KT enablers) was generated in response to an LOC score that suggested a general weakness in KT enablers. Executives at organisation Z, from an enabler’s perspective fully acknowledged the existence of LOC weakness in this area. Resources, processes and technology were elements they acknowledged urgently needed improvement. This point was not discussed at the other two organisations because a general negative feeling was taking hold and more positive items were needed to sustain the meeting progress.

The management response (Negative pattern [code 2/Defensive]: Lack of infrastructure resources for KT activity) was generated from the finding that host organisations required more of basic infrastructure to allow KT activities to take place. The executives’ reactions were defensive in that they were not able to deny the truthfulness of staff claims but were trying to find justifications for such shortages. One response was:

Two years back, we started employing people, and also for the labs we started procuring some facilities. Therefore, we will gradually go to that point. We cannot now jump to this conclusion when two years back we just started this. Yes, we have research projects that need allocated technicians and equipment but when those projects are finished and submitted then we can allocate those technicians to be for anyone else.

A few responses from other executives argued that they had just started KT activities. The worrying element here is that Organisations X, Y, and Z had mostly been in business for decades. They were suggesting that they were either busy with something

else or had just realised their KT activities required a legitimate infrastructure. In both scenarios, a defect is apparent in the management of the KT activity. There appeared to be a defensive pattern to the responses.

### 8.7.4 FEEDBACK ON THE 'PARTICIPATION' MEASURES OF LOC

The management response (Negative pattern [code 1/Denial]: Learning and KT not central to the organisational objective) was generated from the response indicating a lack of systemic comprehension of the recruitment activity. I enquired about the linkage between recruitment practices and meeting the mission of the organisation. Executives at each organisation failed to provide rational links between higher-level constructs such as systemic thinking and operational constructs such as recruitment and selection.

The management response (Negative pattern [code 3/Emotive]: National culture negatively influencing KT) was generated from responses to the negative influences of national culture on internal cultures in regard to KT. The argument was about how the organisational and national cultures influence the performance of KT at the host organisations, and whether staff motivation towards KT and teamwork links to KT performance. AT Organisation X, there was no shared understanding between executives on whether KT was supported by staff themselves because some found that technology transfer was a myth. The following quote from one participant indicates a negative attitude by seeing KT as an illusory inspiration:

Technology transfer is a joke. You know, technology cannot be transferred. The only way [to transfer technology from country to country] is to steal it. It should be stolen and there should be an aim and objective to steal it.

The above comment was striking to all participants as it calls for a fundamental cultural shift in thinking. The connection to national culture here is about ethics. A moment of silence took place and then objections to such a radical view commenced, especially because the author of this idea was a senior researcher attending the executive MFG but he was not an executive. Executive participants in Organisation X did not support this view. Executives rejected his idea as well and found it unethical. The group was more supportive of the legitimacy of enabling a culture that supports

legal KT activities to produce tangible results. For example, they suggested filling the void in helping researchers become more knowledgeable, less dependent on external expertise and internally capable in their research.

While organisation Y (Positive pattern [code 1/approval]) was supportive of the idea that national culture influenced KT, Organisation Z (Negative pattern [code 5/peculiar]) found that there was not a true relationship between national culture and KT. As Saudi Arabia is a large country with a number of regional sub-cultures, there may sub-cultural influences at work in the diversity of the above views.

The management response (Negative pattern [code 2/Defensive]: Value of researcher's contributions not recognised) was generated in response to the perceptions of participants in AR cycle 1 who perceived their work as not being valued appropriately by the host organisations. An AR participant said:

They [Organisation Y] do care about how many papers you produce, but not how many projects you are working on. Some are not allowed to publish all their projects. There are limitations. I worked [did consulting work] for [local industry 1] for a couple of million dollars and I cannot publish that work [to be recognised by Organisation Y].

The researcher felt frustrated that his work was not recognised, arguably because he was bound not to publish his work. In his view, Organisation Y was not paying due attention to projects that contained confidential work. In the researchers' view, his research should be recognised even if he did not publish it. I therefore asked the executives whether there was a link between recognition and KT activities at their organisations. There were no comments on this issue until an executive concluded:

They [the top management] are always trying to improve, then they are supporting people to go and attend international conferences three times a year which is ... I think the [Organisation Y] ... if you are a good researcher ... naturally the [Organisation Y] will recognise you, naturally the [Organisation Y] will respect you... I think.

In the discussion about recognising staff contributions, the complexity of KT was reduced by executives to simple metrics such as arithmetic counts of publications and establishing external partnerships. In their response to this topic, they did not consider the quality of KT activities, the level of social interaction and how a learning ecology is encouraged by staff. The relationship between KT activities carried out by staff and internal recognition was clear to articulate.

The management response (Negative pattern [code 1/Denial]: Lack of internal IP support) was generated from the response on the poor IP support provided to researchers. The denial of some facts by some executives was extreme, especially when I raised the complaints of AR participants about existing IP support services being poor and ineffective in helping researchers achieve their patenting and innovative goals. The denial of the executives about this finding in Organisation Y was in the following form: “Which year did you get this information from [about IP support being poor and ineffective]?” I responded that this data was from the previous year of 2011. There were no comments from the executive. He then adopted a defensive pattern and asked his assistant to list the invention disclosures for this year and other research achievements that he brought with him to the meeting to justify that the data findings were outdated. I highlighted that AR participants asserted that this issue had been chronic for many decades and had never been addressed to the satisfaction of researchers.

In Organisation Z (Negative pattern [code 2/Defensive]), an executive responded with the following statement:

In this particular point [IP support], it is an absolute yes because [Organisation Z] is very supportive and helpful for taking whatever to become patented to the industry, and I believe that [Organisation Z] is trying to link the industry with academia.

The management response (Negative pattern [code 1/Denial]: lack of KT productivity) was generated in response to the views of respondents that KT activities are not productive. The following quote illustrates how an executive opposed an AR participant’s view on lack of productivity:

Here at [Organisation Z], I produced [in terms of KT activities] more than I did in the UK or Canada or the US, simply because [Organisation Z] gives the researcher almost everything they [can] dream of.

It was difficult to argue at this point as there were few metrics to use to refute this defensive statement. Similar responses were detected at organisations X and Y.

The analysis reveals a fundamental confusion amongst some executives about KT. For some, it was impossible to move them past their mental model of KT being about a broad organisational outcome – technology transfer – or a work outcome – patents.

These comments show the difficulty in implementing effective KT, or even knowledge management, in organisations where executives cannot change their pre-conceived ideas about what knowledge is. The next section aimed to challenge these ideas by focusing the executives on people instead of work outputs.

### 8.7.5 FEEDBACK ON THE 'PEOPLE' MEASURE OF LOC

The management response (Negative pattern [code 2/Defensive]: Lack of trust and loyalty) was generated in response to the findings that there are low trust and loyalty levels at the host organisations. Although, executives at Organisation Z were reactive, it seemed that the management was aware and had made previous reflections on this issue from the submitted AR report. One executive said:

Let's go to any institution, you will never find 100% loyalty among its members. You might find 50% are very loyal, 30 % are moderate and 20% are not. So we have to fight to improve these percentages. So in any institute all over the world, you will find people who are really careless about improving their research. They work for the salary. So this is not unique for [Organisation Z] but definitely there is room for improvement on this ... It is not the problem of [Organisation Z]. This is in general even in the USA. For example, I was in one of the best universities in USA, and then I found an opportunity in Saudi Arabia and left them.

It seems that the management had no pragmatic response to low loyalty since they were happy with the status quo of this element. In Organisations X and Y, the management were completely denied the existence of low loyalty (Negative pattern [code 1/denial]).

## 8.8 MANAGEMENT FEEDBACK ON THE RESULTS OF AR CYCLE 2

The feedback on AR cycle 2 in this study was sought from the leadership of host organisations X, Y and Z to offer their views, whether by approval, denial or a subset of either one as illustrated in the previous phase in the pattern classifications of table (8-1). In each of the three focus group meetings that took place in this study, I started by seeking their feedback and impressions on the KT process systems report for their respective organisations. This AR cycle was the most detailed because it was about the internal processes of the organisation and the way work was organised to facilitate KT. Although, the analysis was qualitative, the core business processes were clearly

defined based on the recorded data. Within the context of management feedback, the following data examples provide grounded evidence of underlying theoretical concepts. The response from the executive was considered to be very important in challenging some of the underlying assumptions about what KT was, e.g. the previous focus on technology transfer and work outputs such as publications and patents. In this part of the AR cycle I had hoped that some of these executives would come to see that KT involved many processes that occurred before these outcomes were achieved. Further, that if some of these processes were improved, the work outputs would also increase.

### 8.8.1 FEEDBACK ON THE EXTERNAL-INTERNAL KT SYSTEM

The management response (Positive pattern [code 3/Complimentary]: Attracting organisational partnerships) was generated as a response to the finding that host organisations are trying their utmost to attract external expert partnerships and have core processes for this purpose. The executive management was positive about this finding. They viewed partnerships with external expert organisations as true core business processes for KT. The following quote illustrates the response of Organisation Y:

The stakeholders here are talking about having agreements with research centres like Stanford, MIT, and all those people [who] can do technology transfer because they have the knowhow. The partnership itself is now the main target for us ... For example, when you [any internal researcher] submit a research proposal [to the management] and you [the researcher] don't have partnership with external experts then we [executive management] will reject it right away and this is one of the main tasks for researchers [to find external experts] ... We got the processes [in place]. The processes are there and we have committees who receive proposals. With this committee, the decisions are made to accept proposals or not ... That's why I told you about partnership ... there is a process.

There seems to have been a radical change in this process as the executives reject proposals if they do not involve partnerships with external experts. This was quite extreme but nonetheless was strong evidence to show how the external-internal KT process was supported. Organisations X and Z also had similar views and processes. Little evidence of having processes that manage the post-partnership situation is available, however. This gap could impact this change initiative on the long-term. The

management was not able to provide processes that govern the actual partnership phase. This finding illustrates that there was positive mental models about this KT activity, i.e. it was seen as a good thing, but clarity was lost when implementation was discussed, i.e. how to do it.

The management response (Positive pattern [code 1/Approval]: Attracting individual experts) was generated in response to a general focus on bringing in external experts. Seeing the sheer assertiveness of host organisations in searching for overseas experts, I turned to difficulties in attracting experts from developed overseas countries such as the US, UK and Australia. I enquired about their ability to properly explain benefits and advantages to external experts to encourage their positive decisions to work at the host organisations. The management was, on this rare occasion, open to admitting that:

We [Organisation Y] do enough but it is difficult for people overseas [international experts] to understand us [Saudi research organisations] ... plus the political situation ... plus the culture! It is very important.

The context and tone of the response indicated that the executives were referring to the inability of overseas experts to adjust their personal lifestyles to the local lifestyle that restricts life in many ways. External experts from developed countries are used to the personal freedom, which cannot be replicated at present in Saudi Arabia. This was one of the most transparent and straightforward responses detected. I then asked about the biggest reason for their view that external experts have little interest in working at Organisation Y. The vice president stated:

It is very difficult for them to leave their culture. Keep in mind that I just read an article that says that only 10% of Americans have passports. Ninety per cent don't even have passports. They never go out of the country. So, the culture for them is not to go out. If they go out, they go out for tourism and safaris and things like that.

I asked for clarification on how agreements were made with external experts and what really mattered for Organisation Y. One participant explained:

Our collaboration agreements talks about all the details of the relationship and talk very specifically that this agreement or collaboration is based on doing research and technology development work in Saudi Arabia which in other words translates to the KT to Saudi Arabia. We have that as a clause in the [employment] contract and we watch out for that.

The process in this area seemed underdeveloped because international experts do not have a clear understanding of the offers made by host organisations, as the executive management highlighted. This might be a source of weakness at an internal-to-internal KT level. Given these conditions I enquired about Organisation Z's marketing strategies for attracting foreign experts to work in Saudi Arabia. Executives explained the strategies they use to market their organisation to external experts:

When people come here and see the facilities and see that [Organisation Z] did hire the best people in the world and does have facilities and lots of capabilities, this stands as some sort of advertising so that people outside know what we have.

The outcomes of those strategies, though, resulted in limited recruits as international experts usually would rely more on their social resources than any organised visits to secure their "buy-in". The following quote illustrates how overseas experts make their decisions to work in a Saudi engineering research or higher education organisation:

I had some colleagues from other US universities contact me because they know that I had this research affiliation with [organisation Z]. They want to know what I think of it and whether I am benefitting from it because they've been offered by either [organisation X], [organisation Y] or [organisation Z] to participate in something similar to what I am doing but they wanted to hear from me on my experience rather than what they hear from those organisations.

It is clear from the above quote that social networks within scientific communities play a powerful role far beyond recruitment efforts in attracting external experts.

The management response (Positive pattern [code 1/Approval]: Lack of cooperation from the knower side) was generated in response to a general impression among AR participants in AR cycle 2 that external experts do not always provide useful knowledge for transfer. I asked the executives about their worldwide experiences with different nations specifically in regards to their attitude towards KT with Saudi Arabia. The management liked this finding and agreed that difficulties do exist in this area. They also confirmed that there is a relationship between a given country and the cooperation of experts from that country. The following quote by an executive at Organisation X summarises this discussion:

In the US, yes, they are cooperative ... a little less in Europe ... it depends on the nationality... [experts] are not cooperative in Japan and China ... Forget about the Far East, Korean, Chinese, Japanese. They will cooperate until you sign the agreement with them. Once you sign the agreement then forget it. They will not even repair the things that are not working well. Europeans are a little bit better.



This was a fundamentally important insight from an external-to-internal process perspective. It adds a national culture context to external-to-internal KT at an international level, i.e. that different nationalities have varying behaviours towards KT. The following quote is from the experience of an executive with external partners:

I went to Japan to observe the A/C industry. They said in this area, you are not allowed and no cameras are allowed. We went for training and they would not let me see anything. I asked them how can I see inside this compressor? No, no, no they said. This is secret. Everything was secret. This issue with [international university] happened when I went in the last stage of the KT [agreement financial terms were paid by then].

Another participant who was a senior scientist at that time had a similar incident and stated his experience in the following quote: “When we tried to see how the control parts worked, they refused to let me know. I wanted to investigate it as a control engineer. They rejected this and kept me away.”

I tried to elicit more on this issue because I anticipated that there would be a need to further investigate the sender side of the KT process in future cycles. This data finding can generate an important area for research. In this thesis, I had no opportunity to explore the views of external experts except in AR cycle 2 but no further interviews were planned after this cycle. The importance of this discussion was that there was a shared mental model that some cultures tend to be more protective and secretive about external-internal KT, and general agreement amongst executives that this made their role as seekers more difficult. It was an important phase in the discussion as it engaged the executives in the topic of KT and made them recognise that it was a problem. This was in contrast to the earlier defensiveness, when we focused on the case study organisations themselves, in this area the executives were happier blaming others for problems. On the positive side, the discussion did engage them in KT and started to surface awareness that it was a problem to be managed.

The executives however, did not comment on their reactions to the different attitudes mentioned above. It seems that little is done in response to such negative behaviours. The merits of research alliances, whether transactional or collaborative, are not measured by host organisations and therefore, little can be known about the damage to KT this issue is causing.

The management response (Negative pattern [code 5/Peculiar]: Constraints on internal researchers) was generated in response to a general weakness at an external-internal KT system level in allowing researchers to expand their exposure to external knowledge. I quote one of the AR participants to illustrate this point:

Okay, put yourself in the place of one of the researchers here. The only way to get in contact from within [Organisation Z] to outside world is either by training or conferences. We as researchers are allowed only once per year to have outside contact. Either a training or a conference. If you use your right to go to training then you cannot go for a conference for a whole year. That means you cannot get any knowledge transferred from outside. The only thing you can get from outside will be the papers and nothing else.

I then asked the executives at organisation Z to comment on this quote. The responsive was more of body language than words. Some were nodding their heads in a peculiar way. Others had no response. There was little verbal expression to report. The underlying reason for this response seemed to be that it was related to policies that might be beyond the executives' authority and at the same time, they wished not to be critical of their colleagues.

### 8.8.2 FEEDBACK ON THE INTERNAL-TO- INTERNAL KT SYSTEM

The management response (Negative pattern [code 1/Denial]: Lack of equipment and technology infrastructure) was generated in response to a general weakness at the host organisations in keeping sufficient stocks of material, functioning equipment and supportive technologies for the internal research to expand and produce an internal-internal KT output. At organisation Y, the executives refuted this claim by saying:

The problem has never been about equipment or the labs; it is about the people running these labs. So, I think the kingdom should invest some money in training the people who run the labs, whether they are research scientists or technicians, and make their knowledge up to date because technology is moving so fast.

Although the response was a complete denial of the finding, there was the positive awareness of the importance of KT, which I praised. The response from Organisations X and Z tended to be from the negative defensive pattern. On reflection, this is a reasonable response because Saudi Arabia generally has the money to invest in equipment and technology, and evidence was found via the resources rating being well in the LOC PMM (see chapter 5).

The management response (Negative pattern [code 1/Denial]: Weakness in processes that guide strategic topics) was generated in response to a general weakness in providing processes to guide researchers to focus on strategic topics. The executive at Organisation X denied this gap. In relation to having processes that ensured focused research mainstreams, executives at Organisation X asserted the existence of a specific set of research topics that are communicated to researchers to focus on, as opposed to the view of AR participants who claimed the opposite. The executives' response is illustrated in the following quote: "Any [internal] research proposal should be on a topic that is under the umbrella of one of the main [research focus] strategies [at Organisation X]. There are 12 topics [research areas]."

Although reflective dialogue continued to examine why researchers felt there were no strategic topics, little evidence of sympathy for their claims was detected. The need of organisational staff for management support to provide direction and training to help researchers develop a shared understanding was not acknowledged in the MFG meeting. This was a major finding for this cycle because executives rejected the claims made by AR participants in AR cycle 2 on this topic and did not show any interest in exploring why their researchers felt the way they did. The responses from management imply further internal issues that accumulated to produce such impact.

However, in organisation Y, the discussion provided a new perspective when a participant executive attempted to move towards a negative emotive pattern as he brought attention to difficulty in implementing strategies relating to engineering research. He said that this is the reason AR participants in the report deny the existence of such research strategies. He questioned whether such strategies were taken seriously and in some way implied they were only for show:

The system is there Mr. Moshary, the documents are there, but the problem is following it. Some of the people don't follow it. They look for shortcuts to avoid certain processes. Instead of following the process, he will just take the whole thing and directly meet a VP and he can get the approval for that [even if the topic was not part of the strategy topics].

The topic was concluded on the basis that there is a problem in the area of research strategy and that executives need to find ways to make their strategies work on the

grounds of practicability and shared understanding. This response was more positive at organisation Y.

The management response (Positive pattern [code 1/Approval]: Lack of internal training on IT usage) was generated in response to a general weakness in training staff to use the internal IT systems. This training should help ease the flow of internal-internal research processes. Executives admitted that their IT systems were implemented without proper introduction but also blamed staff for not cooperating as per the following quote:

No, it [the IT system] is just in its beginnings. It needs time. It is new and people are not aware of it so if they go to purchase something then they have to go through this system but they don't know how to use it. Staff were invited to a two-day training but most of them did not attend this training.

It is quite difficult to make a final judgment on who should be accountable for the weak performance of the IT systems that govern the internal research processes. It seems that staff are blaming the management and management are blaming staff..

The management response (Positive pattern [code 1/Approval]: Lack of work processes that ensure productivity) was generated in response to a general perception that staff did not have enough work to do. From an internal-internal KT perspective, there was a question about why researchers felt they had no work to do. Executives blamed the supervisors for not instituting proper workflow processes for their staff. They commented that researchers would come on time and even leave late if they had enough assignments and work to do from their supervisors. An executive from organisation X commented:

The leaders of research groups can control this. The upper management cannot control this. They can give researchers assignments and ask them to report to them. They can have weekly meetings and ask them to do more research to keep them in the workplace doing something and not only think about attendance.

The collective reflections of executives evolved into a shared understanding that the dilemma keeping the workforce in play mode was actually an underlying weakness in the supervisory skills of the front line managers. This was an insightful discussion in which I helped executives modify their mental models that led them to always blame staff for coming late and leaving early. The discussion resulted in their becoming

aware of a new source to the problem, which was the need to improve the skills of their supervisory line managers.

In organisation Z, I raised the same issue. I asked about measurement of staff productivity. The response was substantially different in the sense that it seemed more developed and organised. The executive at Organisation Z provided the following quote:

Supervisors have meetings, quarter evaluations, everything is done properly here ... you have to set your goals [with the supervisor] at the beginning of the year as a researcher and your manager will sit with you and approve it. He might say, okay, you know what, elaborate on this one, then he will say if this is working then after the first quarter we review. Every four months, there are evaluations.

The situations at organisations X and Y were different. They treated researchers in the academic sense, where conditions were flexible and open. However, organisation Z, had more company-oriented processes where researchers were more like business employees than academics. In chapter 5, the LOC results for the three organisations showed that organisation X and Y had higher results (orange code) than organisation Z (red code). There may be a relationship between these results and the findings here.

The management response (Positive pattern [code 4/Constructive]: Weakness in protecting IP rights) was generated in response to a general weakness in protecting the IP rights of internal researchers. The issue of internal IP security measures was not taken seriously among participants who claimed that any IP theft, if it existed, would be an odd occurrence. The following quote by an executive at Organisation X started the discussion:

It is complicated. Sometimes, there are personal issues between a person and another person. Everyone can judge it in some way. But I don't think it is that serious. You have to file your proposal before you submit it to anyone. If you file it as an IP then no one can take it.

However, two of the participants warned against underestimating the problem and described the issue as alarming. The discussions became more intense when a participant took a tangent and said the local industry was involved in unethical practices where he said there had been a local industry takeover of the IP of an internal researcher at Organisation X. I then enquired if this issue might affect the

willingness of researchers to share their knowledge and become more involved in KT activities. An executive claimed that the reason for the loss of interest in research was not IP security but because research as an industry is not recognised as an important contributor to the Saudi economy. He argued that the local industry is actually not interested in IP or in research because it is focused, and comfortable, with importing ready made goods and distributing them locally. So, why would they want to steal IP ideas? This argument was meant to refute the existence of IP theft because IP has little value within the mental model of the local industry. The following quote illustrates the participant's view:

Nobody [in the local industry] is interested or wants to do research. Do you know why? They [local industry stakeholders] say we buy this thing from outside and then we sell it in Saudi Arabia. It is none of our business to improve it, to make it efficient. We're just traders who are buying and selling. So, the idea of research in Saudi Arabia is facing a big problem because it is not part of the economy. People are just selling goods ... the base for [the research] industry is not here. We don't have a [research] industry. We are importers. We are trade agents. This is the point. So, most of the research is governmental [basic] research, 90%. Commercial phase? We don't have one.

Although the discussion was about IP theft in the internal environment, the executives expanded on the topic to include the local industry. The quote above highlights a major problem on the national level in terms of positioning the research industry to play an essential role in the economy. This seems to be a new finding that deserves considerable further research in terms of (a) validating the weakness of the local industry as active players in the economy and (b) formalising a perception of barriers that relate to the internal-to-external KT system.

The management response (negative pattern [code 2/Defensive]: Inefficient IP development processes) was generated in response to a general weakness in managing internal IP production. The issue of IP support was revisited at Organisation Y, where one of the executive participants stated in defence of their IP performance:

In the past few years, there has been a completely different story in terms of the IP. Now, we have a procedure that is well known. Now, we have a huge number of people applying, we passed [X] patents at [Organisation Y], ranked [XX] worldwide. If you go and check the web [there is evidence there] ... I think at [Organisation Y], the whole thing is totally different.

The executives seemed very pleased with the conditions of IP generation at Organisation Y. However, this is not the view of staff at the same organisation.

Similar views emerged from Organisations X and Z.

The management response (Negative pattern [code 1/Denial]: Lack of secretarial support) was generated in response to a general weakness in providing internal researchers with secretaries to help them increase their research efficiency. I then moved to the issue of secretarial support that many AR participants in previous cycles expressed their frustration about. Actually, this was one of the most quoted issues at the three organisations. In response to this claim, executives at organisation Y were not in congruence with the finding as the following quote illustrates:

In general, I think the secretaries that we are bringing from various areas, from the Philippines, from India, are skilled to do secretarial jobs but for research I don't know how do you interpret the problem. For helping researchers, they will do. I disagree because the system here is ... if this is coming from a centre director ... this is completely wrong. I think the centre directors have more than two secretaries [each].

I was surprised that a vice president would contradict his research centre directors in such a direct way. This response illustrates the significant gap in views between frontline managers and upper management. On reflection, the reaction appears to be simply a misunderstanding about the finding. The executives seem to have interpreted the finding as research centre directors complaining they do not have enough secretaries to help them with their research. This is a staff resource issue, which the executives quite rightly disagree with. The complaint is actually about research centre directors feeling they have to spend too much time doing menial, e.g. secretarial tasks, which takes them away from doing more important research work. Why they feel they have to do these menial tasks themselves is the real issue. I suspect it is a complaint about increasing levels of bureaucracy and tight executive control, rather than not having enough secretaries. This discussion is interesting because it highlights how easily KT problems can be misunderstood and how finding shared mental models is difficult.

The management response (Positive pattern [code 1/Approval]: Poor internal knowledge outcomes) was generated in response to a general weakness perceived at the internal level at host organisations in terms of tangible outcomes. In order to measure research outcomes, a timeframe should be enforced. I asked about the reasons for having poor research outcomes, although the organisations have been

operating for decades in Saudi Arabia. The VP of Organisation Y responded with the following statement:

We are a young organisation, about [A] years or [B] years old. The [anonymous US research organisation] has been around for about [C] hundred years or around [D] hundred years. To answer your question, they have experienced people, and when someone comes there as a young researcher to get KT from the senior expert, then he can get [a lot of] knowledge but in [Organisation Y] this is difficult because it is a young organisation. I remember when I started my research, I had to go to the literature because there were no senior researchers with me at [Organisation Y]. Till I became a senior researcher myself, I had to work for 30 years and I have taken a very long route. If I was in [anonymous US research organisation], I would have learned what I learned at [Organisation Y] in the 30 years, I would have learned it in five years or ten years because of working with those people.

The above data shows that respondents believe that they should be allowed generous time frames so that they can produce tangible results. It was doubtful to me whether the government would be convinced by such an explanation. They claimed that the decades they spent in research were not enough to produce significant research outcomes, which I found to be mostly due to the absence of benchmarks.

### 8.8.3 FEEDBACK ON THE INTERNAL-TO-EXTERNAL KT SYSTEM

The management response (Negative pattern [code 1/Denial]: Lack of policy articulation) was generated in response to a general weakness on the enablers' side of the LOC. Discussions on processes related to managing organisational policies were then discussed. As the following quote illustrates, the executives disagreed with the AR cycle 2 report in that they said all policies that govern their business process were actually well recorded: "Everything is there in the [organisational] website". The discussion was once again diverted by a manager towards discussing the impact of those policies on KT collaborations with overseas organisations. Executives agreed that those policies do not properly protect their rights against overseas research organisations. They said that some overseas knowledge providers do not cooperate at the final stages of their partnerships because most funding would have been consumed at that advanced stage and host organisations would find themselves too late to discontinue the partnership. The failure of external-internal KT is usually followed by a negative impact on the internal-internal KT.



The management response (Positive pattern [code 1/Approval]: Poor budget management) was generated in response to a general weakness in managing budget spending. The core business processes relating to budget allocation and financial management were discussed. The discussion changed into a discussion on internal budgeting processes. Executives agreed about the negative effects of poorly designed financial processes but they blamed the ministry of finance for many budgetary deficiencies.

The management response (Negative pattern [code 4/Suspicious]: Lack of commercialisation with the local industry) was generated in response to a general weakness in commercialising internal IP. The issue of commercialisation of innovative projects was then discussed as an important internal-external KT process. Executives felt that researchers should become more focused on generating research results rather than on asking about commercialisation of their work. They were suspicious about why researchers were bothered about this issue. The following statement by an executive illustrates this perspective:

Once a researcher submits his or her research finding, it is no longer his or her property and nor is it his or her responsibility to look after commercialisation. The department concerned with commercialisation would take over and keep the developments confidential from the inventor.

Executives justify this because commercialisation is beyond the researchers' area of responsibility. Another executive said: "It is not your job as a researcher to know this because it becomes the property of [organisation X]". This once again highlights a legitimate response from the executives, but it is based on misunderstanding. In other words, the reaction is logical if we accept the executives' mindset on this. However, this is not what the participants are complaining about. They are actually complaining that their organisation makes commercialisation difficult, so they lack motivation to try. The executives are saying that staff should not be concerned because someone else will do the commercialisation, however, this fails to grasp that staff motivation to do commercial research is the problem. It is further evidence of misunderstanding the KT problem.

In organisation Y, the responses to this issue had many similarities with Organisation X. Restrictions on researchers' exposure to external experts were first discussed. I

tabled a statement by one of the previous AR participants in previous cycles:

The first problem that researchers find here is that they are not allowed to expose themselves directly to international experts without going through a tedious process of signing agreements or finding an institution that already has an agreement with [Organisation Y] and so on.

After a moment of reflection, an executive then suspiciously refuted that notion: “The researcher was restricted? I don’t think the researchers face this situation”. As a contextual observation, I had noticed during the focus group meetings with executives of all host organisations that most often, whenever contradictions in views occurred between executives, they tended to withdraw from the discussion. It seems that their mental models assume that they should always, as insiders, be in agreement in front of outsiders, including myself. This was especially true when a higher-level executives opposed a lower level employee. It was usually a recurring cut-off point for me when this occurred. In terms of this particular issue, I felt that other executives did not agree that researchers do not “face this”, but that they opted not to disagree publicly. My interpretation suggests that the top executive did not want to open the door to allow researchers to autonomously communicate with external organisations because this would mean the leadership would lose their control, and hence, their power. In a bureaucratic environment, this was important to the leadership. I felt this was off limits; hence, I commenced on the next topic to sustain the reflective discussions.

The management response (Negative pattern [code 1/Denial]: Lack of process performance measurement) was generated in response to a general impression that process performance is not gauged. I asked the executives: Do you all agree that there are no clear measurements for KT activities at [Organisation Y]?. The vice president responded with confidence:

I don’t agree with that. KT is measured at our organisation by the number of publications we make in recognised journals. ISI is our benchmark and that benchmark is a very stringent benchmark and that’s how you determine that you have gained certain knowledge, and that you have put it on paper and published the paper in a recognised journal.

Another executive added following comment:

Citation is also a benchmark ... The first thing is publication then citation then patenting. These are all benchmarking for KT ... We don't have a certain yardstick for that. Our yardstick is only publications and outcomes ...

Clearly, there were no KM measures adopted for any of the three KT systems. Once again, there is a misunderstanding about what KT is. The executives are again using traditional measures of academic work output, e.g. citations. This is not a measure of KT, i.e. whether knowledge has been transferred between staff and internal or external partners. A similar response was given at Organisations X and Z. It is the IP measure that defines their KT performance.

The management response (Negative pattern [code 5/Peculiar]: Lack of KT agents) was generated in response to a general weakness in coordinating KT activities. I asked about how they perceived having a knowledge agent to coordinate KT activities to improve the efficiency of their core KT processes. Their response was negative because the executive in the following statement described the idea as irrational:

At [Organisation Y], we believe that the [internal] researcher or the project manager [who is dealing with an external expert or the local industry] from our side is the responsible person to watch out for KT [coordination].

Although there were no processes to guide researchers on how to carry out such a task, the executives were denied that this was an issue that deserves attention or may represent a barrier to KT.

The management response (Negative pattern [code 3/Emotive]: Poor legitimacy of some policies and procedures) was generated in response to a general weakness perceived at a policy and procedures level at the host organisations. An astonishing reply from a vice president came when I questioned the legitimacy of policies that come from the government and top ministry leaders. I seem to have posed a “confronting enquiry” by asking whether there was an intention to hear or respond to the complaints made by AR participants in this study against governmental policies. I suggested that this might result in changing those policies, re-positioning them or rethinking their legitimacy (i.e. an opportunity for double loop learning). The response below illustrates how it was so difficult for governmental executives to enter into double-loop learning:

These processes have got a certain basis. They have not come out of the air. They have been developed by the public administration department in Riyadh. I personally believe

in following the system because it is not based on someone's idea, it has been worked very thoroughly, like why you need three quotations, why do we need analysis. So, I was sitting with my family and we were talking about inheritance rules, I said I will not say before I die that I want half of my assets to go to my wife and this much to go to this person. When they came and asked me I said I will never do that, I will leave it up to the law to decide because it must have thought about everything, I believe that our law thought about why 1/8 should go to the wife, and 1/4 and 1/2, so we shouldn't mess with it. We should not. Similarly, if the government has developed a certain system even though it is delaying some jobs, we should keep it. I remember Dr [anonymous previous president], I told him we need five signatures to get this through, he said: the more signatures, more authentic the document becomes. It takes time but it becomes more authentic. I believe in the governmental system.

This was one of the most comprehensive responses where everyone in the meeting carefully listened. When the vice president finished his *speech*, the response by other executives was clearly polite (i.e. silence). I suggest that this is seen as a political issue. I then made another attempt to argue further and I urged him to sympathise with what is good for research in this country so things can change for the better. He then replied in an emotive fashion: "The people [in the government] who made the rules have thought about it much more than you and me". I saw different facial expressions on each participant and decided that the situation was best managed by moving to the next topic.

The management response (Positive pattern [code 1/Approval]: Local industry issues) was generated in response to a general weakness connecting local researchers together. The AR cycle 2 report regarding problems at Organisation Z related to the local research industry level was discussed. I asked about their views on KT in Saudi Arabia between research institutions. This problem was recognised by the executives and they confirmed that it is a major issue that engineering research organisations in Saudi Arabia were isolated from each other. An executive added:

My understanding is that the Saudi Arabian economy is not that diverse. First, knowledge transfer must be directed between Saudi universities. I personally think that they must establish a network for local universities and I currently know zero.

This matter viewed in the same way but to a lesser degree at both organisation X and organisation Y, where they were closer to a Positive Curiosity (code 5) pattern.

The management response (Positive pattern [code 2/Factual]: Lack of domestic IP support) was generated in response to a general weakness in that there was a shortage of local IP consultancies. In establishing processes for research infrastructure such as

expert local networks, communication schemes and IP support, there needs to be local businesses and consultancies that support those efforts. Executives admitted that the scientific capabilities to support IP activities are still lacking but found this a normal phenomenon:

The legal ability is here but the scientific assessment to judge whether this work is patentable or not is lacking ... but it is normal to seek consultancy in this area. Even in the USA, if you wanted to file a patent, you need to send it to several people in different universities to assess. It is not usually a local job. This is not bad. This is healthy. As I said honestly [Organisation Z] is proud of its record and we do have facilities here that no other organisation has in the region.

They were comparing US universities seeking support from US IP consultancies to Saudi universities seeking support from US IP consultancies. Such facts were undeniable but it seems they were little understood. Although I asserted in my questions that my focus was on competitiveness on the international level, host organisations always praised themselves as being the best in the *region*. This indicated that their theory-in-use actually was focused on being competitive only on the national level. It was an embedded acknowledgement that host organisations are not competitive at the international level. This was difficult to accept publicly as their espoused theory of their competitiveness was that they were approaching the international stage.

None of the three host organisations provided evidence to suggest that they opposed the findings of the previous AR reports on performance problems. In all three host organisations, executives expressed their opposition to some findings based on their personal beliefs, but provided few measures to support their claims. From a process point of view, AR cycle 2 was the one that was most opposed by executives because it pointed to policies and rules that underlie the core business processes of the host organisations.

### 8.9 MANAGEMENT FEEDBACK ON THE RESULTS OF AR CYCLE 3

The feedback on AR cycle 3 in this study was sought from the leadership of host organisations X, Y and Z to solicit their views by approval, denial or a subset of either one as illustrated in the previous phase in the pattern classifications of Table 8-1. In

each of the three focus group meetings that took place in this cycle, I started with seeking the participants' feedback and impressions on the results of the KT barriers report. AR cycle 3 report was the most sensitive because it touched on individual, organisational, national and international behaviours.

The findings were highly controversial in the view of executive managers at the three host organisations, which increases the importance of this section. In an intensive tone, an executive from organisation Y started the discussion on the AR cycle 3 report by claiming the superiority of organisation Y above all other research organisations in Saudi Arabia and he said that since the report was based on the collective data findings of the three organisations in Saudi Arabia then the majority of its content could not be not expected to be applicable to organisation Y. He said: "We don't compare ourselves with other research organisations in the kingdom". I humbly asserted that the correlations in the qualitative findings were significantly high in AE cycle 3, although they were somewhat different in the LOC measure. The three case-study organisations, including organisation Y, shared most of the KT issues on the individual, organisational and national levels. This did not convince him. Within the context of management feedback, the following data examples provide grounded evidence of underlying theoretical concepts.

### 8.9.1 FEEDBACK ON THE INDIVIDUAL LEVEL BARRIERS

The management response (Negative pattern [code 1/Denial]: Lack of recognition of researchers for their work) was generated in response to a general frustration that researchers were not sufficiently recognised. One of the main issues in the AR cycle 3 report was that researchers felt frustrated about being left alone to face the challenges of scientific and engineering research and that their organisations never provided the support and recognition they deserved, given the struggles they faced on a daily basis. An executive from organisation X rejected the claim as explained in the AR cycle 3 report and highlighted the many forms of support organisation X provides to researchers. He highlighted multiple opportunities for researchers to learn and share their knowledge in recognition of their work. He said that:

[S]ome of the ways we recognise our researchers are by sending them for] attending conferences, participating in summits, participating in presenting papers and research. They [also] go for sabbaticals, sometimes for one year and sometimes for three months. So, all types of [recognition to] let's say [promote] absorbing of technology are offered here. Each individual needs to work for it. I mean they can apply for it because it is available ... With the new president, things have changed.

Given that the process by which such support is facilitated was complex, other executives did not opt to discuss the matter. The issue of recognition was one of the major gaps from a mental models perspective between staff and executive managers, which suggests a tacit-tacit socialisation quadrant problem (Nonaka and Takeuchi, 1995) at the host organisations. In other words, the issue had not been sufficiently discussed to reach a point of convergence or agreement.

The management response (Negative pattern [code 3/Emotive]: Barriers related to lack of respect for researchers) was generated in response to a general frustration that staff were not treated with respect. A fundamental shift of enquiry occurred at this stage and the discussion diverged from the issue of recognising researchers to discuss the very fundamental need of human respect. This was considered sensitive and some executives did not want to comment. From a contextual perspective, this indicated that previous discussions between the executives themselves had taken place on this subject. I raised evidence that researchers feel disrespected and undermined by executive management. Researchers reported that they were not trusted. Even their attendance was recorded using factory tools (i.e. a fingerprint attendance recorder). An executive then defended the fingerprint attendance machine and commented: "This came from the president himself. He is fingerprinting himself also".

When I encouraged exploration about why this was irritating to researchers even when the president himself was registering his attendance using this machine, executives said they believed that researchers did not have enough work to do and therefore were feeling tempted to leave their workplace during duty hours, and that a strict attendance system was required to ensure they stayed at the workplace during their office hours. They agreed that the strict attendance monitoring system was legitimate given the lack of discipline from the researchers. The executives felt researchers were being disrespectful of their organisation by not keeping to their working hours.

I asked another host organisation about lack of respect for internal researchers and suggested that the level of respect given to researchers was much lower than the respect given to expert visitors, for example, as reported by some AR participants in cycle 3. I wanted to confront the management with this sensitive issue because local researchers were not likely express themselves to their management on these topics. I was then surprised to see the vice president point to a senior researcher whom I had invited to attend and he asked him the following question:

Professor X, do you not get more respect and glory when someone comes from another institute [overseas] if he is comparable with your expertise? Are you not respected more at Organisation Y?

Professor X was surprised to be asked such a question in front of all the other executives. He took a few moments to contemplate and then responded as follows:

Of course [pause], well [pause], now [pause], we see [Organisation Y] is talking about becoming a world-class organisation. Also [Organisation Y] is talking about world-class practices and the top administration, to the best of my knowledge, is very seriously revisiting this [goal]. To what extent we can minimise this gap [for Organisation Y] to become a world-class organisation? Do we have world-class practices [such as respect to researchers]? I see that there is progress.

The notion that “there is progress” implies that the underlying answer to my question was actually no. It seemed that there was a lack of respect. Once again, the answer was conservative and diplomatic, seeing that the vice president wanted a scientist who was three levels below him in the hierarchy to answer the question in front of him. The vice president seemed to understand the underlying answer and his comment was:

There can be some isolated cases but in general to reply to your question, the researchers at [Organisation Y] are fully recognised financially and respect wise. There is no discrimination in terms of expatriates or Saudis.

The above quote implied that good pay to researchers meant that respect was provided by default. At this point in time, seeing the heated meeting intensified, one of the executives wanted to leave. He mentioned that he had another commitment to attend but nonetheless, he seemed uncomfortable with the discussions, especially given that he mentioned earlier that he felt that the meeting was focused on negative issues. I



explained that the meeting was to discuss the KT barriers report, which was intended to mainly highlight problems. Seeing that he was the participant who was most opposed to the criticisms of the report among other executives, the vice president commented on his request to exit the meeting by saying: “So you will leave me here to fight alone [laughs]”. I understood how the meeting was perceived and how defensive top executives can become in order to defend their practices and policies. I therefore realised how difficult it was for me to enforce double loop learning, shared understandings and a helping approach to the focus group meeting. Most executives were from the old generation (baby-boomers, in the term used in the US) who were expected to retire in the next two to five years. It seemed too difficult to make such changes in thinking with senior staff under these circumstances.

The management response (Positive pattern [code 1/Approval]: Barriers in the absorptive capacity of researchers) was generated in response to a general weakness in the AC of staff during KT activities. The approval of executives at organisation X to the absorptive capacity issue was immediate and they confirmed that it was an impediment to KT activities. I enquired about their training practices and the use of IT systems to enforce learning to reduce the gap between external experts and local researchers. Executives provided general comments that these programs were taking place but still the AC of staff had not changed. Executives claimed that the problem was related to individual absorptive capacity, which reflected on the poor performance of the core business processes of engineering research organisations in Saudi Arabia. I then enquired about their plans to resolve this problem and an executive said:

Once you have researchers, you have to make them ready to absorb the technology. How? By giving them certain assignments and pressurising them a little bit until they can absorb technology.

This was a cornerstone in the discussion as it meant that the main source for KT weakness at host organisations was identified as the low absorptive capacity of internal researchers. Executives at Organisation X saw this as the number one barrier to KT.

The management response (Negative pattern [code 2/Defensive]: Barriers in social networking) was generated in response to a general weakness in enabling individual

social networking with the outside world. The KT barrier of social interaction between internal researchers and external experts was questioned. Executives seemed supportive of limiting informal social interactions between their internal researchers and external experts if the external organisation did not have an agreement with the host organisation in Saudi Arabia, as the following quote suggests:

We are pushing to deal with organisations and not with individuals. I mean [pushing for] joint research with research partners. You can bring their experts for some time and spend some time with them and learn from them and by this approach you transfer the technology.

Although the executive management does not have the power to restrict personal communication between internal researchers and the outside world, there are severe implications to this policy. First, if the internal researcher needed any funding to pursue his individual collaboration then the organisation will not give it to him or her. Second, if the internal researcher gets into legal issues with the external expert then the organisation will not support him or her. The risks are significant, which creates a barrier that the executives do not seem to acknowledge.

The management response (Negative pattern [code 5/Peculiar]: Barriers in building individual capabilities) was generated in response to a general weakness in the capabilities of individuals at host organisations. The discussion on the impact of internal capabilities in KT was defended tactically by the executive at Organisation Y as the following quote illustrates: “I think we are still learning [building capability]. We [our capabilities] cannot jump from the bottom to the top directly. We have to follow a step-by-step approach.”

With these words, the executive was expecting all involved to be patient and accept that movement up the capability ladder would be incremental. The problem here is that many researchers feel that the movement is currently down the ladder, which illustrates another significant difference in views between staff and management.

The management response (Negative pattern [code 1/Denial]: Barriers in IP support) was generated in response to a general weakness in keeping researchers motivated to produce IP. AR participants in previous cycles complained that IP support services were poor and found that this had become a personal issue for many researchers because it began to affect their motivation, loyalty and commitment. However, the

management at Organisation Y did not accept this reality when they were asked about the satisfaction level of researchers regarding IP support provided by the organisation. The following response by the vice president illustrates this position:

They are very satisfied. We are very prompt in replying to their emails. The procedure for filing a patent is very clear and is on our website. They can even come to our offices and they can ask us the procedure.

This was a total denial of the claims made by the researchers. The underlying root-cause for this denial is a research area that should be investigated. One reason may be that executives are very much isolated from the life of researchers and the differences in their values and beliefs might have aggregated to a large gap. Thus, researchers see what executives do not see.

The management response (Negative pattern [code 1/Denial]: Barriers related to lack of rewards) was generated in response to a general weakness in providing staff with encouraging incentive rewards. On rewards and motivation, I asked executives for their views on the inadequate KT-related incentives for researchers to motivate them to engage in sharing their knowledge. I pointed to issues reported by AR participants in the report that confirmed the existence of barriers of this sort. The response was: “Are you sure you met people in Organisation Y? ... I think your sample has a problem”. The cynical tone was obvious, which provided enough evidence that the management were not interested in discussing this issue. However, the vice president instantly made the following comment:

This is completely untrue. Absolutely untrue. I am a researcher [as well]. I have spent all my life as a researcher and then I got into management. I know that there are ... I always say that the researchers have a lot of incentives at Organisation Y. If you relate an incentive directly to money then this is one thing. But it is another thing when we see that Organisation Y has launched a new program that distinguishes professors who are good researchers. They give them funding, research assistance, [X] year contracts which is something very unknown in the kingdom. These days, our researchers are swimming in money. Heavy funding ... If you are a good researcher, you don't have the time to teach.

The tone and control over the discussion was intense and so the decision was made to close the discussion and move to another topic. I then asked about motivating non-Saudi staff who needed as much motivation as Saudis. My argument was that non-Saudis are not allowed to head research institutes and research centres. I argued this was discrimination that caused a KT barrier. I asked: In an environment that is

supposed to be academic and international, should such demotivating practices exist?.

The response was:

Yes, it is, but not to the limit that you are talking about ... the [leader of the organisation] has to be Saudi, right? the vice [leader] has to be Saudi, the deans have to be Saudis. This is governmental law and we cannot break that ... but when it comes to the project management, then non-Saudis can be project managers ... there are quite a number of expatriate foreigners who are project managers ... any one can do without any discrimination. But for strategic projects like working with an international organisation then yes, I agree that the head of the Saudi team is normally a Saudi because he is representing Saudi Arabia in the international arena ... If you are talking about the research, then I don't think there is any discrimination.

The discussion was ended at that point since the denial came to be emotive and the objective of the meeting was not to convince the management of any findings as much as raise their awareness and seek their feedback.

The management response (Positive pattern [code 1/Approval]: Barriers related to training on communication skills) was generated in response to a general weakness in individual communication. When I asked about training staff in efficient communication to support KT activities between internal researchers and external experts, the idea was rejected, as per the following quote: "No, I don't think that guidelines and training for this [communication training] is really necessary. We are educated enough, we know [how to communicate with] those people". This is another important misunderstanding about KT. People feel they share knowledge because they can talk. However, the transfer of knowledge can be ineffective (poor quality) and inefficient (slow) if communication skills are lacking in either the knower or seeker.

I tried to facilitate further reflections and discussions on this issue. This helped reduce the gap between the views of AR participants mentioned in the report and the views of the management as the quote above suggests. This resulted in a more balanced argument on the issue of communication and one of the executives stated: "But there is something. There may be a person A and a person B. They never met before and therefore there may be a difficulty. In this case, I agree with you."

This was an improvement in their mental models on the issue of communication. I detected some fundamental changes in awareness taking place. This could be

considered a contribution of this study to the host organisations. However, in relation to solving the issue, the executive concluded:

But if someone is in the States and I am here. He knows me and I know him. We met a couple of times in conferences and we already had email exchanges and if there is something that we need to talk about face to face. For this communication, why do we need to have guidelines and training?

Once again, the outcome was raising their awareness to question their decisions and views and encourage double loop learning. This type of comment highlights, once again, confusion and misunderstanding amongst some executives about KT. For example, the executive who made the comment above is using single-loop learning only. He is being defensive by arguing that he can already share knowledge with overseas colleagues, so there is no need for a formal process on KT. Single-loop learning satisfies his claim that he is doing the 'thing' (i.e. external-to-internal KT) correctly because in his view knowledge is exchanged and collaboration occurs. However, he does not use double-loop learning to ask whether he is doing the right 'thing'. He is unwilling to challenge his underlying assumptions about external-internal KT because he is following the normal process of collaboration. He thinks he is doing it 'right' so why change? However, double-loop learning may help him see that there may be a better or a different way of external-to-internal KT. The need for training and guidelines, therefore, becomes a tool to share best practice from the knowledge of those who are really good at external-to-internal KT.

This discussion further emphasises that one of the major stumbling blocks in the MFGs was to get the executives to double-loop learning. Many of the misunderstandings about KT highlighted in this chapter are a result of executives with many years of experience as academics, creating and sharing knowledge all through their careers, failing to see there may be a different way to do things.

### **8.9.2 FEEDBACK ON THE ORGANISATIONAL-LEVEL BARRIERS**

The management response (Positive pattern [code 1/Approval]: Barriers related to successive planning) was generated in response to a general weakness in preparing new research leadership executives. I enquired about how they viewed preparing a new generation to grow and lead the organisation in the future. I enquired about the

existence of any system for succession planning. There were no systems in place as the appointments were usually made by the president with little planning. I then argued that such lack of planning prevents host organisations from passing experiences from the previous generation to the newer generations and that this might lead to loss of organisational memory. One of the executives responded:

I disagree because you know I remember my contract very well. It is written there and I have developed a team for this. The concept of development of teams means that I have to groom a future generation who can shoulder the responsibilities when I retire. So, I disagree ... We have a system, job descriptions, in a job description for example, I have to prepare a future generation and hold these responsibilities.

The above quote focused on contractual responsibilities but did not indicate how to implement this stipulated responsibility. How to carry out this obligation was the missing part, in my view.

### 8.9.3 FEEDBACK ON THE NATIONAL LEVEL BARRIERS

The management response (Positive pattern [code 1/Approval]: Barriers in research support on the national level) was generated in response to a general weakness in the government regarding support for engineering research. The executives agreed that this barrier existed. On the national level, Organisation X executives expected that the support of the government for specific areas of research could increase the momentum to commercialisation and national benefit. To illustrate, I quote an executive stating the following:

Now you can see the renewable energy investment by the government. For three years, after the initiative of the King started to gain momentum, investors have come to the government and supported it.

This indicated that host organisations feel helpless about increasing their research intensity when external national support from the government is minimised. The support is not just about money but rather more importantly as the quote implies it is about policy. The dependency of host organisations on other governmental agencies was detected and thus may prove to be a major influence as perceived by executives at host organisations.

### 8.9.4 FEEDBACK ON INTERNATIONAL-LEVEL BARRIERS

The management response (Negative pattern [code 2/Defensive]: Barriers related to politics) was generated in response to a general impression that politics are playing a negative role at the host organisations. I asked if there were political issues surfacing at host organisations and if there were lobby groups based on gender or nationality? The following quote by an executive illustrates their view:

We have 126 nationalities and everything is perfect. It is making our environment rich. People here think as scientists and do not give attention to politics ... Organisation Z may be in the first ten worldwide in diversity. It is of course normal to see groupings where Chinese are more together and other nationalities are together but it is normal that they have their own society.

The management response (Positive pattern [code 5/Curious]: Sponsoring the outcomes of the focus group meeting) was generated in response to final comments of the MFG. The VP in organisation Y was curious to know that research outcomes of this study and requested to be informed once the final conclusions were drawn to possibly sponsor some of its outcomes or continue the research cycles for further analysis. This was the final point in the MFG meetings.

In general, the three meetings were intense, rejecting (especially in organisation Y) and failed to achieve the acceptance by the executive management of the reports generated for AR cycles 1, 2 and 3. These reports were detailed and added up to almost 500 pages. However, most of the findings were not approved. The resistance to the findings resulted in a failure to win the support of the management at the three host organisations.

On examining this occurrence, I argue that the reasons are related to (1) the fact that the meetings were audio recorded and that making transparent statements may have been perceived as too risky, (2) the attendance of two hierarchal levels in the same meeting was threatening for the lower level persons (i.e. executives and their delegates), and (3) the large gap in the mental models between executives and researchers (which the reports were built upon) was significant and difficult to resolve in a single meeting. The communication gap between the management and researchers and the minimal face-to-face interaction might be the reason for the substantive differences in views between them. Therefore, future research might

consider converting the focus group meetings into workshops of longer duration and using persuasion techniques to modify the mental models of attendees as the best way to “buy-in” their approval to the findings.

In this analysis, the recurring theme about misunderstanding KT and lack of double-loop learning was also frequent and caused many misconceptions to the potential, and risk, associated to KT activities. This implies inclusion in future sessions some activities that challenge the underlying assumptions at the three case-study organisations.



## 8.10 CONCLUSION

As integral contributors to engineering research, executives and research leaders have considered KT success to be a major concern (Cummings and Teng, 2003). The strategic nature of KT and the complexity of contextual variables affecting KT, necessitated the participation of executives whose understanding and possible action encompass a priori unit for possible change (Parkhe, 1993). Peter Senge (1990) asserts the importance of “shared understanding” among decision-makers and stakeholders *before* action is taken. Argyris and Schon (1982) stress the importance of double-loop thinking for addressing challenges. As previous AR cycles were focused on recruiting participants from all department, research centres and hierarchal levels to develop a shared understanding on KT issues among organisational members, this AR cycle addresses the need to include top leaders into the learning loop.

From a meta-knowledge perspective, it seems that there was a knowledge blockage in the process of my research activity itself. What should host organisations have done with reports containing a long list of identified problems and issues that emerged from different perspectives, subsystems, departments, individuals and analytical lenses over three AR cycles? In some cases, I observed that some barriers were incomprehensible (i.e. a knowledge blockage at the leadership level). I needed a way to combine multiple problems in a meaningful way to clarify the *big picture*. Systemic thinking provides an understanding of the whole and how the parts of the whole integrate to produce overall outcomes (Senge, 1990). It was counter-productive for me, and for the host organisations, to try to discuss the issues identified in the previous reports in isolation to each other; rather, contemplating how the collective set of issues interacted, arguably, best reveals the ideal function that balances a solution equation.

My observations on the effects of previous AR cycles confirm that a MFG was necessary after each cycle to bring about consensus among the leaderships at the host organisations and accelerate an action response. This did not take place and is considered a learning outcome for the future, as it was a weakness in this research. I consider reliance on management reports with the absence of MFGs early on in the

study as one shortcoming of this study that should be avoided in similar research studies in future. I advocate an MFG after submission of each management report.

From a methodological perspective, feedback on data findings is valuable to confirm the accuracy of data (Gibbs, 2007). The approval of decision-makers in regard to the identified issues validates data and provides substantive weight to the findings. Triangulation was my approach to verifying the information elicited. In doing so, the online LOC survey, face-to-face interviews and the MFG's produced the validation measures of triangulation. Hence, this chapter and this AR cycle were about validation. I was checking with case-study organisations whether the findings make sense. Clearly they didn't accept it all. In terms of going forward to the second part of this AR cycle in chapter 9 to develop the KT strategy based on the outcomes of the focus group meetings, the challenges with the lack of validation of many findings will clearly become new barriers to the KT strategy implementation. Therefore, I intend to avoid, as possible, the findings that were rejected from being included in the initial KT strategy of chapter 9 because acceptance may allow a quicker change to occur. As a few key examples of positive feedback and negative feedback to highlight the key findings, figure 8-7 presents a summary.

Code	Examples for Negative Patterns	Examples for Positive Patterns
1	<b>Denial pattern:</b> Learning and KT not being central to organisational objectives.	<b>Approval pattern:</b> Weakness in KT enablers
2	<b>Defensive pattern:</b> Technology not used to support KT activities	<b>Factual pattern:</b> Lack of KT processes to evaluate KT practices
3	<b>Emotive pattern:</b> National culture negatively influencing KT	<b>Complementary pattern:</b> Strength in attracting organisational partnerships
4	<b>Suspicious pattern:</b> Lack of commercialisation with the local industry	<b>Constructive pattern:</b> Weakness in protecting IP rights
5	<b>Peculiar pattern:</b> Constraints on internal researchers	<b>Curiosity pattern:</b> Sponsoring the outcomes of the focus group meeting

Table 8-3: Key examples of positive and negative feedback

The main pattern with the management thinking was to persistently apply single-loop learning. For example, they are much more positive towards blaming external partners, than internal-to-internal processes where they need then to accept responsibility. Also, there is a rejection of staff views. They tend to resist questioning their basic assumptions to ask, "are we doing the right thing". This implies that further meetings, workshops and seminars may be necessary.

# CHAPTER 9: THE KT STRATEGY

## AR CYCLE 4: PART 2 (SOLUTION FRAMEWORK)

*“Change is the only constant variable in business today.”*

*(Senge, 1990, 2006)*

### 9.1 INTRODUCTION

The knowledge strategy capability gap (AR cycle 1), KT process inefficiencies (AR cycle 2) and KT barriers (cycle 3) have now been validated by the executive management (AR cycle 4 – Part 1). The validation process in chapter 8 was part of phase 5 (analysis and reflection) of AR cycle 4. However, phase 5 is not yet complete. The validated gaps, inefficiencies and barriers need now to be addressed. This chapter completes AR cycle 4 by introducing a KT strategy. A KT strategy is not a list of solutions to identified barriers per se, rather, a view of a high-level whole-system framework driven by qualitatively aggregated focal points (Koenig and Srikantaiah, 2004). Although this chapter concludes AR cycle 4 and the study as a whole, it should not indicate the discontinuation of the project lifecycle. As it took three AR cycles to identify the barriers, it would not be possible to produce the solution in one AR cycle. The ultimate answer to the KT predicament is beyond the scope of this thesis or any AR project; rather, AR projects should never end (Greenwood and Levin, 1998).

The conceptualisation of the initial KT strategy that is proposed in this chapter builds on a main focal point; that is, finding the strategies that *accelerate* knowledge flows. This offers a general guide to stakeholders at host organisations to continue their journey after the completion of this study by solving the numerous and renewing barriers to knowledge flows by stressing the focal point (i.e. acceleration). Therefore, instead of providing micro-level solutions that may become overwhelming to comprehend and implement at this stage, an initial solution space is proposed for the KT strategy. In the KM lessons learned by Short and Azzarello in Koenig and Srikantaiah (2004), they suggested starting with focal points as a short version of a detailed solution strategy. They justified this viewpoint from necessity as their clients needed to understand the high-level concept of the solution first before going into detailed solutions. Their argument is illustrated in the following quote:

[O]ne frustrated client mentioned a project [for KM solutions] list containing 60 [KM] projects, all part of the KM program of his company. How can a line manager running a profit center, possibly make sense out of the mass of possibilities. As a challenge, it is similar to attempting to put together a jigsaw puzzle without the picture on the top of the box it came in. There are so many pieces that all belong, but what goes where? How does one fit with another?

The initial KT strategy in this chapter therefore only provides ‘the picture on the top of the box’. This high-level solution concept is a significant contribution that represents a short version of the KT strategy. In order to resolve the limitations of this thesis, future AR cycles may discover ways to mobilise the puzzles to explore how they fit together. This chapter establishes the concept and understanding to what pieces of the puzzle are most important in the first place to qualify as part of ‘the picture on the top of the box’.

As this thesis is data driven, revisiting the previously identified barriers in chapters 5, 6 and 7 help create a sense of cohesiveness to produce an interconnected first-level KT strategy. An important finding in this process is that in many cases, solving a KM-related barrier in one place of the KT processes may solve it everywhere in the organisation because most solutions ‘rely heavily on the softer, human behaviour and cultural aspects of business rather than on computer and technology’ or pure process mechanisms (Koenig and Srikantaiah, 2004). Addressing the solutions in the first-level KT strategy may significantly reduce the needed second-level KT strategy in the next cycle (i.e. in AR cycle 5).

## 9.2 CYCLE 4 – PHASE 5 (PART 2): “ANALYSIS AND REFLECTION”

Figure (9-1) shows the fifth phase of AR cycle 4, which represents the second part of the same phase of chapter 8. This part presents the initial KT strategy for this thesis.

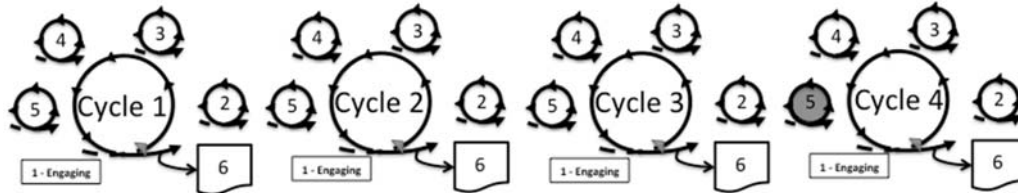


Figure 9-1: Cycle 4 – Phase 5 (Part 2): “Analysis and Reflection”

The approach for this phase started in chapter 8 by transcribing the focus group responses on AR cycles 1, 2 and 3. The transcriptions from focus group meetings produced 119 pages and were coded into 375 codes. Figure (9-2) illustrates the codes classifications. Code classifications were further disaggregated into three sub-classifications to link each code with the relevant AR cycle (i.e. AR Cycle 1, 2 and 3).

The image shows a screenshot of the NVivo software interface. The 'Nodes' list on the left includes: Nodes, Relationships, and Node Matrices. The main window displays a table of nodes and their sources.

Name	Sources	References
AR Cycle 2 (Knowledge sharing processes)	0	0
AR Cycle 3 (Knowledge blockages)	0	0
MFC Negative Feedback	3	125
AR Cycle 1 (LOC related)	3	23
AR Cycle 2 (Performance Measurement (BPR, Lean, TQM, K	3	53
AR Cycle 3 (Knowledge blockages related)	3	104
MFC Positive Feedback	3	140
AR Cycle 1 (LOC related)	3	24
AR Cycle 2 (Performance Measurement (BPR, Lean, TQM, K	3	44
AR Cycle 3 (Knowledge blockages related)	3	127
Solutions	0	0

Figure 9-2: NVIVO coding for the focus group meetings of AR cycle 4

A memo was attached to each code to add all qualitative reflections. Figure (9-3) presents a snapshot illustration of this activity. The substantive amount of reflections that emerged from coding the data supported the emergence of grounded themes that helped generate to new perspectives. I discovered new themes that did not exist in previous AR cycles (Gibbs, 2007), which are presented in the following sections as the basis for the KT strategy.

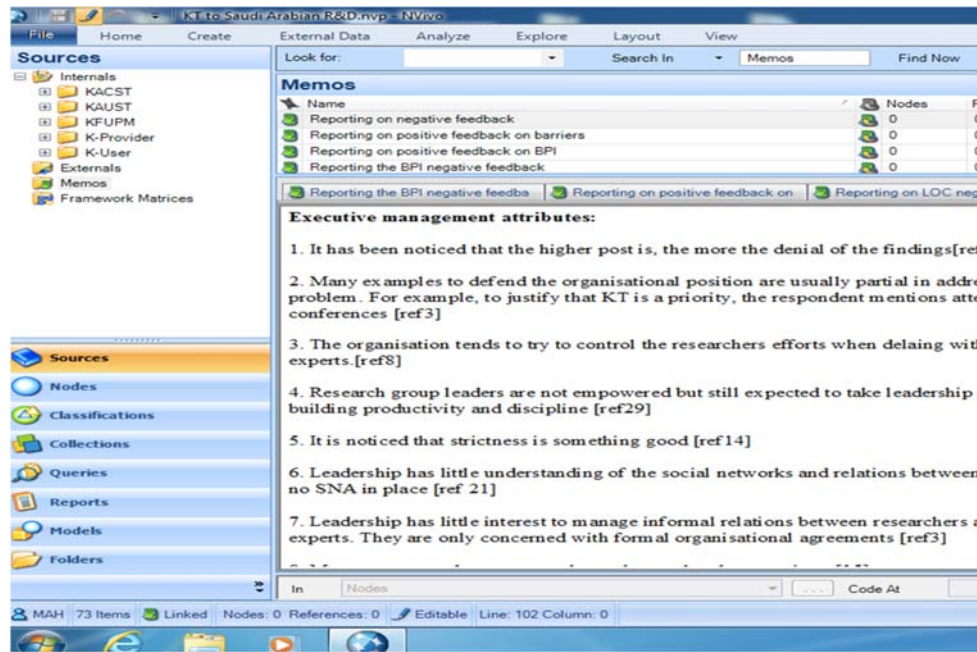


Figure 9-3: Using NVIVO to record reflections linked to each code in AR cycle 4

In terms of starting KT strategy development, AR participants suggested numerous solutions to KT problems during the interviews of AR cycle 2 and 3 related to incentive systems, governmental interventions and staff recruitment. However, their concepts were fragmented and abstract. Those concepts had little practical application because they were based on symptoms rather than on underlying reasons. Their incapacity to conceptualise practical solutions increased their internal frustrations and puzzled feelings. The more the KT strategy targets the inner-levels of the multi-layered barriers identified in previous cycles, the more symptoms it will eliminate.

### 9.2.1 CONCEPTUAL KT STRATEGY DEVELOPMENT

The original focal point in this study is to *accelerate* knowledge flows on three KT systems: (1) external-internal, (2) internal-internal and (3) internal-external KT. The key focus is therefore to conceptualise a KT strategy that increases the speed of knowledge flow across the host organisations at those three distinctive system levels. Figure (9-4) presents the solution space concept. KT barriers (upper part of the figure) and KT solutions (lower part) act within a cascaded process. The output of barriers is input to solutions. The middle of the figure is a function that represents the validation process, which filters the barriers into the KT strategy development space.

## CHAPTER 9: THE KT STRATEGY

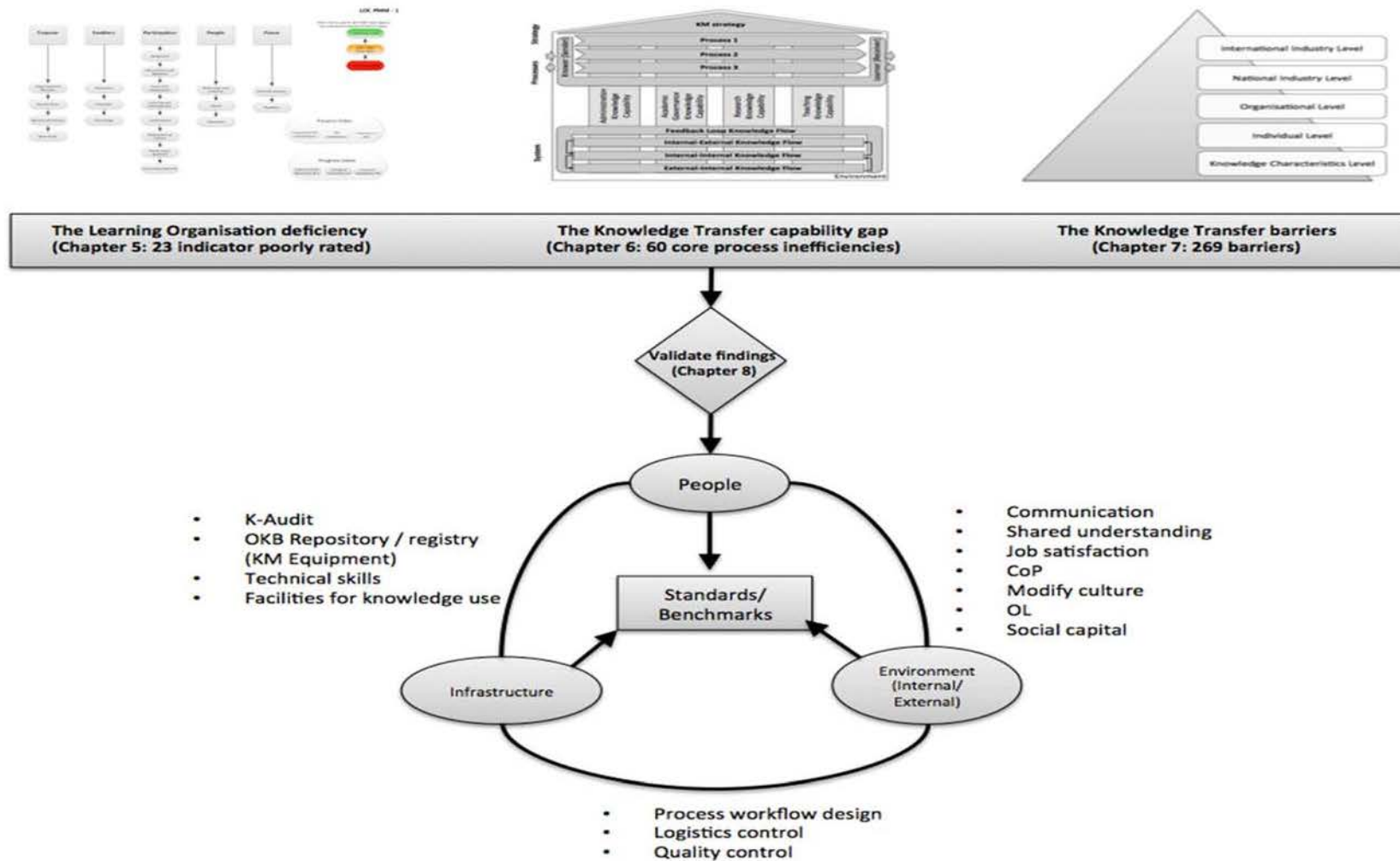


Figure 9-4: A proposed conceptual KT strategy

As explained above, figure (9-4) starts from the top part. The diagram on the top left represents the LOC measure of 23 indicators (outcomes from chapter 5). The next diagram to the right, the IKTM, represents the model used to assess inefficiencies in 60 core processes (outcomes from chapter 6). The third diagram, the KT barriers models, represents the architecture that identified 269 problems (outcomes from chapter 7). These three diagrams were explained and applied to the data in the chapters indicated above.

The KT strategy development space in the lower part of the figure reorganises the output of the validation decision discussed earlier so that it is linked with one or more of the three main KT strategy space areas: *people*, *environment* and *infrastructure*. The output of the solutions space then feeds inwards to the *standards and benchmarks* area as shown in the centre of the solution space. Only successful solutions are standardised as benchmarks. This means testing is needed before solutions are sent inwards, as a validation measure. This means that validation is implemented for barriers and solutions.

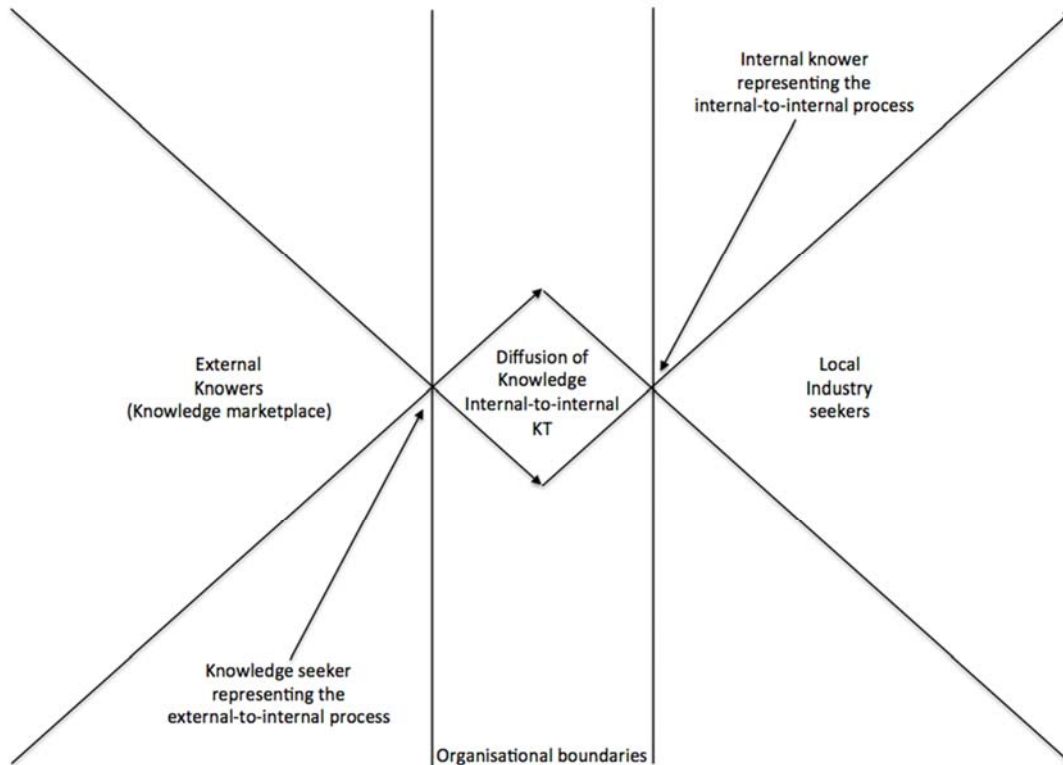
The above concept however has a drawback. It does not distinguish between the three KT systems nor does it verify the ontological and epistemological dimensions during knowledge flow, thus risking a knowledge flow with missing specific ontological or epistemological activities. Filling this gap in the concept is necessary to ensure that a solution *checklist* comprehensively verifies covering all dimensions of the KT activity.

### 9.2.2 FROM A SOLUTION CONCEPT TO A SOLUTION FRAMEWORK

For each KT system, effective knowledge flow requires specific capabilities that are attached to distinctive activities. In order to verify that no KT activity was missed out, this framework will stand as a checklist for the KT strategy. As presented in chapter 6, these capabilities fall under five core activities: administration, academic governance, research, teaching and community engagement. In other words, within these activities are KT processes that hold weak or absent capabilities. In order to address the weaknesses or absence of some capabilities, the ontological and epistemological dimensions must use a checklist across all activities. This means not only that knowledge for transfer needs to be identified but also where (ontology) and how (epistemology) it is to be transferred.



The ontological dimension for administrative activities, for example, focuses on the process of diffusion of administrative knowledge to validate the diffused knowledge as justified, true belief. In other words, the more people who believe and use this administrative knowledge as true and justified, the more this knowledge can contribute value to the organisation. When this process is effectively carried out, the KT strategy may claim that the knowledge was successfully transferred from an ontological perspective. Figure (9-5) illustrates the concept of ontology for this discussion.



**Figure 9-5: The ontological diffusion of knowledge across the three KT systems (Massingham, 2012)**

As illustrated above, a wide range of knowers in the marketplace transfers knowledge to specific seekers at host organisations. Those agents then diffuse knowledge across the organisation until new agents take the role of knowers to transfer knowledge to the wide range of local industries. The case study organisations integrates with Massingham's model because the ontological and epistemological perspectives are similar.

The epistemological dimension for administrative activities focuses on understanding the interaction between tacitness and explicitness of administration knowledge between the knower and the seeker in the above example. This dimension focuses on how tacit-tacit

and explicit-explicit knowledge are socialised and combined respectively within the KT process to create value. When these processes are effectively carried out, the KT strategy can claim that knowledge was successfully transferred from an epistemological perspective.

Similarly, other core activities such as academic governance, research, teaching and community engagement require similar explanations as they use identical lenses. By combining the above systems, activities and dimensions within one KT strategy framework for each KT system, tables (9-1), (9-2) and (9-3) emerge. These frameworks illustrate a checklist measure for the KT strategy framework. The barriers identified in chapters 5, 6 and 7 have to fit within this *checklist* to produce solutions that address all KT dimensions. The tables identify 60 check point that could ensure that the KT processes are accelerated from both an ontological and epistemological dimensions.

## CHAPTER 9: THE KT STRATEGY

KT SYSTEM >	External-Internal system [KTS-1]									
KT CAPABILITIES >	Internal Administration activities [KTS-1-1]		Internal Academic governance activities [KTS-1-2]		Internal Research activities [KTS-1-3]		Internal Teaching activities [KTS-1-4]		Internal Community engagement activities [KTS-1-5]	
APPROACH TO KNOWLEDGE >	Ontological dimension [KTS-1-1-1]	Epistemological dimension [KTS-1-1-2]	Ontological dimension [KTS-1-2-1]	Epistemological dimension [KTS-1-2-2]	Ontological dimension [KTS-1-3-1]	Epistemological dimension [KTS-1-3-2]	Ontological dimension [KTS-1-4-1]	Epistemological dimension [KTS-1-4-2]	Ontological dimension [KTS-1-5-1]	Epistemological dimension [KTS-1-5-2]
<b>External People</b> (External experts, external managers, external people involved in the supply chain)	-President -Vice Presidents	Synthesis 1: Tacit to Tacit	- Middle managers - Project managers	Synthesis 1: Tacit to Tacit	- Researchers engaging with external experts - Support staff	Synthesis 1: Tacit to Tacit	- Lecturers engaging with external experts - Teaching assistants - Students on exchange programs	Synthesis 1: Tacit to Explicit	- Senior researchers engaged with external experts -Community activists	Synthesis 1: Tacit to Tacit
<b>External Infrastructure</b> (Systems, resources, policies and processes)	- Vision and mission - IT systems - Hard management skills	Synthesis 1: Explicit to Explicit  Synthesis 2: Explicit to Tacit	- Knowledge-base systems - Process control procedures	Synthesis 1: Explicit to Explicit - Explicit to Tacit	- Research laboratories - Testing sites - Video conferencing systems	Synthesis 1: Explicit to Explicit - Explicit to Tacit	Classrooms - Teaching laboratories - Video conferencing systems	Synthesis 1: Explicit to Explicit - Explicit to Tacit	- Media and marketing tools - Conference and social halls	Synthesis 1: Explicit to Explicit - Explicit to Tacit
<b>External Environment</b> (Overseas managements, governments, cultures and knowledge marketplace)	Inter-organisational level	Synthesis 1: Explicit to Tacit - Explicit to Explicit	Inter-organisational level	Synthesis 1: Explicit to Tacit - Explicit to Explicit	Inter-organisational level documents	Synthesis 1: Explicit to Tacit - Explicit to Explicit	Inter-organisational level	Synthesis 1: Explicit to Explicit	Inter-organisational level	Synthesis 1: Explicit to Tacit
<b>External Standards and benchmarks</b> (KPI's)	Global benchmarks	Synthesis 1: Explicit to Explicit Synthesis 2: Explicit to Tacit	Leadership benchmarks	Synthesis 1: Explicit to Explicit Synthesis 2: Explicit to Tacit	- Leadership benchmark standards	Synthesis 1: Explicit to Explicit Synthesis 2: Explicit to Tacit	- Leadership benchmarks	Synthesis 1: Explicit to Explicit Synthesis 2: Explicit to Tacit	- Local benchmarks	Synthesis 1: Explicit to Tacit

**Table (9-1): The KT solutions framework for the external-internal system**

## CHAPTER 9: THE KT STRATEGY

KT SYSTEM >	Internal-Internal system [KTS-2]									
KT CAPABILITIES >	Internal Administration activities [KTS-2-1]		Internal Academic governance activities [KTS-2-2]		Internal Research activities [KTS-2-3]		Internal Teaching activities [KTS-2-4]		Internal Community engagement activities [KTS-2-5]	
APPROACH TO KNOWLEDGE >	Ontological dimension [KTS-2-1-1]	Epistemological dimension [KTS-2-1-2]	Ontological dimension [KTS-2-2-1]	Epistemological dimension [KTS-2-2-2]	Ontological dimension [KTS-2-3-1]	Epistemological dimension [KTS-2-3-2]	Ontological dimension [KTS-2-4-1]	Epistemological dimension [KTS-2-4-2]	Ontological dimension [KTS-2-5-1]	Epistemological dimension [KTS-2-5-2]
<b>Internal People (Internal staff)</b>	- President - Vice Presidents	- Tacit to Tacit	- Middle managers - Project managers	- Tacit to Tacit	- Researchers - Support staff	- Tacit to Tacit	- Lecturers - Teaching assistants - Students - Apprentices	- Explicit to Explicit	- Senior researchers - Community activists	- Tacit to Tacit
<b>Internal Infrastructure (Systems, resources, policies and processes)</b>	- Vision and mission - IT systems - Hard management skills	- Explicit to Tacit - Explicit to Explicit	- Knowledge-base systems - Process control procedures	- Explicit to Tacit - Explicit to Explicit	- Research laboratories - Testing sites	- Explicit to Tacit - Explicit to Explicit	Classrooms - Teaching laboratories	- Explicit to Tacit - Explicit to Explicit	- Media and marketing tools - Conference and social halls	- Explicit to Tacit - Explicit to Explicit
<b>Internal Environment (Internal and local government directives, domestic knowledge marketplace, culture)</b>	- Inter-organisational level	- Tacit to Tacit - Explicit to Explicit - Explicit to Tacit	Inter-organisational level	- Tacit to Tacit - Explicit to Explicit - Explicit to Tacit	Intra-organisational level	- Tacit to Tacit - Explicit to Explicit - Explicit to Tacit	Inter-organisational level	Explicit to Explicit - Explicit to Tacit	Inter-organisational level	- Tacit to Tacit - Explicit to Tacit
<b>Internal Standards and benchmarks (KPI's)</b>	- Lessons learned benchmarking	- Explicit to Explicit - Explicit to Tacit	- Leadership benchmarks	Explicit to Explicit - Explicit to Tacit	-Departmental benchmarks	Explicit to Explicit - Explicit to Tacit	- Leadership benchmarks	Explicit to Explicit	- Local benchmarks	Explicit to Explicit - Explicit to Tacit

**Table (9-2): The KT solutions framework for the internal-internal system**

## CHAPTER 9: THE KT STRATEGY

KT SYSTEM >	Internal-External system [KTS-3]									
KT CAPABILITIES >	Local industry Administration activities [KTS-3-1]		Local industry Academic governance activities [KTS-3-2]		Local industry Research activities [KTS-3-3]		Local industry Teaching activities [KTS-3-4]		Local industry Community engagement activities [KTS-3-5]	
APPROACH TO KNOWLEDGE >	Ontological dimension [KTS-1-1-1]	Epistemological dimension [KTS-1-1-1]	Ontological dimension [KTS-1-1-1]	Epistemological dimension [KTS-1-1-1]	Ontological dimension [KTS-1-1-1]	Epistemological dimension [KTS-1-1-1]	Ontological dimension [KTS-1-1-1]	Epistemological dimension [KTS-1-1-1]	Ontological dimension [KTS-1-1-1]	Epistemological dimension [KTS-1-1-1]
<b>Internal People (Internal Individuals)</b>	-President -Vice President	- Explicit to Explicit	- Middle managers - Project managers	- Tacit to Tacit	- Researchers - Support staff	- Tacit to Tacit	- Trainers engaging with host organisations - Trainees and apprentices engaging with host organisations	- Explicit to Explicit	- Senior researchers - Community activists	- Tacit to Tacit
<b>Internal Infrastructure (Systems, resources, policies and processes)</b>	- Vision and mission - IT systems - Hard management skills	- Explicit to Tacit - Explicit to Explicit	- Knowledge-base systems - Process control procedures	- Explicit to Tacit - Explicit to Explicit	- Research laboratories - Testing sites	- Explicit to Tacit - Explicit to Explicit	Classrooms - Teaching laboratories	- Explicit to Tacit - Explicit to Explicit	- Media and marketing tools - Conference and social halls	- Explicit to Tacit - Explicit to Explicit
<b>Internal Environment (Internal and local government directives, domestic knowledge marketplace, organisational culture)</b>	- Inter-organisational level	- Tacit to Tacit -Explicit to Tacit - Explicit to Explicit	Inter-organisational level	- Tacit to Tacit -Explicit to Tacit - Explicit to Explicit	Inter-organisational level	- Tacit to Tacit -Explicit to Tacit - Explicit to Explicit	Inter-organisational level	- Tacit to Tacit -Explicit to Tacit - Explicit to Explicit	Inter-organisational level	- Tacit to Tacit
<b>Internal Standards and benchmarks (KPI's)</b>	- Industry benchmarks	- Explicit to Explicit - Explicit to Tacit	- Leadership benchmarks	- Explicit to Explicit - Explicit to Tacit	- Leadership benchmarks	- Explicit to Explicit - Explicit to Tacit	- Leadership benchmarks	- Explicit to Explicit - Explicit to Tacit	- Local benchmarks	- Explicit to Explicit - Explicit to Tacit

**Table (9-3): The KT solutions framework for the internal-external system**

The framework above illustrate that KT incurs different ontologies for each system and activity but relatively similar epistemologies. Using the different cells in the tables above, and the conceptual framework of figure (9-1), a systematic approach to produce the solutions can be attained as if a checklist was used to ensure that knowledge is transferred efficiently (diffusion) and effectively (tacit-explicit interaction). This also provides a foundation for theoretically validating potential KT strategies before it is tested empirically, thus, providing an economic measure to the KT process.

The way the above frameworks should be used is by taking the left column solution space descriptors as representing the knower and each activity column as the seeker. In table (9-1), the knower for the three KT systems may either be external people, external environment or external infrastructure. The seeker is from internal administration, academic governance, research, teaching and community engagement activities. Similarly in table (9-1), the knower may be in the role of internal people, internal environment or internal infrastructure.

To illustrate the way KT strategies should be drawn from barriers ontologically and epistemologically, the following section will build the KT strategy components and then aggregate them into a coherent KT strategy blueprint. This is considered an initial solution blueprint that can be used as a future guide to design the detailed KT strategy that uses the above framework as an essential checklist to sustain the ontological and epistemological lenses. In this way, no ontological or epistemological elements that relate to KT processes are overlooked.

One more important reason to focus on the creation of the above framework is that it provides reliability to the study outcomes since it standardises the way barriers are addressed. As business is turbulent and continuously changing, the identified barriers and corresponding solutions may change over time, however, the above solution framework should remain functional because it provides a framework for approaching the solution derivation activity. This suggests that while the above framework is sustainable, the solution blueprint presented below is dynamic and may change over time due to highly contextual environment. Therefore, the above framework should be tested in future AR cycles to prove its reliability to be used iteratively against any suggested solution.

### 9.2.3 FROM A SOLUTION FRAMEWORK TO A SOLUTION BLUEPRINT

In this AR cycle, the high-level KT strategy represents a solution blueprint for host organisations. It is built on three main strategy components; namely, strategy alignment, KT process improvement and KT culture adjustment. Future AR cycles can further disaggregate these high-level strategies into smaller projects, task activities and dollar-relocation plans (Koenig and Srikantaiah, 2004). The selection of the components was based on the level of acceptance, importance to the core business and feasibility of implementation. Systemic thinking was used as an approach for selection. Without using this perspective, a risk may arise that the solution blueprint would focus on one puzzle element or another without addressing the whole picture. Since this thesis is data driven, the above components must look back to the data, coding, analysis and reflections of previous cycles to derive the best KT strategy as a solution blueprint.

First, the analysis of the LOC indicators in chapter 5 (AR cycle 1) was compared to best practice organisations, which contained a set of best practice indicators that might relate to possible solutions. Second, the identified core processes inventory in chapter 6 (AR cycle 2) did not only define the waste and inefficiencies in business processes related to KT but also provided some sort of solutions in the form of ‘To Be’ processes (see chapter 6 and Appendix B). Third, the analysis of the multilayered barriers architecture in chapter 7 (AR cycle 3) did not only provide knowledge, individual, organisational, national and international level barriers but also suggested many solutions to them during the interviews that were coded in NVIVO. Based on the three focal points suggested by the solutions framework, the initial KT strategy should address the following focal points:

- (1) Focal point 1: accelerating knowledge flow through strategy alignment.
- (2) Focal point 2: accelerating knowledge flow through process improvement.
- (3) Focal point 3: accelerating knowledge flow through cultural adjustment.

#### 9.2.3.1 FOCAL POINT 1: ACCELERATING KNOWLEDGE FLOW THROUGH STRATEGY ALIGNMENT

The impact of a workforce that is strategically misaligned can be substantially negative. Evidence is found in LOC ratings (i.e. organisational direction and talent indicators),

supports that the capability of researchers is misaligned with organisational requirements. Enabling an organisation with people who has a shared vision and mental models (see chapter 5) to pursue their mission statement is the first element proposed for the initial KT strategy (i.e. the people element). Enabling the organisation with a management that is strategically aware of this issue is important. Before staff can approach the outside world (i.e. the knowledge marketplace), alignment of internal measures need to be revisited for correction. Although as mentioned in the introduction of this chapter that many barriers may be resolved beyond the targeted ones, the following LOC indicators are considered the deepest deemed for improvement in focal point 1:

- (1) Organisational direction
- (2) Mission and vision
- (3) Finding purpose/awareness

First, organisational direction is to communicate a clear message to researchers about focal point 1 of the KT strategy by bringing all organisational members at all levels to a unified understanding on the organisational goal. A shift in the intrinsic beliefs of staff is necessary to realize improvement in this focal point. The essence of the message could communicate to staff that the organisation management aims to:

1. Significantly increase the human capital by improving the way staff learn from others and how they share knowledge internally and with the local industry using best practice KT systems between external knowers and internal seekers, between internal knowers and internal seekers and between internal knowers and external seekers (i.e. epistemological dimension).
2. Generate incremental value from human capital by using the KT systems to reduce dependence on external experts by growing internal capability in areas that will most benefit the Kingdom of Saudi Arabia (i.e. ontological dimension). This can be achieved by aiming to:
  - a. Increase the efficiency (productivity) and effectiveness (quality) through increased number of innovations and elevated global recognition respectively.



- b. Increase the individual commitment from staff towards their organisations by building a sense of shared commitment, which is essential to sustain the reduction of dependence on external experts.
  - c. Communicate to staff how the growth in the organisational capabilities is actually achieved through building the individual capability of researchers. It is the collective synergy between the individual capabilities that will bring the reduction of dependence on external experts to reality.
3. Translate the success of the organisation in aligning its knowledge strategy with its activities into individual and personal success by recognising and rewarding the best contributors to the strategy alignment focal point.

The second part of this component is to communicate a clear message to researchers about the accountability measures relating to this focal point of KT. The solution for this part suggests introducing standard operating procedures (SOP) that provide guidance on what is considered right and what is wrong and why. The SOP will bring a shared understanding and with the support of social activities, discussions about the information in the SOP will emerge, which will help staff internalise the explicit knowledge into tacit knowledge (i.e. the epistemological dimension). Without this explicit activity, the KT strategy alignment may lose its alignment. Although quantitative measures may be difficult at this point, future AR cycles may identify new systems from the KM industry, which by then could have a set of standard metrics for quantitative evaluations or audits.

An important outcome to standard operating procedures (SOPs) and performance benchmarks is guiding organisational members to align their work practices with the organisational knowledge strategy. Standards and benchmarks inform organisational members how well they are doing as compared to organisational plans. Auditing performance against standards and benchmarks identifies system time delays, efficiency defects and productivity issues, which then brings action to adjust and restrain from defective diversities. For example, the data in chapter 8 showed that executives did not consider the decades they have been in business as sufficient to be accountable for producing tangible engineering research results. Enforcing standards and benchmarks would eliminate such controversies and bring clear evidence of performance delays, thereby, a basis for accelerating KT.

No respondent was able to provide measurable evidence of the achievements in terms of KT. Although there seems to be measurement to productivity, it is obvious that the designers have not aligned them with KM concepts. Leadership claims that there are no measurement tools that can be implemented for measuring KT except tracking the number of publications and number of research projects conducted. This section needs to build its solutions on an overall road map or vision, relationship management, business drivers and enablers, cultural changes, report cards, measurement accountability and performance indicators. Communicating values is one of the key benchmarks that might be a solution to many identified barriers. Once these elements are shaped, the following questions for each point in terms of KT emerges: How do we make this happen? How to measure them? How do we report, track, articulate knowledge sharing? The call for accountability could communicate that the organisation aims to:

1. Implement a quarterly LOC survey to measure progress on the LO improvements.
2. Establish a set of ROI metrics and business indicators (KPI's) to measure the business outcomes, which may include:
  - a. Auditing the productivity of each position in terms of set metrics such as patents, publications and successfully completed projects.
  - b. Conducting a comparative analysis between different positions to explore the best fit between roles and responsibilities and individuals in the organisation.
  - c. Conducting ROI analysis to verify if KT is functioning as an overhead or a profit centre. It takes into account the cost versus benefit analysis to produce the net cash flow. Possible considered costs may include IP management systems, expertise profiling systems, best practice repositories systems, business intelligence systems and collaboration management systems. Possible net worth benefits may include value of patents, savings in search costs, savings in knowledge workers' time, increase in profitability and decrease in staff turnover costs. It is also possible to use the IRR and NPV measures to account for the value of knowledge increase over time (Koenig and Srikantaiah, 2004).

3. Conduct a quarterly knowledge audit to measure the change in the knowledge accounts of individuals, research centres and the organisation as a whole.
4. Conduct a semi-annual SNA survey to measure the improvement in social capital on the individual and collective levels.

The over-communication of this strategy is necessary. Workshops, informal meetings and consortiums are good tools to propagate the strategy. The strategy should focus on acceleration of valuable knowledge based on measurable guiding references. This element enforces the ontological perspective of the solution because it creates a shared understanding and validates the purpose, direction and overall strategy of the organisation in relation to focal point 1. Bennet in Koenig and Srikantaiah (2004) describes this element as:

... creating a shared vision; building the business case; demonstrating leadership commitment; facilitating a common understanding; setting limits; sharing new ideas, words and behaviours; identifying the strategic approach and thrusts; developing the infrastructure; providing tools, measuring and incentivizing; promoting learning; and envisioning an even greater future.

With this vision, researchers can march to the outside world with confidence and clear direction, while backed up with a committed leadership that knows what it wants, precisely. On the personal level, the success of the above message may bring self-awareness and self-directed learning capabilities to a useful stage. This in return may result in increased professional outcomes (e.g. patents, publications, grants) as tangible improvements in business performance. The above sub-component will address many poor results that emerged from the LOC survey for the indicators mentioned above.

From the above presentation, the first solution component to the thesis blueprint addresses a substantial array of issues at case-study organisations. When trying to implement the suggested ideas, the challenge comes back to assembling the puzzles into the big picture. Once the above focal point is adopted by host organisations, the next AR cycle should set the tools, training, and techniques that can develop learning capabilities in light of the above KT strategy. The ultimate objective of these tools is to remove the barriers to KT at host organisations and provide a sustainable KT system that will continue to accelerate knowledge flows in the necessary rate into the necessary internal

locations at the necessary time frames. Future AR cycles may focus on delivering and monitoring the tested this KT strategy.

### **9.2.3.2 FOCAL POINT 2: ACCELERATING KNOWLEDGE FLOW THROUGH PROCESS IMPROVEMENT**

Host organisations are facing difficulty in translating their core business processes into commercialised research products and in marketing them successfully. They also have difficulties providing solutions to the local industry. Focal point 2 as a main solution component suggests accelerating knowledge flow to build the capability of host organisations in improving their business processes. This focal point therefore addresses the need for re-engineered workflow processes that accelerate KT into, within and out of host organisations.

The platform for this solution component has already been established in chapter 6 where the 'To Be' processes have been defined (see Appendix B), the lean thinking solution have been derived (see Appendix B) and the importance versus feasibility of each core process has been visualised (see figure 6-13, 6-14 and 6-15). The solution component thus will focus on how to select from the 60 'To Be' processes a high-level 'big picture' solution to allow the next AR cycles to solve the remaining puzzle parts. As discussed earlier, addressing the deepest parts of a complex problem may resolve issues beyond the targeted problems. This means that the weight of the 60 processes vary because addressing specific processes may streamline other processes.

From a solution perspective, the first step is to recognise that not all business processes can be addressed at the same time. There needs to be a prioritisation model to organise the solution derivation task. First, the process selected needs to be knowledge intensive so that it may incur higher levels of knowledge flow. Knowledge intensive processes contain heavy knowledge traffic and rely on effective use of key knowledge resources. Second, the process selected needs to be of high importance to the core business. Third, the modification or replacement of the process needs to be feasible by the organisation. In this solution component, 5 core processes were selected as the most appropriate for focal point 2 based on the above criteria. These processes are listed in table (9-4) with their

corresponding ‘To Be’ processes. They are expected to contain root-cause issues that may streamline issues in other processes.

No.	Process Description	‘To Be’ process
1.3.2	Criteria to evaluate suitability of internal experts for external research collaborations.	Establish criteria, approval, and apply in selection process; cost benefit analysis
1.4.1	Sending researchers overseas to learn	Specify outcomes, capture outcomes, measure tangible learning benefit at organisational and individual gain levels
2.3.2	Activities to facilitate internal knowledge exchange	Establish vision; strategy and procedures for cooperation at inter, intra, and individual levels of knowledge sharing; incentives; mechanisms; and establish infrastructure
2.4.6	Designing and delivering teaching content for research students	Peer review, communities of practice
3.3.6	Measurement of research activity with the local industry	Commercialisation Unit to drive

**Table 9-4: Selected core processes for focal point 2 solution component**

In the following, a discussion to the processes in table (9-4) is provided to illustrate the impact of improving them on knowledge flows and on the KT strategy in general:

Process ([1.3.2]: Criteria to evaluate suitability of internal experts for external research collaborations) is a crucial business process because it represents the process in which case-study organisations select their ambassadors to the outside world. The impact of possible issues that may result from incorrect selection of internal staff is numerous and in some cases may become fatal to the external-to-internal KT system. For example, internal researchers with poor English language speaking skills may prevent appropriate communication with external experts; lacking awareness of competency gaps may mislead the task of filling them by learning from the external expert; lacking clear goals for targeting the knowledge needed from the external expert may prevent the internal researcher from performing independently later on without the external expert; lack of relevant qualifications and experience may affect the AC to learn; lack of motivation may affect the discipline and hard work ethic, subject matter interest, willingness to learn during the external-to-internal KT processes. This list of issues is highly correlated with knowledge flow efficiency. The stickiness of knowledge embedded in this process may

be reduced if the abovementioned issues were addressed. It is therefore evident that the success of KT is dependent on the workflow design of the business process.

The improvement to this process requires resolving these issues that currently hinder the performance of the process. For example, the host organisations must work on enhancing the awareness of behaviours, attitudes and competencies, which may be used to make good selection decisions about internal staff suitable to work with external partners. The criteria should be developed as part of a SOP and should be approved and applied accordingly. The process should also consider the knowledge exchange that takes place when overseas experts visit host organisations. Encouraging the bright internal staff to have plans for interacting with external visitors and allowing them to be relieved from normal duties to prepare for those engagements may have a positive impact on this process. The following quote illustrates how the AR participant was inspired and emotional while engaging with overseas experts:

I really like the [WXX] program. I really like this because they get people from all over the world from different places and they hold the seminars in [Organisation Z] in different fields. It amazes me that they do these workshops here ... so instead of going to attend workshops [overseas], they are coming here, and some of the people are the best in the world with Nobel prizes.

Although these visits are short and little laboratory joint research takes place due to time limitations, it leaves inspiring effects on the concept of engaging with external experts. Instituting organisational processes that manage visits from inspiring people is suggested by the data as a valuable extension to idea of sending researchers overseas.

Process ([1.4.1]: Sending researchers overseas to learn) is considered an efficient way of accelerating external-to-internal KT because it overcomes the predicament of proximity when researchers reside with the external experts and immerse in external environments, cultures and social networks. From an epistemological perspective, many tacit to tacit transfer could be obtained from this process. However, this process may result in limited diffusion from an ontological perspective because the flow is specific to the individual traveling to the overseas expert. The way the process functions is that researchers and student join overseas institutions on the basis of exchange and collaboration programs. However, the outcomes are poor.

The process improvement to this process requires identifying the incorrect practices that resemble a root-cause. One way to do this is to learn from best practice in this area and include in the SOP. The objective and process must take into account that this process aims to send researchers and student to return to diffuse the knowledge, thereby, accelerating knowledge flow through process improvement. In order to ensure that focal point 2 is addressed, the process should consider the number of exchanges taking place with overseas institutions, the quality of the overseas institution, the knowledge learned from the exchange through a report on posting completion. This process is equally important in three stages; the planning for the overseas exchange, the activities during the exchange, and the accountability measures after the exchange. Unless those three stages receive due attention, improving the process outcomes may not be satisfactory. This solution therefore suggests major work for documenting what should take place during these three stages.

Process (2.3.2) is equally important from an ontological perspective because it deals with diffusion of knowledge and from an epistemological perspective because it requires a criterion for practicing knowledge sharing. At the moment, this process lacks a shared vision on different levels such teams, research centres, departments both for short-term and long-term goals. It also lacks performance metrics, i.e. input (e.g. funding) and output (e.g. innovative knowledge). The criterion in which people who contribute to this process being recognised is also not specified.

The process improvement to this process requires establishing specialist research centres; cooperation between research centres; providing autonomy to the main players in knowledge exchange; instituting intellectual freedom; providing an SOP for collaboration, i.e. how people should work together; providing incentives for collaboration; providing incentives for research output, e.g. papers, patents etc.; providing fixed grants, rather than externally competitive; providing different levels of grant funding to facilitate research at multiple paths (i.e. senior, mid, and junior staff development); completing the research infrastructure, i.e. all labs established; supporting weekly research seminars to share ideas and ensure knowledge retention, i.e. invest in growing and keeping people. The process improvement to this process thus requires structural and cultural systems to direct knowledge sharing. Activities should be implemented and simultaneously linked to performance metrics.

Process (2.4.6) is important because it is not only to enforce internal-to-internal KT but also it supports the internal-to-external KT in a very early stage. Students at host organisations either are hired by host organisations or by the local industry. Establishing a strong generation of researchers supports both the internal-to-internal KT system and the internal-to-external KT system. It also builds the social capital of individuals, which usually takes a long time to build. Providing focus to this process can provide a solid foundation for research work in Saudi Arabia. This process currently lacks consultation hours because lecturers are not available to help students. The process also lacks practical interaction with the industry because teaching material is based on theoretical knowledge. In addition, the process lacks end result clarity because students have little planning abilities.

The process improvement to this process requires developing leading-edge course content; using on-line material, e.g. case studies, videos; providing research student with learning techniques for conducting literature reviews, summarising papers, presenting the current body of knowledge; engaging socially with students to resolve sensitive issues such as understanding and addressing student attendance and participation in class. The solutions for this process build on quality teaching, student satisfaction and clarity of end result. Student and subject surveys, peer review and best practice may help building appropriate metrics to gauge the improvement in this process in fulfilling the contribution it can make to focal point 2.

Process (3.3.6) is important because a major issue at host organisations is output accountability measures. Working with the local industry is complex and requires a strong commitment from researchers and the leadership at host organisations because the local industry is more business oriented than host organisations. The interactions between a governmental organisation (i.e. public sector) with a local industry (i.e. private sector) involve several idiosyncrasies. First, the orientation of researchers at host organisations are less competitive than that of engineers in the local industry in terms of business profit and loss. This causes an issue because the experts (i.e. the knower) are supposed to be from the host organisations. In the view of host organisations, this may be different because host organisations focus on keeping the research activity functioning regardless of the business financial output. Second, the commercialisation capabilities at host



organisations are weak. Although research at host organisations may be more advanced than that of the local industries, the specific strengths do not include all research innovation dimensions. The local industry cannot tolerate commercialisation weaknesses because it is what drives profitability.

The process improvement to this process requires addressing the root-cause of the problem. The points highlighted above draw attention to some of the main differences between the two sectors (i.e. public and private) and may suggest fundamental mental model differences that indicate a possible need for the solution to revisit focal point 1, which addresses the values, vision and shared understanding at host organisations. Researchers at host organisations, as part of this process, should be able to appreciate the importance of the output volume of projects when working with the local industry, the time durations they take to produce tangible results, the publications and recognition of commercial value and the knowledge diffusion among local industry staff that increases the competitiveness of those industries. In order to address each point, host organisations need to re-engineer this process through involving the local industries in workshops, seminars, public lectures to gather their views and build a valid and reliable measurement system that produces accurate measures for the indicators of local industry satisfaction. This solution is difficult to be understood or applied without a dialectic thinking approach, which allows for a thesis (i.e. proposition) to engage with an antithesis to produce the innovated solution (i.e. synthesis). This dialectic thinking approach may be an ideal setting between host organisations and the local industries.

### **9.2.3.3 FOCAL POINT 3: ACCELERATING KNOWLEDGE FLOW THROUGH CULTURAL ADJUSTMENT**

This focal point might be the most difficult to solve because it involves behavioural change management. Some might go to the extreme of believing that it is impossible to change cultures especially as chapter 7 and 8 explains how complicated the cultural situation at host organisations are. Building effectiveness in managing the behaviour of people at the host organisations may first be addressed by developing congruence between their espoused theory and theory-in-use (Argyris, 1980). They need to know that

what they say is different at the moment from what they do. By this way, the purpose of helping people to make better informed choices about the actions they design and implement starts from understanding reality (Argyris and Schon, 1978).

As chapter 8 illustrated, many KT barriers, including cultural issues, have been denied by the executive management. For example, lack of respect was an issue that negatively affected the internal culture at host organisations. However, the executive management has yet to approve this as a barrier in order to commence on a solution. The denial of the problem does not make the problem go away. It actually builds and creates congestions throughout the organisations. Therefore, this first step for this solution component is to adjust the cultural norm in perceiving current barriers. Leaders, managers, and supervisors need to notice the problem and realise its effect in order to appreciate the need for solution.

Short and Azzarello cited in Koenig and Srikantaiah (2004) suggest that in order to know which problems matter most to the success of the anticipated solution, it is important to know which problems matter most to the business users. It is important to identify which KT barriers are most confronting to the feelings of people, teams, department and social networks in the organisation and bring all involved to acknowledge those barriers. In the following, Short and Azzarello explain that the acceptance of the solution is dependent on these factors and is considered key to the success of the solution itself:

The essence of a successful KM solution, then, is one that addresses a perceived issue among those who are affected by the solution, and it does so in a way that is consistent with prevailing cultural and behavioural norms. When a solution is aligned in this fashion, the likelihood of acceptance is maximised.

Assuming that future efforts to convince stakeholders of the many cultural issues at their organisations was successful, the next step would be to begin on addressed the root-cause of those layered cultural issues. The most significant negative cultural concerns of staff at host organisations were related to (1) lack of peer trust and respect, (2) tendency of superiors towards increased unjustified control over subordinates, (3) lack of discipline and accountability. The first is a psychological contract issue, the second is a behavioural issue and the third is a regulatory norm issue. They all share the need to validation so these concepts can be accepted as realities. In order for these barriers to be valid, they must part of the staff justified, true belief. In other words, the more people who believe

that these barriers exist, the more valid it becomes and the more necessary they are to be resolved.

First, culture is a tacit construct that people of an organisation share. Understanding the interaction between tacitness and explicitness of knowledge sharing and how they are combined to create value for the organisation is relevant here because the adjustment of culture requires both tacit and explicit KT to be realised. When an organisation has a culture of mistrust and disrespect then communication fails (Schein, 2009). When communication fails, knowledge sharing and work processes suffer. This issue is at the heart of focal point 3 because it touches on the backbone of knowledge flow activities, which is communication. The root-cause for this issue is primarily cultural because it stems from specific cultural behaviours. For example, people at host organisations do not listen well to each other. This results in a disconnection between the mental models of peers and turns into peculiar emotions that ignite mistrust and disrespect. In AR cycle 1, final conclusions confirmed that mental models (Senge, 1990) was rated as 'red' code.

One organisational solution may be inviting inspiring people to come to meet internal staff, talk with them, and know their life journeys as humans. When these interactions reoccur periodically to honour the individual inspirational factor, respect and trust in people, a new perspective to work may emerge. This solution is not rewarding staff for any achievement and indeed not asking people to trust each other per se. This is exclusively about inspiring people to respect the concept of trust and respect to peers. In doing so, setting the example may bring life to the barrier of lost trust. Staff needs to see trust and respect in motion in order to understand its essence and apply it.

The leadership also must set the example of respect and trust and translate it in all their actions (see KT barrier code: [4.2.6.3] Social capital and trust in chapter 7). Their dealings with internal staff should be based on mutual trust and respect. Internal researchers should be treated in the same way visitors are. The motivation of internal staff is constrained by ethnocentrism (i.e. westerners having more status/credibility than local researchers in the mental models of the leadership). Rewards and recognition should be awarded to local researchers. The leadership may also establish SOP that could help

institute trust and respect such as procedures to protect Saudi IP and others to protect their privacy and dignity in the workplace.

In order to measure possible improvements in this area, host organisations should establish peer review surveys (i.e. 360 degree evaluations) and communicate the results, which if positive, could reflect on a wider range of individuals and expand incrementally. The solution here relates to change management and this brings the complexities of change into this solution.

Second, authoritative personalities are common in developing nations because democratic thinking is not established in those parts of the world. The tendency of superiors towards increased unjustified control over subordinates provides an indirect measure to the level of democracy among decision makers in sharing the decision making process. The empowerment indicator in the LOC measure and locus of control in subsequent discussions relate to this issue. The impact of this issue is substantial on knowledge flows and research output. For example, decisions that apply unjustified budget control deny creativity (i.e. top down rather than bottom up), thereby, a culture that is limiting knowledge flow.

The solution for this issue is to allow researchers freedom and autonomy to develop their own research; remove the bureaucratic culture and hierarchy from research processes (i.e. approval, controls); ensure stability in management/decision makers; and eliminate constraining rules (i.e. finger scans for attendance recording). The control of attendance using finger scans in the latter example suggest that leaders may not understand that work per se is difficult to measure and clocking on and off is no real indication of output, only of physical presence. By that I mean sometimes a lot can be achieved in 1 hour in terms of ideas and creativity and sometimes little is done in 8 hours sitting in front of a computer. However a directive for example to publish 3 papers a year, or present at 3 conferences a year is a more achievable aim and allows the researcher some autonomy in its execution.

The way each of those solutions are designed and implemented varies according to the context and specific situation of each host organisation. However, the principle that

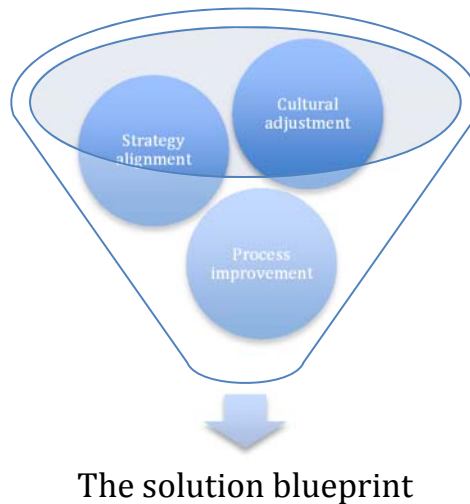
serves focal point 3 is clear, to lift cultural barriers that inhibit accelerating knowledge flow. It is widely accepted at the public sector of many developing countries that government work accommodates cultures that lack discipline and accountability. Carelessness and work time waste is one of the major cultural barriers that host organisations face. The root-cause for this is complicated and may extend to the national culture as an input measure (see the KT barriers code: [4.2.4.2] The push strategy and code: [4.2.4.1] Low dedication of local researchers in chapter 7).

A LO is an organisation that is quick to identify, digest and apply the lessons learned in its interactions with its environment, hence, using the time wisely and applying discipline in the workplace (McNabb, 2007; Senge, 1990). If researchers were not inspired towards this active orientation of quick learning and using, host organisations would not be able to reach the LO status. This was discussed as an individual motivation factor but here it is about what the organisation can do in the context of organisational culture to bring this orientation as an organisational norm.

The solution for this issue is to have a critical mass of experienced staff to accelerate the discipline learning curve for junior staff; strengthen the psychological contract of staff; help staff motivate each other to get engaged in work activities by finding contacts; helping staff to search for interesting ideas by establishing networks and communication with the local industry; encourage any opportunity for socialisation, conferences, meetings; consider job redesign to adjust position related cultural effects (formalise KT roles); clarify iteratively the role of the researcher and establish communities of practice across institutes (i.e. Canadian Chair in Chemistry model).

Performance metrics are limited in this area. Cultural assessments through the use of psychometric measures and emotional intelligence benchmarks may serve to measure the progress in the cultural change attempt. This solution may require longer time than the other two solution components because they require changing habits that have long been accepted and normalised at host organisation. As a change strategy, perhaps a transformational change approach where incremental radical change is implemented with periods for stabilisation after each period may provide better results. For example, there should be explicit rules and regulations that exert pressure on researchers to perform and accept accountability to their actions.

In summary, the solution blueprint for this thesis is a high level solution that requires further disaggregation and additional AR cycles to materialise into a pilot initiative. The present blueprint focuses on accelerating knowledge flows by addressing three main issues. Three solution components are suggested using focal points. The first focal point focuses on accelerating knowledge flow via strategy alignment. The second focal point focuses on accelerating knowledge flow via process improvement. The third focal point focuses on accelerating knowledge flow via cultural adjustment. Figure (9-6) below illustrated the solution blueprint.



**Figure 9-6: The solution components of the thesis blueprint**

### **9.3 AN EXAMPLE ON MAPPING THE SOLUTION BLUEPRINT TO THE SOLUTION FRAMEWORK**

The above solutions may be mapped to the solution framework to stand as a checkpoint that ensures that all ontological and epistemological dimensions were addressed. For example, on the external-internal system level, the proposed solution component (code [KTS-1-3-2/1]: Creating measurable value through knowledge communities) is suggested to accelerate knowledge flow from external knowers to internal seekers. This solution is suggested solve several validated barriers (see chapter 8) relating to research capabilities at host organisations. In the solution framework of table (9-3), the ontological solution dimension suggests involving the following internal entities in the KT solution space:

- (1) Researchers
- (2) Support staff
- (3) Research laboratories, testing sites
- (4) Inter-organisational documentation
- (5) Benchmarks

The epistemological synthesis solution suggested by the framework in table (9-3) involves the following epistemological interactions:

- (1) Tacit to tacit KT
- (2) Explicit to explicit KT
- (3) Explicit to tacit KT

Knowledge flow from external knowers to internal researchers needs to follow a process that increases its chances to be internalised by staff (Nonaka and Takeuchi, 1995). The knowledge of the knower may as per the solution space either tacit (people) or explicit (formal environment or infrastructure). External knowledge may be in the form of tacit knowledge possessed by individuals (i.e. the People element of the solution space), explicit knowledge possessed by formal correspondence from external sources (i.e. the formal environment element of the solution space) or external database and search technologies (i.e. the external infrastructure element of the solution space).

The high-level solution component suggested for a selected focal point may address the identified issues that resolve several barriers. The following guiding ideas may provide useful solution tracks.

- (1) Focus not only on knowledge products (ontological dimension) but also on knowledge processes (epistemological dimension). If internal researchers were to acquire one important element of knowledge, it should be the values, beliefs and psychological contracts external experts possess towards their organisations and fields of work. It is this tacit knowledge that could provide the platform for a successful transfer and conversion between tacit and explicit knowledge.

(2) Include success stories in the communication blend to transfer external experiences to internal researchers (i.e. the research activity) to increase diffusion (i.e. epistemological dimension). Business intelligence concepts could support this idea (i.e. the administrative and academic governance activity). Transforming the researchers psychological mindset from a governmental based job to a globally competitive job responsibility can ignite powerful creativity (i.e. epistemological dimension). Keeping the researchers up-to-date with success stories could help nurture this psychological effect.

(3) Establish community of practice (CoP) activities such as semi-annual conferences (i.e. ontological and epistemological dimensions) and offer incentives to external experts to join this community (i.e. environmental space). The community should be Saudi-based to gain control but it should involve at least 50% of members from overseas (i.e. ontological dimension). Each CoP should have a measurable value (i.e. standards and benchmarks solution space). The progress should be monitored every 6 months. Communities of Interest (CoI) could also be established with less intensive expertise. This provides social support to the CoP in their conferences (i.e. environmental space). This activity will also solve many standardisation issues because researchers will learn what is right and wrong in what they do (i.e. diffusion-ontological dimension). It will help them identify best practice. This activity should be supported by the state-of-the-art technologies to provide a system to engage and share ideas, concepts, checklists and tools to practice sharing knowledge within the CoP (i.e. infrastructure space). These systems do not come for low cost, however, host organisations should understand that these ideas are already implemented in many world-class organisations with proven its success (i.e. benchmarks solution space) (Nonaka and Takeuchi, 1995; Senge, 1990).

(4) Offer incentives to researchers to build their social capital using a reasonable percentage of external experts (i.e. people solution space). Social capital is a powerful motivator to joining a CoP (i.e. ontological dimension).

(5) Offer researchers a cost analysis report on the ROI for the organisation from the external-internal KT perspective (i.e. standards and benchmarks solution space). Although difficult to measure its value, there are clear indicators that can indicate the ROI from KT activities. These measures may include increased innovativeness, enhanced efficiency, improved productivity, increased profit, better decision making, faster

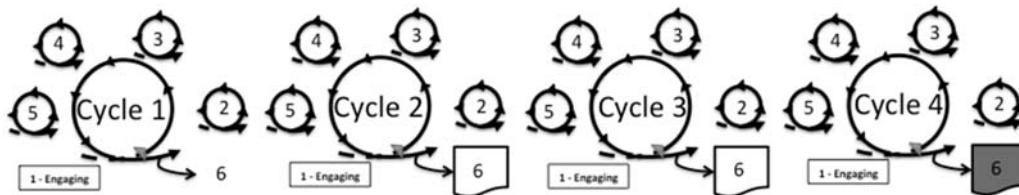


responsiveness, enhanced flexibility, improved quality, reduced duplication effort, greater employee empowerment and satisfaction, (Ernst and Young, 1997; KPMG, 1999).

In the above example, I have illustrated to the solution developer how to use the solution framework as a quality measure to validate any KT solutions. This framework ensures that the ‘big picture’ is considered. It acts as a checklist from an epistemological and ontological perspective, as well as from an activity and capability perspective. This is also placed in a defined solution space where these dimension interact to systemically solve the different parts of the puzzle holistically.

## 9.4 CYCLE 4 – PHASE 6: “REPORTING THE SOLUTION”

As figure (9-7) below illustrates, this section describes the sixth phase of AR cycle 4. In this phase, I will present the segment of the AR journey that explains how reporting took place in this particular cycle. I will also present the result outcomes that emerged from this activity.



**Figure 9-7: Cycle 4 – Phase 6: “Reporting the Solution.”**

The effect, by achieving economies of scope, is more beneficial for organisational performance than the effect of achieving economies of scale, which are generated when organisations are able to apply distinctive knowledge to the same sort of organisational operations repeatedly. KT activities require a focus and a clear intent. KM initiatives are costly because achieving the aims of an economy of scope is tedious and requires sustained efforts.

The summary presented in figure (9-8) below provides an overall ‘big picture’ to the initial KT strategy. The main three focal points are considered first-level strategies that may stand as the main body for many smaller strategies. These strategies should be developed in future research. In other words, this phase should emerge into an engaging phase for a new AR cycle (i.e. AR cycle 5) that the host organisations may carry out to continue their AR journey. The outcomes from AR cycle 4 should provide sufficient evidence to the need for further AR cycles.

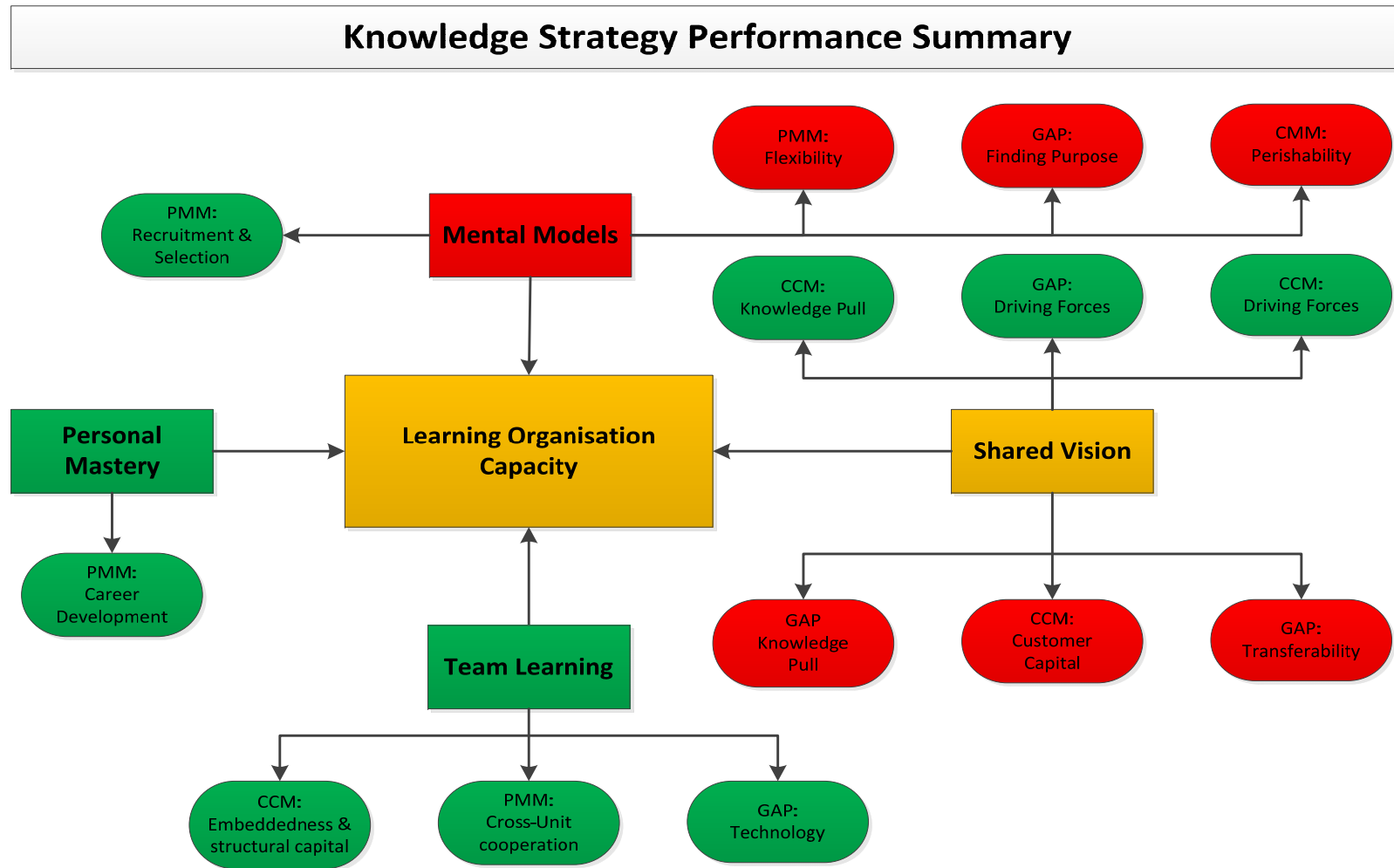


Figure 9-8: Initial KT strategy elements

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## 9.5 CONCLUSION

The conceptual solution framework of figure (9-8) may be perceived as a new solution universe or space to define the arena in which barriers are linked to appropriate *solution domains*. This chapter therefore is considered only a reflective starting point for formulating a holistic *solution system* that addresses every KT barrier in this thesis. As Nonaka and Takeuchi (1995) suggests that before new solution innovations are realised in their final form, they usually start from evocative thinking and are mostly created from ‘analogy’, ‘concepts’ and ‘models’. These outputs are then further developed into prototypes for testing. At the final stage, the innovation is released as a product for use. This chapter deals with Nonaka and Takeuchi’s first step for a solution innovation, that is, developing the ‘analogy’, ‘concept’ and ‘model’.

This phase of AR cycle 4 is profoundly essential in laying the foundation for the encapsulation of the KT phenomena challenges and producing a shared understanding on the characteristics of the issues that has been identified at the host organisations. In doing so, I fulfil the accountability of this study to appropriately provide: ‘clear goals’, ‘adequate preparation’, ‘appropriate methods’, ‘significant results’, ‘effective presentation’, and ‘reflective critique’ (Glassick *et al.*, 1997).

In the same way that Barachini (2009) asserts “It is important to note that parts of the presented results strongly depend on European culture and cannot be generalized as such” (p. 99), I also find that this section is highly contextual and culturally-dependent on Saudi Arabian idiosyncratic variables that bring many generalisation cautions. Having said that, this illustrates the value of this thesis to Saudi engineering research organisations as likely to be a unique study that may provide a high level guide to establish an industry level strategy for resolving the problems knowledge flows face within an engineering research context.

# CHAPTER 10: CONCLUSION

*“It is He Who made the sun a shining thing and the moon as a light and measured out its (their) stages, that you might know the number of years and the reckoning. Allah did not create this but in truth. He explains the Ayat (proofs, evidences, verses, lessons, signs, revelations) in detail for people who have knowledge.”*

*Surah Yunus (Jonah), The Noble Quran*

## 10.1 INTRODUCTION

As I started this thesis with defining what knowledge is, I will end it with another attempt. Knowledge always needs to be anchored to truth. Like measuring time, the anchor is the sun and the moon. Without them being true, time can neither be true nor measured. In this 5-year journey, many claims have been made as true. The truthfulness of the findings was anchored by the powerful quotes that indicated the existence of numerous KT capability gaps. As the three Saudi engineering organisations accepted to host this study and engage in an AR examination of their internal and external knowledge flows, they have allowed highly strategic governmental bodies in Saudi Arabia to be vulnerable to ‘outsiders’. This indicated a commitment to change and to finding truth.

This study is characterised with deep involvement of organisational members in each research cycle for the purpose of changing their unsatisfactory knowledge capabilities. US experts and researchers from the local industry in Saudi Arabia were invited to provide their perceptions about knowledge flows to and from the case-study organisations.

The main objectives for this thesis were to examine the knowledge flows within hosting organisations, between host organisations and external (overseas) experts and between host organisations and domestic (local) industries. These objectives were grounded in the

motive for the case study organisations participating in the study. Saudi Arabia wants to decrease its dependence on external experts and build local capability. As the world moves towards becoming a global knowledge economy, Saudi Arabia wants to take its place and to compete on the global stage. In order to achieve these national goals, its leading research institutes must grow their capability and manage their knowledge resources against best practice. In negotiating participation in this study, I gained acceptance from the research institutes that KT was a problem. My supervisor and I began this learning journey assuming that improving KT between external experts and local Saudi staff would result in positive outcomes e.g. increased local capability. The study grew from these humble beginnings to include internal-to-internal KT, as well as internal-to-external KT. I found that transforming the research institutes to become learning organisations to help put Saudi Arabia on the global knowledge economy stage was a multi-faceted problem.

During these examination processes, three AR cycles were undertaken (see chapter 5, 6 and 7). They revealed diverse barriers as compared to best practice benchmarks. The undertaking of rectifying those problematic issues legitimised a separate study in its own right. AR cycle 4 (see chapter 8 and 9) was conducted to start a new wave of AR cycles that will generate micro-level solutions for the barriers identified in AR cycle 1, 2 and 3. AR cycle 4 provided a high-level KT strategy to kick-start the solution cycles expected to be carried out by the host organisations themselves.

By examining and resolving the above issues, KT is strategically sought to help the Saudi economy prosper in building engineering and technological capabilities, thus reducing its dependence on foreign expertise and providing ‘in house’ research innovation to the local industry. This mission of addressing a nation-wide phenomenon was impossible to be accomplished in one PhD; however, it may be argued that this thesis is one step forward in the right direction. Building the capability of the three host organisations may be a good starting point to establish the platform for engineering research in Saudi Arabia to diffuse knowledge that it plans to transfer from overseas institutions. This KT mechanism was explained in the integration model proposed in chapter 3.

The selected host organisations already have established relationships with overseas research organisations through alliances, transaction-based collaborations, university

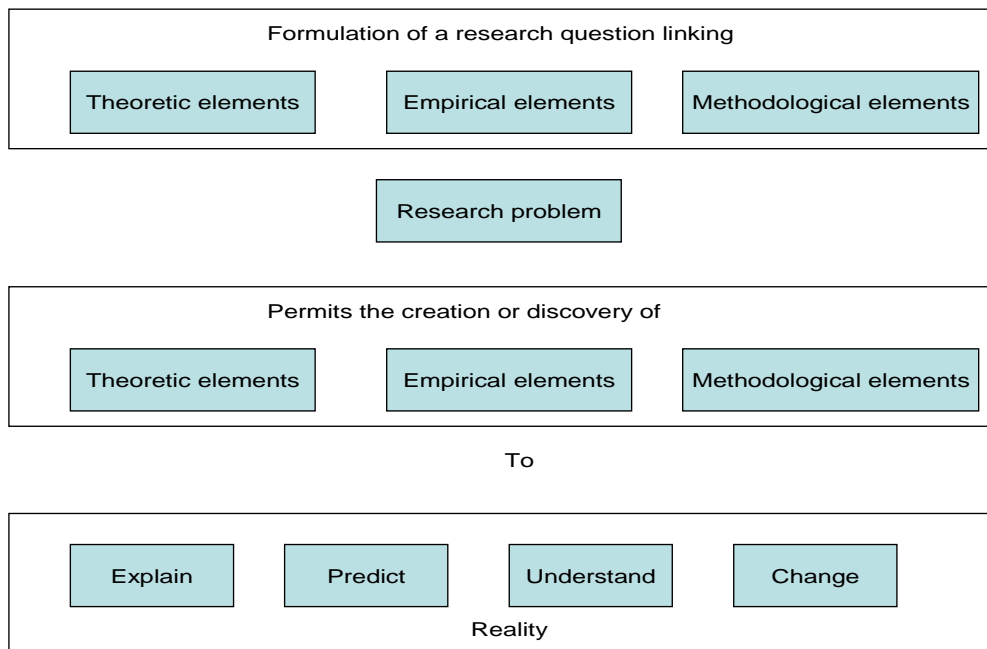
exchange programs and transactional expert visits to conduct ‘in house’ research projects. Such engagement with the outside world may position the host organisations as knowledge conduits for the Saudi engineering knowledge base. The interaction between local industries and overseas experts is complex and host organisations represent, in my view, the most appropriate mediating system to connect the local industry to the world.

However, the initiation of inter-firm KT in engineering research relationships may be difficult because of (1) the limited *willingness* of the expert partner (i.e. the knower) to disclose knowledge, (2) the limited *ability* of the novice partner (i.e. the seeker) to acquire and assimilate knowledge. This thesis was conducted on the assumption that the willingness of the expert was reasonably attained. Therefore, the thesis focused on the latter difficulty.

The rationale for assuming the first difficulty was resolved for simplification purposes to reduce the number of variables that construct the problem function. This first issue was difficult to include because it would involve many political variables that are beyond the scope of the KM field of study. It also includes inner-governmental issues that may divert the study into unknown territories beyond the scope of KM and Management Science. In addition, as the willingness of external variables was beyond the power of internal staff, this assumption was made so that the host organisations make real-life change by focusing on what was in their own boundaries (i.e. altering the variables they control). In other words, this thesis adopts, in some way, the RBV of the firm where the focus is on building internal capabilities rather than focusing on external environmental factors to reach the aspired competitive advantage. In this way, the thesis lays a foundation for contributing to our understanding of KT as a KM capability, and then how this capability can improve performance, which fits nicely with extending the RBV and KBV theories of the firm.

## 10.2 SUMMARY OF THE CONTRIBUTIONS OF THIS THESIS

The outcomes from this research study were on multiple levels. In addition to the significant contribution it made to way of thinking of AR participants and the host organisations in Saudi Arabia, it also provided useful contributions to the existing body of knowledge. I was guided by the following framework in figure (10-1) to ensure that the contributions of this study are of high value at three distinct measures. This framework explains how contributions to theory, methodology, and practical/empirical elements were framed as achievements to this thesis.



**Figure 10-1: The process of planning my contribution to the body of knowledge**

By building on the theory, methodology and empirical work provided by previous researchers in the literature, I was able design and implement the field study to engage in action learning and collect valuable data to begin my contributions to the body of knowledge. In this process of discovery of new theoretical, empirical and methodological elements, I was able to explain, predict, understand and ultimately change the reality of the host organisations. As new knowledge requires originality of thought, I was able to source originality by engaging with the power of the quotes that were grounded in the



data. I have presented many quotes in earlier chapters and more are organised in Appendix E. It is my AR engagement with the words of the insiders that sparked new insights and allowed a deeper understanding to the phenomena being studied. Following Phillips and Pugh (2000) who identified 15 definitions of originality, I present my contributions on the theoretical, methodological and substantive levels.

(1) Theoretical Contribution: The main theoretical contribution was to further our understanding of knowledge flows as an organisational process from a systems perspective. More specifically, I extended the theoretical foundations of (a) inter-organisational and intra-organisational knowledge flows by suggesting the three KT systems (external-to-internal KT, internal-to-internal KT and internal-to-external KT); (b) grounding KT within activity by suggesting the five activities that require KT capabilities (administrative activities, academic governance activities, research activities, teaching activities and community engagement activities) using RBV and KBV theory to identify how knowledge is applied and, therefore, how KT creates value, which developed further the idea that knowledge creates value through use and that knowledge flow is a dynamic activity that allows us to see how it flows, how it is used and how it creates value; and (c) the barriers architecture by suggesting a five layer model (knowledge characteristics level, individual level, organisational level, national level and international level). These three theoretical models were presented in chapters 6 and 7 in figures (6-7) and (7-5).

There were also various theoretical contributions in chapter 7 to link the data with the literature to confirm, extend or add to existing theories. In the case of confirming an existing theory, then this thesis would have provided empirical evidence to theory; by supporting earlier research within the new context of KT within Saudi Arabian research institutes. In the case of extending an existing theory then this thesis would have provided empirical evidence to identify new variables to existing theories. While in the case of adding new perspectives to theory, this thesis would have offered a new theory related to a specific construct as presented in chapter 7.

I have also provided theoretical contributions in relation to strategy development in chapters 5 (the knowledge strategy) and chapter 9 (the initial KT strategy). In chapter 5, I have adapted the use of the LOC model to develop a knowledge strategy theoretical base line to establish the position of the study. This was useful to develop the theoretical

perspective to designing the initial KT strategy solution space that integrated the complete theoretical content of this thesis into figure (9-4). This KT strategy model is a significant theoretical contribution to standardise the way a KT strategy should be designed. This was complemented with a theoretical framework that links the KT strategy model with the epistemology and ontology dimensions while linked to the five KT activities. This framework was presented in the three tables (9-1), (9-2) and (9-3). The theoretical contribution of this thesis is therefore distributed over the various chapters of this thesis from chapter 5 to chapter 9.

(2) Methodological contribution: The main methodological contribution in this thesis is the further development of AR as a methodology for examining knowledge flows (e.g. see 2008 reference). This contribution is no 13 in Phillips and Pugh's (2000) list, 'being cross-disciplinary and using different methodologies'. While AR is a well-accepted methodology, it has had limited application in large empirical investigations of KT on the scale of this thesis. The consistency the AR approach brought this qualitative examination of knowledge flows to follow 4 AR cycles that each consisted of 6 phases. The contribution of methodology here is how the KM concept was integrated with the AR methodology to bring about the 4 themes for the AR cycles (i.e. the knowledge strategy, the KT processes, the KT barriers and the initial KT strategy). By fitting each theme consistently within a 6-phase AR cycle, this thesis has demonstrated a methodological advancement in helping AR studies in KM to bridge the gap of replication capability. This thesis, based on the set methodology, can provide a clear guide for empirically replicating its approach. This is why I have consistently insisted to include some details about phase of every AR cycle. It was to contribute to the body of knowledge from a methodological level.

Although these contributions were sourced from previous action researchers such as Checkland and Holwell (1998), Greenwood and Levin (1998) and Emery and Purser (1996), the way their methodologies were used in a KT context for the three different organisations and using different research techniques in each cycle was unique in this study. This adaptation process was also combined with management science thinking by including vertical and horizontal engagements among organisational members as a methodological process. This was described in figures (3-9) and (4-4). The integration model of figure (3-10) was used to implement the key elements of my version of the AR

cycle approach described in figure (4-6). In this way, it was possible to incorporate proven validity measures such as triangulation within the AR methodology. In AR cycle 1, an online survey was used. In AR cycle 2 and 3 face-to-face interviews were used. In AR cycle 4 a focus group approach was used. All approaches aggregated within the AR methodology adapted for the KT context to produce reliable and transparent reflections that emerged into an initial KT strategy. The AR cycles also created momentum and change in the learning journey of all participants, including myself.

(3) Substantive contribution: The main substantive contribution of this thesis on the practical level was to develop an initial KT strategy of desirable organisational culture for Saudi engineering research organisations. This contribution is no 9 in Phillips and Pugh's (2000) list, 'using already known information but with a new interpretation'. While the AR cycles 1, 2 and 3 have provided enormous amount of information about the low LOC indicators, KT processes waste points, and KT barriers, there was still the substantive task of synthesising a solution in the form of a KT strategy to solve those issues identified. This was an exercise in theory development rather than theory testing.

The initial KT strategy in chapter 9 provided an initial blueprint solution for the Saudi engineering research organisations to consider for further development and future implementation. Through this KT strategy, the Saudi engineering research organisation should become closer to the aspired learning organisation. They should also be more amenable to cultural adjustments. Substantive means practical and this is why the initial KT strategy took a long path by first understanding the practical angle of how KT occurs and its barriers within the Saudi organisations to enable a truly practical guide in which its theory is grounded and sourced from data. The key findings that can help develop LOC, unlock the waste points, and address the barriers at host organisations were presented in chapter 9 in three focal points that comprised further disaggregated KT strategies for each focal point:

- (1) Focal point 1: accelerating knowledge flow through strategy alignment.
- (2) Focal point 2: accelerating knowledge flow through process improvement.
- (3) Focal point 3: accelerating knowledge flow through cultural adjustment.

The initial KT strategy presented in this thesis therefore provided from a substantive dimension the main focal points and a first-level KT strategy set. These strategies provide a practical guide for further disaggregation into implementation steps, which would then allow for testing for empirical generalisation. Although the findings are yet not generalisable, they may stand as an initial empirical starting point in which future studies may test, confirm, extend or alter.

### **10.3 SUMMARY OF THE FINDINGS IN THIS THESIS**

This thesis has answered various types of questions related to the KT phenomena at the host organisations. In the following sections, the thesis provides evidence to addressing the what, where, why, and how aspects of the KT phenomena:

#### **10.3.1 WHAT IS THE MAIN ISSUE IN THE SITUATION OF THIS THESIS?**

This thesis advocates that the best way to understand a phenomenon is to try to change it. Therefore, the main issue of the current situation seems to be a heavy dependence on external experts while being passive towards the local industry. In addition, synthesizing internal knowledge among organisational members appears to be misguided and far from effective. At this stage, the main issue revealed a strategy fault. The issue is about host organisations not having the learning capabilities to produce engineering research innovation. The host organisations were assessed in terms of their learning capabilities using the LOC test and were found less competitive than their best practice counterparts, especially in the following aspects:

- (1) Flexibility
- (2) Finding purpose
- (3) Perishability
- (4) Transferability
- (5) Customer capital
- (6) Knowledge-pull

Details on the above are presented in AR cycle 1 in chapter 5. The higher-level issues emerged from lack of organisational direction, shared mental models, research focus and commitment. The main finding was that a change in the way host organisations learn and build capability was necessary to fill the gap in the performance of the identified knowledge strategy. The approach was to examine a specific KM strategy, which was KT. However, KT requires in-depth examination of knowledge flows between staff and with the outside environments. By adopting KT as a practical approach to lift the

capability of each host organisation from being a less learning organisation to become a more competitive learning organisation, the main issue was crystallising and better understanding how knowledge flows occur at Saudi research organisations. The issue was clear enough to draw attention to begin searching for where exactly does KT take place within the core processes of the businesses involved. This is discussed in the next section.

### **10.3.2 WHERE ARE THE MAIN ISSUES LOCATED IN THE SITUATION OF THIS THESIS?**

The main issues, after identifying the knowledge strategy faults, lie in core business processes that manage knowledge flows at the host organisations. Knowledge itself cannot be managed; rather, it is the carriers of knowledge that can be managed (i.e. business processes). Knowledge flows within existing business processes and through the design and operation of those processes can flow efficiently or otherwise. When knowledge processes are inefficient (slow) and ineffective (poor quality output), the business processes require re-engineering. The processes that were identified with high negative impact on KT were:

- (1) Evaluating the suitability of internal experts for external research collaborations
- (2) Sending researchers overseas to learn
- (3) Facilitating internal knowledge exchange
- (4) Designing and delivering teaching content for research students
- (5) Measuring of research activity with the local industry

In AR cycle 2 (see chapter 6), 60 core business processes were identified to represent KT conduits. These processes contained diverse inefficiencies and waste points (see Appendix C). The locations of these inefficiencies were likely to resemble impedance points to knowledge flows. In other words, KT may flow faster if these inefficiencies were eliminated or when the processes as a whole are improved. In some situations, important business processes to support knowledge flow were not found. In this case, there were missing processes that needed to be instituted to allow the acceleration of knowledge flow.

The process of BPR meant establishing new processes, but this step required new policies and decisions from the top management. However, these policies were never instituted either because they were never approved or because they were never discovered as necessary for being instituted. This thesis helped illuminate the size and number of waste points in each process to support the decision making process in Saudi engineering research organisations. Whether the issue was an inefficient or absent business process, it was essential before altering any process to first examine why the business processes were behaving in that way. To understand why those issues occur across so many core processes, the next section of further research provides details.

### **10.3.3 WHY ARE THERE SUCH ISSUES AT THOSE LOCATIONS WITHIN THESE PROCESSES?**

When business processes suffer inefficiencies in multiple ways, the knowledge flow becomes ineffective (i.e. low knowledge output quality). This impacts the operators of those processes and affects their motivation, commitment and loyalty to the core business. Over extended periods of time, such demotivation becomes deeper ingrained in the beliefs of people to the extent that it becomes a cultural norm, where people are not committed and demotivated to serve the goals of the organisation. This thesis identified 269 reasons (see Appendix E), however, the following reasons are considered primary reasons for inefficiencies found in business processes at Saudi engineering research organisations:

- (1) Lack of peer trust and respect
- (2) Tendency of superiors towards increased unjustified control over subordinates
- (3) Lack of discipline and accountability

In many occasions, it was found that there was some sort of reciprocal ecology between inefficiencies and the reasons for those inefficiencies. For example, some processes suffer long bureaucratic approval durations, which were due to excessive control and the low trust that superiors feel towards their subordinates. This trust, however, was due to low performance of staff and lack of staff accountability to make responsible decisions. Yet, this occurred because staff lost their belief in the processes that they operated in the first instance, which then developed the norm of being irresponsible or uncommitted. The

‘why’ question, therefore, seems to follow a spiral function rather than a linear function. The cause-effect interaction is relevant to this discussion because the findings suggest some sort of complexity in which each cause is actually an effect to another cause that might be traced back in a spiral motion.

The underlying reasons suggested a link to organisational culture that accepted the existence of a delay window to material delivery, for example. The problem was rooted back to the mental models of how service quality is perceived. No matter how the process was improved, the problem would not be eliminated without addressing cultural norms and personal beliefs of people involved. This is why chapter 7 is crucial to effectively address and complement the findings of chapter 6 to change the theory in which people at Saudi engineering research organisations use to operate their minds and actions. Further contemplations were exerted to these findings to contribute to the theoretical development, extension or confirmation of existing theories.

Each knowledge barrier affected business processes in multiple locations across one or more business process. The reason for their existence in specific locations in different business processes was mysterious in some instances and required further examination. Therefore, it was quite difficult to map the inefficiency process locations with the knowledge barriers identified in chapter 7, which an area that could be considered for future research. A further level of enquiry might be to question the reasons that lead to those barriers to exist in the first place (i.e. triple-loop learning). It was sufficient for the course of this study to uncover the reasons behind process inefficiencies because the objective was to reveal an initial KT strategy rather than further diagnostics. The AR approach helped elicit the knowledge barriers by qualitatively examining the work environment and understanding how people felt about their work and how did they carry their business.

These knowledge blockages showed why knowledge slows down at specific process locations (or nodes). Nonetheless, AR cycle 4 (see chapter 9) showed that addressing a single knowledge barrier might eliminate multiple knowledge flow inefficiencies. This is because for the same reason mentioned earlier, knowledge barriers in chapter 7 are underlying reasons (i.e. deeper problems) to the process inefficiencies identified in chapter 6. The next step was to identify an initial response to those barriers as a strategy.



### 10.3.4 HOW CAN WE DEAL WITH IDENTIFIED ISSUES?

After thoroughly examining the knowledge flows at host organisations and discovering their diverse underlying issues, the outcome of this study shows that knowing the problem does not by default reveal the solution. The solution seems to be ingrained in a multifaceted fashion to different dimensions of the organisation and its members, which makes designing the solution perhaps as complicated as examining the phenomena. Therefore, only an initial KT strategy was suggested, which required further disaggregation and testing. The initial KT strategy that was suggested in this thesis comprised of the following elements:

- (1) Strategy alignment
- (2) Process improvement
- (3) Cultural adjustment

Knowledge transfer seems to provide almost no value for short-term returns; rather, it is likely to be situated for long-term value creation through the LO model. For the long-term value to reveal, best practices need to be sustained across all organisational levels. Without a *sustainable long-term commitment*, KT is likely to fail in providing considerable value to the organisation. Barriers would return quickly and inefficiencies would reoccur as it did before or even more in magnitude. The analogy of losing weight is helpful here. If the target of the individual was to quickly lose weight and once that target was achieved, the commitment level reduces, then the lost weight would quickly be gained back. There would be no value from taking the trouble to follow a weight loss program. In order to make value from losing weight, one must change the lifestyle itself so that health is sustained. It is a fundamental shift in thinking where beliefs, values and daily practices blend to maintain a healthy living.

Similarly, for KT to have real value to the organisation, the lifestyle of the organisation, department and individual must change to sustain a healthy, effective and value-creating organisation. The solution is thus to focus on sustainable behaviours that are usually uneasy to adapt. This thesis examined KT issues and provided a KT strategy; however, it is those involved who need to embrace the concept of sustainable change. This is the challenging and most questionable part of the journey, which has yet to be uncovered. Future work should pursue this challenge and reveal its unanswered questions.

## **10.4 LIMITATIONS**

Other means to improve LOC include knowledge creation, usage, storage, retention and retrieval among others. The focus in this thesis was only on knowledge transfer. The other KM elements require further research that are out of the scope of this thesis and represent a limitation to this study since raising the capability of Saudi engineering research organisations will require at different points in time all KM elements.

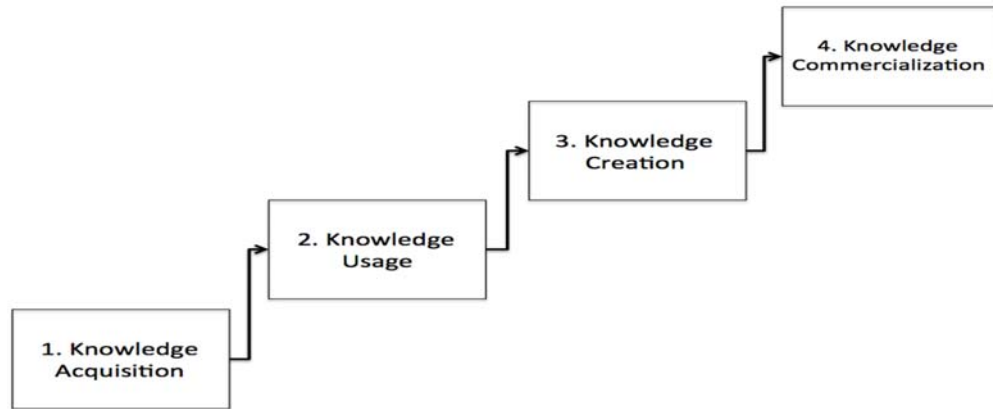
Another limitation to this research study is the absence of knowledge measurement. The literature suggests that changes in knowledge capital significantly influence organisations' future (Watkins and Callahan, 1998). However, I find an ambiguity factor on how to articulate those changes in knowledge capital, let alone how can knowledge capital be measured within and across organisations. The focus to the context of this thesis was more appropriate to be exerted on the flow dynamics of knowledge to measure performance rather than on a value snapshot to measure knowledge stocks. Although knowledge measurement is useful in creating benchmarked knowledge strategies, it does uncover underlying phenomena that could lead to the causes of possible knowledge process bottlenecks. For this reason, knowledge measurement was excluded from this thesis.

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## 10.5 FUTURE WORK

In order to facilitate a complete solution system that meets the objectives of this study, it was required to understand the knowledge strategy performance gap, identify processes responsible for knowledge flow waste and determine underlying reasons for the existence of knowledge flow waste. This solution can thereby be realised by aligning strategy with knowledge flows, re-designing knowledge processes that flow within –embedded in- core business processes and address knowledge bottlenecks so that valuable knowledge reaches who need it at the time they need it. A major part of the above steps were completed in this thesis, however, there is still work to do. The knowledge processes, when aligned with strategy, efficiency and effective behaviour represent the KT strategy. The KT strategy presented in this thesis however established the theoretical platform for testing and produced high-level strategies but requires further development as it should be disaggregated into smaller tasks downwards as well as it should be part of a bigger system upwards where other KM strategies are integrated to form the knowledge strategy.

In this way, KT adds more substance and detail but also climbs the ladder of integration with other KM strategies to fit into the ‘bigger picture’ in terms of how knowledge is transferred, created, used, stored and measured. This future development may provide Saudi engineering research organisations with a comprehensive framework that makes full use of the KM field of study. However, this thesis has provided a significant contribution by allowing a cause and effect understanding of the what and why aspects of the KT phenomena at the Saudi organisations, which allowed to avoid the confusion of the status quo and begin to find meaning and purpose in their efforts to produce higher capabilities and create high quality engineering research. The future knowledge strategy should evolve in the way illustrated in figure (10-2). As the figure below shows, this study has advanced the knowledge acquisition stage in the KM ladder and should, once the KT strategy is completed and tested, commence on the next stages of knowledge usage, creation and commercialisation. Nonetheless, knowledge processes are usually iterative and require consistent reinforcement as explained numerously in the previous chapters.



**Figure (10-2): Future work needed for Saudi engineering research organisations**

The common factor between the above stages is continuous learning. Learning and acting upon new experience at Saudi research organisations should be continuous after this research is complete. As this thesis has reached an end by completing AR cycle 4, AR cycle 5 perhaps could be the future cycle to act as a pilot for the outcomes of AR cycle 4. Each cycle must build on its predecessor, whereby outcomes of each cycle inform the next. In this way, past experience makes value to the present and the present makes value to the future of the organisation. Discontinuation of this cyclic process may lead eventually to failure. The beginning of failure takes place when the direction is lost and people fall in the trap of re-inventing the wheel. However, if future work is carried out in the way described above, Saudi engineering research organisations will reach success.

Finally, the level of animosity towards the findings of this thesis (e.g. see chapter 8) is an unresolved issue. Based on the early discussion of knowledge, the findings stand as justified true belief. However, it is difficult to decide who is the final authority to say this is true. The unresolved tension is that when I sought validation of the findings from management (e.g. chapter 8), they didn't give it to me. Their rejection was due to taking my findings as criticism of them, their institutes and Saudi research itself. The tension becomes to identify who is right, staff or management. It is not easy to decide who has the right to say this is justified true belief. The management misunderstood that only one capability, KT, was examined. I believe there is much positive strength in Saudi organisations but my focus was on KT. They did not understand KT. They misinterpreted it. This is where shared mental models must begin. This is where the solution -or AR cycle 5 begins (i.e. getting shared mental models about KT, and shared vision about KM).

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# APPENDIX (A)

## PART 1: DEMOGRAPHICS ON LOC SURVEY PARTICIPANTS

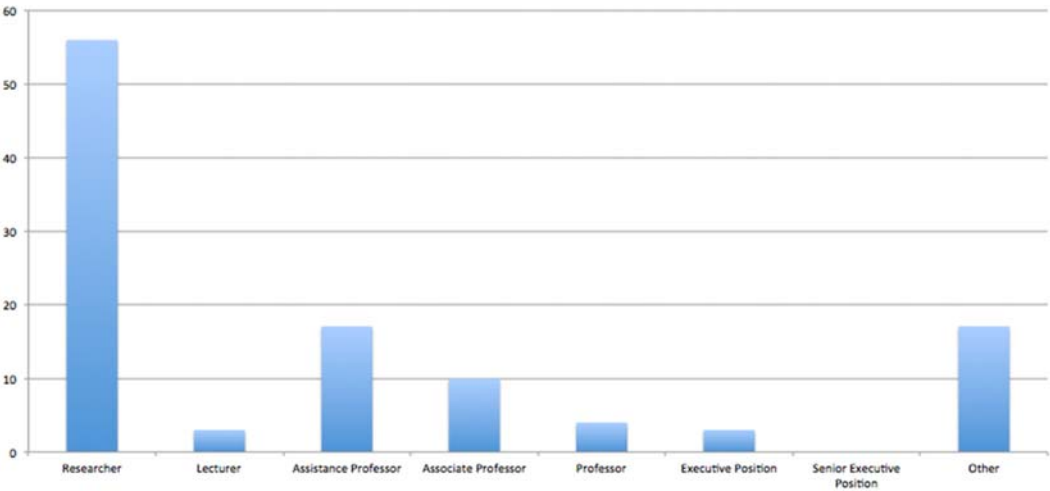


Figure 1: Count of positions

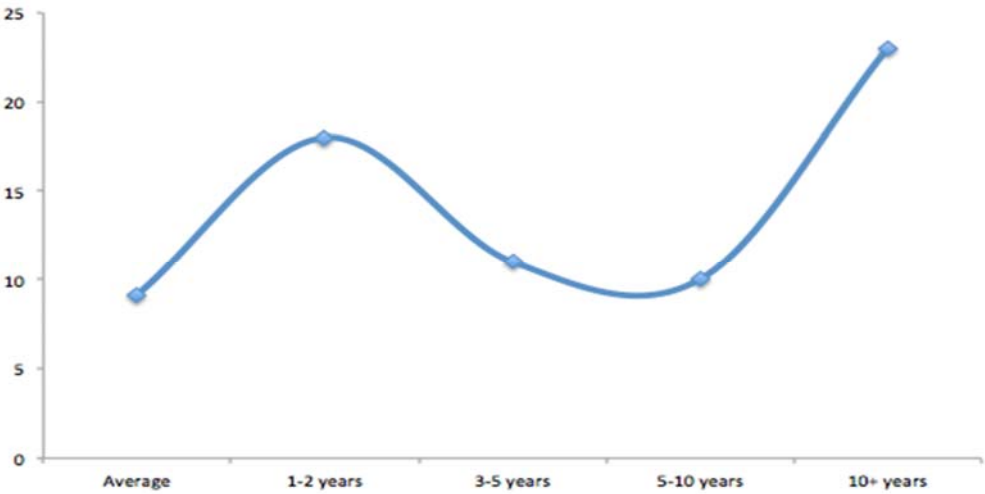
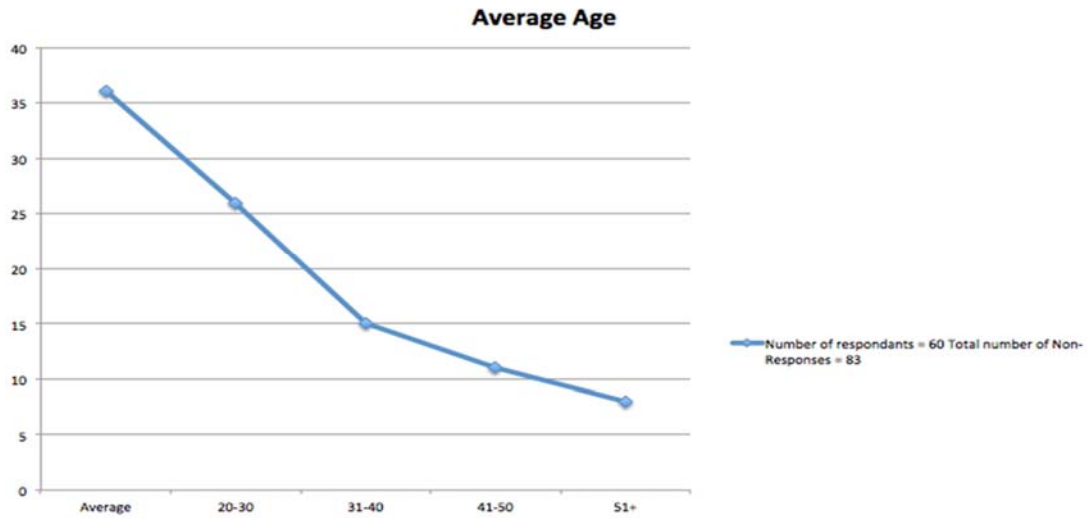
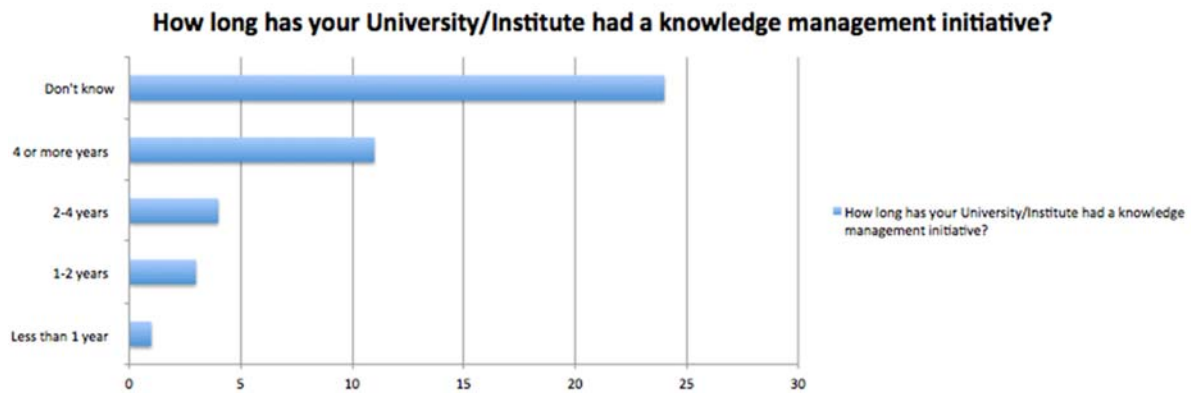


Figure 2: Average employment as a researcher since graduating from first degree



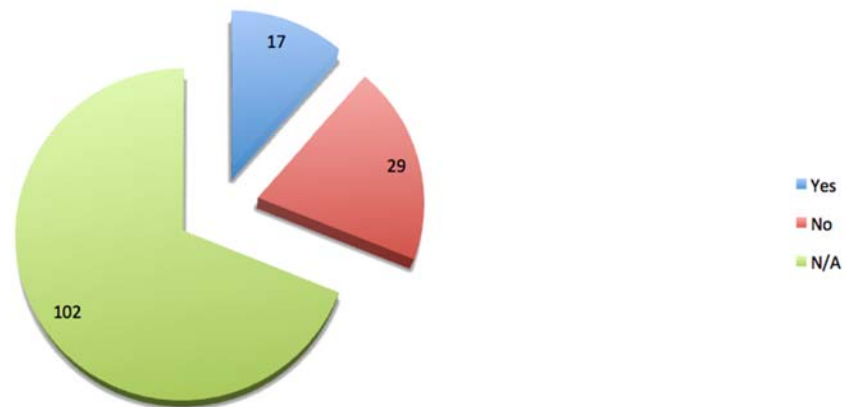
**Figure 3: Average age of respondents**



**Figure 4: Average duration of KM programs at case-study organisations**

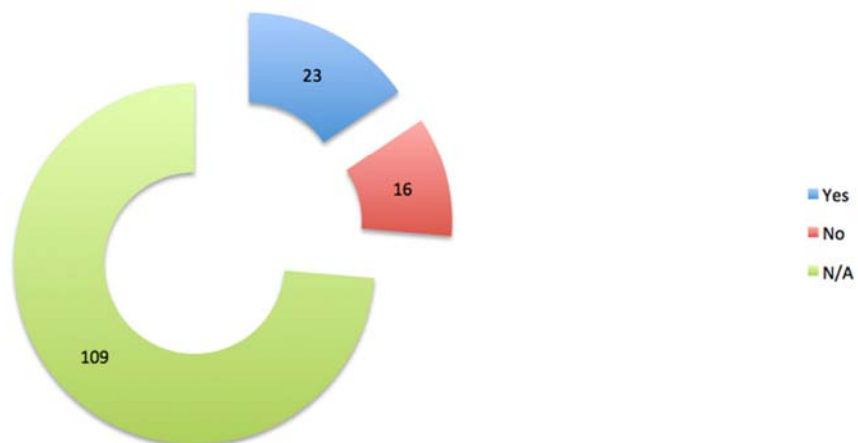


**Are you aware that your University/Research Institute has ever measured the value of its knowledge resources in the past?**



**Figure 5: Perception of knowledge measurement at case-study organisations**

**Does your Institute overall strategic goals include knowledge management explicitly?**



**Figure 6: Inclusion of KM in overall strategy at case-study organisations**

## **APPENDIX (B)**

### **AR CYCLE 2 INSTRUMENT (INTERVIEW QUESTIONS)**

**KNOWLEDGE TRANSFER STUDY  
EXPLORING KT PROCESSES AT CASE-STUDY ORGANISATIONS AS  
PART OF AR CYCLE 2**

**CONSENT FORM FOR PARTICIPANT**

THIS CONSENT FORM WILL BE HELD FOR A PERIOD OF 5 YEARS

Title: Engineering knowledge transfer: A proposed system for Saudi research institutions

Researcher: Moshary Al-Holaibi

- I have been given and have understood an explanation of this research project. I have had an opportunity to ask questions and have them answered.
- I understand that I may withdraw myself or any information traceable to me at any time up to one month from the date of the interview without giving a reason.
- I agree to be interviewed for the purposes of this research.
- I agree that the interview will be audio taped, and understand that, I may choose to have the recorder turned off at any time.
- I understand that if I have agreed to be interviewed, I may request to view and amend the transcripts of the interview.
- I understand that if I have agreed to be interviewed, a transcriptionist will hear the tapes. I understand that the transcriptionist will sign a confidentiality agreement ensuring the confidentiality of my information.

Signed: Signed by the participant (hard copy available)

Name:

Email:

(Please print clearly)

Date:

APPROVED BY THE RESEARCH SUPERVISOR

..... ON .....

*Remark: This interview follows a semi-structured design. The questions have been set having in mind flexibility to move horizontally or vertically during the interview, which is dependent on the respondent answers and the researchers' assessment during the interview. The transcription represents answers to each pre-set question – from the design stage- and follows it with what actually was said between the researcher and the interviewee during the interview in relation to the pre-set question.*

### Section 1: Respondent Details (Demographics)

1. Name:
  2. Qualifications (Knowledge):
  3. What is your main area of expertise?
  4. How long have you been employed as a MANAGER/DIRECTOR?
  5. How long have you been employed at your current University/Research organisation?
- 

### Section 2: Activity

This section asks you about the type of work you do. Which of the following activities do you feel you perform at your University/Research Institute?

6. How important do you feel this activity is to you in meeting your expectations of your current role at the University/Research Institute? Please rate each activity on a scale of 1 to 10 where 1 = not at all important and 10 = extremely important.
7. Please rank the activities that you perform in order of overall importance to you in doing your role from 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup> etc until you no longer wish to rank the activity.
8. How unique do you feel this activity is to your University/Research Institute? By unique we mean how much do you feel this activity is *performed differently* to the way it is performed at other Universities/Research Institutes. Please use the following scale.

1 = Exactly the same as done at other Universities/Research Institutes

2 = Much the same as done at other Universities/Research Institutes

3 = Some difference with what is done at other Universities/Research Institutes

4 = Different to what is done at other Universities/Research Institutes

5 = Very different to what is done at other Universities/Research Institutes

Activity	Q11 Work Performed (Tick)	Q12 Importance Rating	Q13 Importance Ranking	Q14 Uniqueness
<i>Teaching</i>				
Preparation (e.g. reading, preparing lecture notes etc)				
In class (lecturing/tutoring)				
Student consultation/meetings				
Marking				
Administration (entering marks etc)				
Program/Subject Coordination				
Other teaching not mentioned				
<i>Research</i>				
Literature review/reading				
Designing projects (finding ideas)				
Writing grant applications				
Managing successful grant projects				
Conducting laboratory experiments				
Patenting results of research				
Commercialising patents				
Liaising with academics from other <u>internal</u>				

research institutes/within your University				
Liaising with industry (partners)				
Liaising with academics from other domestic universities ( <u>external</u> )				
Liaising with academics from overseas universities ( <u>external</u> )				
Designing questionnaires/survey instruments				
Data analysis/reporting				
Writing (conference papers/journal articles)				
Revision (revise and resubmit papers)				
Commercial research (i.e. research partnership with external partners for a fee/grant) (you work <i>with</i> them)				
Consulting (i.e. research for external partners for a fee/grant) (you work <i>for</i> them)				
Other Research not mentioned above (specify)				
Administration/Corporate Governance				
Attending Meetings				
Program/Subject Development				
Other Admin				
Community Service				
Journal/Dissertation reviewer				
Volunteer work with industry				
Volunteer work with community				
Other Community work				

### Section 3: Knowledge Flow

This section asks you about the way knowledge flow internally and externally at your organisation.

Please note: by knowledge transfer I mean that knowledge is exchanged, i.e. you send knowledge to another individual or group, or they send it to you (you receive knowledge).

9. When you consider the type of knowledge transfer *you personally* are involved with at work is it: (could be multiple response)
  - a. Internal transfer, i.e. between you and your colleagues?
  - b. A research collaboration between you and a knowledge provider? (no money is exchanged)
  - c. A research collaboration between you and a knowledge user (e.g. Saudi engineering firm)?
  - d. A commercial transaction, i.e. money is exchanged in return for knowledge?
10. If more than one, ask respondent to rank them in order of frequency using this table. Which of these do you do most frequently, which next, and so on.
  - a. Internal transfer, i.e. between you and your colleagues?
  - b. A research collaboration between you and a knowledge provider? (no money is exchanged)

- c. A research collaboration between you and a knowledge user (e.g. Saudi engineering firm)?
- d. A commercial transaction, i.e. money is exchanged in return for knowledge?

Type of knowledge transfer	Involved (yes/no) Q15	Rank (1 <sup>st</sup> , 2 <sup>nd</sup> etc) Q16
Internal transfer, i.e. between you and your colleagues?		
A research collaboration between you and a knowledge provider? (no money is exchanged)		
A research collaboration between you and a knowledge user?		
A commercial transaction, i.e. money is exchanged in return for knowledge?		

I would now like to ask you some more questions about the type of knowledge transfer you are personally involved or two of the types of knowledge transfer you are involved with. Select main area from 15 or 16 above, e.g. internal transfer, then ask:

17. Does this mainly involve:
- a. you and one other person
  - b. you and other people (by that we mean working with multiple others but one on one)
  - c. you and a group of people
  - d. your group and another group of people

18. Can you describe a situation where you were involved in knowledge transfer?

Now I'd like to explore this in more detail.

- 1. When did you recognise the need for knowledge transfer?
- 19. How was this knowledge transferred to you?
- 20. How did you use this knowledge?
- 21. How do you know the knowledge you gained works?

#### *Knowledge Search Cycle Questions*

22. Let us reconsider some of the more important activities that you do at work.

(go back to the list from q13. List the top 3 most important activities and ask these questions). If you need information on how to do something associated with this activity, where is the best place to get that information?

23. If more than one source, please rank them in order of importance.

Activity (list top 3 from Q13)	Main source Q23 (tick)	Rank (1 <sup>st</sup> , 2 <sup>nd</sup> etc) Q24
Activity 1		
Policies, procedures or other written down information found		

on the institute's web-site or other codified source		
Internal Expert (other staff member)		
External expert		
Just learn by doing it yourself		
Activity 2		
Policies, procedures or other written down information found on the institute's web-site or other codified source		
Internal Expert (other staff member)		
External expert		
Just learn by doing it yourself		
Activity 3		
Policies, procedures or other written down information found on the institute's web-site or other codified source		
Internal Expert (other staff member)		
External expert		
Just learn by doing it yourself		

#### Section 4: Barriers/Problems

This section asks you about problems associated with knowledge flows internally and externally at your organisation.

##### *Organisational Issues*

##### **INTERNAL**

25. Do you feel the *organisational culture* encourages knowledge transfer between staff at your research institute? (Note: by culture we mean the behaviours and attitudes of staff, e.g. the normal way we do things around here)

- |            |   |
|------------|---|
| Yes        | 1 |
| No         | 2 |
| No comment | 3 |

26. Why do you feel that way?

##### **EXTERNAL**

27. Do you feel the *organisational culture* encourages knowledge transfer between staff at your research institute and external experts (i.e. people outside your organisation)? (Note: by culture we mean the behaviours and attitudes of staff, e.g. the normal way we do things around here)

- |            |   |
|------------|---|
| Yes        | 1 |
| No         | 2 |
| No comment | 3 |

28. Why do you feel that way?

29. Do you feel the *organisation provides you with the right tools* to support knowledge transfer between staff at your research institute? (Note: by tools we mean systems, technology, policies and procedures)

- |            |   |
|------------|---|
| Yes        | 1 |
| No         | 2 |
| No comment | 3 |
30. Why do you feel that way?
31. Do you feel the *organisation provides you with the right tools* to support knowledge transfer between staff at your research institute and external providers? (Note: by tools we mean systems, technology, policies and procedures)
- |            |   |
|------------|---|
| Yes        | 1 |
| No         | 2 |
| No comment | 3 |
32. Why do you feel that way?

### ***Individual Issues***

As already discussed, Knowledge Transfer often involves an exchange between a person(s) with knowledge (knowledge provider) and a person seeking knowledge (knowledge seeker). I would now like to ask some further questions regarding your experiences as a knowledge seeker (refer to the following table to complete responses).

### **INTERNAL KNOWLEDGE TRANSFER**

33. How important is the following factor to you when you are seeking knowledge from another colleague at your research institute? (i.e. internal knowledge transfer)?

Please rate the importance of each factor using this scale:

- |                      |   |
|----------------------|---|
| Not at all important | 1 |
| Not very important   | 2 |
| Not important        | 3 |
| Important            | 4 |
| Very important       | 5 |
| Extremely important  | 6 |

34. How important is the following factor to the other person, you believe, when you are seeking knowledge from another colleague at your research institute? (i.e. internal knowledge transfer)?

Please rate the importance of each factor using this scale:

- |                      |   |
|----------------------|---|
| Not at all important | 1 |
| Not very important   | 2 |
| Not important        | 3 |
| Important            | 4 |
| Very important       | 5 |
| Extremely important  | 6 |



**EXTERNAL KNOWLEDGE TRANSFER**

35. How important is the following factor to you when you are seeking knowledge from an external expert? (i.e. external knowledge transfer)?

Please rate the importance of each factor using this scale:

Not at all important	1
Not very important	2
Not important	3
Important	4
Very important	5
Extremely important	6

36. How important is the following factor to the other person when you are seeking knowledge from an external expert? (i.e. external knowledge transfer)?

Please rate the importance of each factor using this scale:

Not at all important	1
Not very important	2
Not important	3
Important	4
Very important	5
Extremely important	6

Table: Importance of Individual Factors				
Factor	Internal		External	
	Knowledge Seeker (You) Q 33	Knowledge Provider (Colleague) Q34	Knowledge Seeker (You) Q35	Knowledge Provider (External Expert) Q36
<i>Motivation</i>				
Trust in the other person				
High performance (good knowledge transfer) will be rewarded				
<i>Calculative reward</i>				
High performance (good knowledge transfer) will be recognised				
<i>Calculative approval</i>				
It will make a difference to the organisation				
<i>Personal outcome expectancy</i>				
The people involved are highly competent				
<i>Collective efficacy beliefs</i>				
The people involved produce high quality work				
<i>Collective outcome expectancy</i>				
<i>Ability</i>				
Effective communication skills				
Explaining <i>what</i> to do				
Explaining <i>how</i> to do something				

Explaining <i>why</i> something is done				
Small <i>gap</i> in understanding of the topic, rather than a large gap				
<i>Psychological Contract</i>				
Control over the process (i.e. how knowledge transfer is happening) <i>Locus of control</i>				
Democracy in the relationship (i.e. equal decision making or power) <i>Network constraints</i>				
Organisational commitment (positive emotional relationship with the organisation they work for) <i>Affective attachment</i>				
Job satisfaction (how much they enjoy their job) <i>Employee Satisfaction</i>				
Trust leadership of their organisation <i>Trust</i>				
Have a long-term career plan with their organisation (i.e. want to stay) <i>Careerism</i>				
<i>Knowledge Usage</i>				
Whether the knowledge will be used				

Now let us discuss some of these issues in more detail.

We will focus on one of the topics from each perspective. (Choose one of the topics rated the highest (i.e. most important) by the respondent, for each question).

37. When we discussed internal knowledge transfer, you mentioned \_\_\_\_\_ (mention topic and write it down) as one of the more important issues for you. Would you please tell me more about why this is important to you when you are seeking knowledge from a colleague (i.e. internal source).

38. When we discussed internal knowledge transfer, you mentioned \_\_\_\_\_ (mention topic and write it down) as one of the more important issues for the other person. Would you please tell me more about why you think this is important to others when you are seeking knowledge from a colleague (i.e. internal source).

39. When we discussed external knowledge transfer, you mentioned \_\_\_\_\_ (mention topic and write it down) as one of the more important issues for you. Would you please tell me more about why this is important to you when you are seeking knowledge from an external expert (i.e. external source).

40. When we discussed external knowledge transfer, you mentioned \_\_\_\_\_ (mention topic and write it down) as one of the more important issues for the other person. Would you please tell me more about why you think this is important to others when you are seeking knowledge from an external expert (i.e. external source).

### ***Knowledge Issues***

41. Do you think the knowledge itself is a problem in knowledge transfer, i.e. is it just difficult to explain?

Yes	1
No	2
No comment	3

42. Why do you feel that way?

### ***National Issues***

43. Do you feel the *national culture* creates problems associated with knowledge transfer between staff at your research institute and external knowledge suppliers, e.g. overseas universities, consultancies, or other external experts? (By national culture we mean the values and norms of the society).

Yes	1
No	2
No comment	3

44. Why do you feel that way?

45. Overall, how well is knowledge transferred within your organisation, i.e., between staff working for your institute? [Please note by knowledge transfer we mean that knowledge is exchanged, i.e. you send knowledge to another individual or group, or they send it to you (you receive knowledge).]

1	Extremely unsatisfactorily
2	Very unsatisfactorily
3	Unsatisfactorily
4	Satisfactorily
5	Very satisfactorily
6	Extremely satisfactorily

46. Why do you feel that way?

47. How do you feel this situation could be improved?

48. Overall, how well is knowledge transferred between your organisation and knowledge suppliers, i.e. other universities, consultancies, or other external experts?

1	Extremely unsatisfactorily
---	----------------------------

2	Very unsatisfactorily
3	Unsatisfactorily
4	Satisfactorily
5	Very satisfactorily
6	Extremely satisfactorily

49. Why do you feel that way?

50. How do you feel this situation could be improved?

51. Overall, how well is knowledge transferred between your organisation and knowledge users, i.e. Saudi firms?

1	Extremely unsatisfactorily
2	Very unsatisfactorily
3	Unsatisfactorily
4	Satisfactorily
5	Very satisfactorily
6	Extremely satisfactorily

52. Why do you feel that way?

## Section 5: Roles

### INTERNAL TRANSFER

53. Is internal knowledge transfer - i.e. the exchange of knowledge with your colleagues at the Research Institute – a formal part of your job? (By formal we mean it is part of your job description)

Yes	1
No	2
No comment	3

If no, ask Q 54, otherwise go to Q55.

54. Should internal knowledge transfer be a formal part of your job? (By formal we mean it is part of your job description)

Yes	1
No	2
No comment	3

55. Why do you feel that way?

56. Should your research institute appoint staff as specialists to facilitate the flow of knowledge inside your organisation?

Yes	1
No	2
No comment	3

57. Why do you feel that way?

### EXTERNAL TRANSFER

58. Is external knowledge transfer - i.e. the exchange of knowledge with external experts – a formal part of your job? (By formal we mean it is part of your job description)

- |            |   |
|------------|---|
| Yes        | 1 |
| No         | 2 |
| No comment | 3 |

If no, ask Q 59, otherwise go to Q60.

59. Should external knowledge transfer be a formal part of your job? (By formal we mean it is part of your job description)

- |            |   |
|------------|---|
| Yes        | 1 |
| No         | 2 |
| No comment | 3 |

60. Why do you feel that way?

61. Should your research institute appoint staff as specialists to facilitate the flow of knowledge from external experts into your organisation?

- |            |   |
|------------|---|
| Yes        | 1 |
| No         | 2 |
| No comment | 3 |

62. Why do you feel that way?

## Section 6: SOLUTIONS

### ORGANISATIONAL ISSUES

If respondent answered no to Q27, ask Q63, otherwise ask Q64.

63. You mentioned in Q27 that organisational culture was a problem with knowledge transfer at your Research Institute, how do you think this situation could be resolved?

If respondent answered yes to Q27, ask Q64, otherwise ask Q65.

64. You mentioned in Q27 that organisational culture was NOT a problem with knowledge transfer at your Research Institute, how else do you think the organisation could improve knowledge transfer?

### INDIVIDUAL ISSUES

(you will need to go quickly back to the answers recorded for Q37 and Q38)

65. You mentioned in Q37 and Q38 that \_\_\_\_\_  
(mention the key issues) was a problem in INTERNAL knowledge transfer, how  
do you think the situation could be improved?

(Go quickly back to the answers recorded for Q39 and Q40)

66. You mentioned in Q39 and Q40 that \_\_\_\_\_  
(mention the key issues) was a problem in EXTERNAL knowledge transfer, how  
do you think the situation could be improved?

## KNOWLEDGE CHARACTERISTIC ISSUES

67. You mentioned in Q41 that \_\_\_\_\_ (mention the  
key issues) was a problem associated with the knowledge itself in knowledge  
transfer, how do you think the situation could be improved?

## Section 7: Conclusion

68. Are you convinced that Saudi Arabian research institutions still require  
knowledge transfer in order to be competitive on a global scale, or do you believe  
that they are already internationally competitive?

- |   |   |
|---|---|
| 1 | Still need for more knowledge from external knowledge suppliers |
| 2 | We no longer need external knowledge suppliers                  |
| 3 | No comment  |

69. Why do you feel that way?

70. Are Saudi Arabian firms satisfied with the performance of Saudi Arabian research  
institutions in providing knowledge that is equivalent to what they might obtain  
from other institutions in other countries?

- |   |   |   |
|---|---|---|
|   | Extremely unsatisfied with the knowledge provided by Saudi institutes | 1 |
| 2 | Very unsatisfied with the knowledge provided by Saudi institutes      |   |
| 3 | Unsatisfied with the knowledge provided by Saudi institutes           |   |
| 4 | Satisfied with the knowledge provided by Saudi institutes             |   |
| 5 | Very satisfied with the knowledge provided by Saudi institutes        |   |
| 6 | Extremely satisfied with the knowledge provided by Saudi institutes   |   |

71. Why do you feel that way?

72. Do you have any further comments or anything we have missed?

## APPENDIX (C)

### KT PROCESSES

#### HOST ORGANISATIONS BUSINESS PROCESS MAPS USING BPR AND LEAN THINKING TO IMPROVE KT

Notes: The transfer of knowledge at the Research Institutes, i.e. External to Internal, Internal to Internal, and Internal to External is multifaceted. Respondents mentioned a wide range of issues. Some of these are existing processes for sharing knowledge about research, some are about sharing research itself, some are processes which are not done well or do not exist but should be done. So the list below is a starting point to examine what is and what should be in terms of knowledge sharing about research at the Research Institutes. It therefore represents a list of problems discussed in chapter 6 and a list of solutions discussed in chapter 9.

#### 1.1 EXTERNAL TO INTERNAL: ACADEMIC GOVERNANCE

<b>1.1 Academic Governance of Knowledge Flowing from External Partners to Saudi Research Institutes [Sources: 16 / Quotes: 54]</b>						
<b>No.</b>	<b>Process</b>	<b>Description</b>	<b>Process Steps/Activities</b>	<b>Lean benefits to the KT process</b>	<b>Evidence to prove quality</b>	<b>Value, Feasibility</b>
<b>1.1.1</b>	National Coordination	Ministry of Education coordinates external partnerships	The Ministry works with the research institutes to develop a strategic vision of Saudi and overseas partnerships	Remove duplicated effort, build synergies across the Research Institutes, ensure the Ministry sees value	National Plan is endorsed by the Royal Council, and monitored	(9, 2)
<b>1.1.2</b>	Identify External Partner	Evaluate potential partners and the value they can bring	Classify targets as (a) they own the knowledge and we want it, (b) they can develop the knowledge and then give it to us, (c) we can work together to develop the knowledge	Clarify the maturity level of the partner and their role in the knowledge exchange	Maturity level is validated	(10,8)
<b>1.1.3</b>	Contract	Prepare appropriate specification supported	Specify the type of knowledge being exchanged, the value being created	Eliminate misunderstandings; provide clear focus, ways to	Contract is agreed and	(9, 6)

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		by international law	(expectation), the how process, measurement metrics, timeframes, and financial agreements.	monitor the process, and enforceable by law.	lawyers are satisfied.	
<b>1.1.4</b>	Agent	Person(s) to identify partners and negotiate contracts	Develop job description, recruit and select, set performance targets, monitor and manage the person(s)	Specialist support for academic staff	No. of targets found, satisfaction survey from academic staff, no. of contracts approved by lawyers	(10,8)
<b>1.1.5</b>	Attract Visitors	Bringing partners for a short period	Identify, recruit, and deliver key note speakers to work with institute staff for a short period (e.g. 2 weeks)	Opportunity to meet with leading experts and be exposed to their knowledge for a short, focused period	No. of scholars visiting, quality of presentations, no. of staff exposed	(7, 8)
<b>1.1.6</b>	Attract Collaborators	Recruit partners for a full-time period	Provide incentives to attract the best talent, this includes salaries but even more importantly, the best equipment, so the partner has the best tools to work with	Attract leading experts who can then share their knowledge	No. of experts measured by their research impact factors.	(10, 9)
<b>1.1.7</b>	Attract Partner organisations	Recruiting joint ventures	Differentiate between commercial transaction (fees) and research collaboration (no fees), establish new relationships, build on existing relationships (e.g. MIT)	Sharing at strategic and also multiple levels	No. of joint venture agreements, quantity outcome measures	(9, 3)
<b>1.1.8</b>	Commercial research	Paying partners for knowledge	Identifying knowledge gaps or areas of potential that the institutes want to grow	Strategic competency gap filling, growing capability	No. of leading experts, measured by research impact	(9,4)
<b>1.1.9</b>	Measurement	Metrics to report knowledge sharing activity	Traditional areas such as time spent at the research institute by the partner, no. of papers produced, grant income generated and so on. Need to include non-traditional areas such as transfer metrics (seminars given etc.), plus communities of practice, frequency of interaction, interaction outcomes, degree of mentoring, growth in capability, psychological contract improvements.	Measure value for money of the partnership, and quantify value both in traditional and non-traditional ways.	Research activity is increased, and staff grow their capability	(10, 7)



## 1.2 EXTERNAL TO INTERNAL: ADMINISTRATION

Notes: These are activities that might be performed by a central administration at the host organisations e.g. Human Resource Management (1.2.1) or a Commercial Research Unit (1.2.2).

1.2 Knowledge Flowing from External Partners to Saudi Research Institutes about Administration [Sources: 19 / Quotes: 43]						
No.	Process	Description	Process Steps/Activities	Lean benefits to the KT process	Evidence to prove quality	(Value, Feasibility)
1.2.1	Attributes of Executives	Skills to identify and capture opportunities regarding external knowledge	<ol style="list-style-type: none"> <li>1 Political awareness: Need to be aware of political sensitivities, e.g. inform Ministry of Foreign Affairs</li> <li>2 Commercial acumen: Capacity to evaluate whether research will produce tangible or valuable outcomes</li> <li>3 Strategic management: planning and executing</li> <li>4 Use experts: consultants who can bring specialist skills to fill management gaps</li> </ol>	Leadership skills which drive external knowledge flows efficiently and effectively	Skills audit, LOC ratings in leadership	(10,6)
1.2.2	International Best Practice	Imitate the way leading international universities manage their external to internal knowledge flows	<ol style="list-style-type: none"> <li>1 Get international experience from external experts which demonstrates evidence to trust them via case studies and track record</li> <li>2 Identify industry partners for commercial research opportunities</li> <li>3 Ease of expatriation e.g. visa applications</li> <li>4 Facilitate secondment to work with industry partners gaining experience</li> <li>5 Internships, student projects working with industry</li> <li>6 Establish an advisory group, experts who check on progress annually</li> <li>7 Conduct focus groups with external experts to surface issues and direction</li> </ol>	Activities which provide enabling systems for working with external experts	Existence of administrative group and evidence of these activities being performed	(9,4)
1.2.3	Knowledge Sharing	The process of approving external to internal	<ol style="list-style-type: none"> <li>1 Research Institute Administration manage the contract and other</li> </ol>	Identify the inputs (e.g. legal) and outputs (e.g. tangible outputs)	An External Research	(9,3)

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	Approvals	knowledge flows	<p>formalities</p> <ol style="list-style-type: none"> <li>2 Resolve legal issues, i.e. whether to follow International Law in forming agreements/contracts</li> <li>3 Liaise with Ministry of Foreign Affairs for Saudi embassy to work with industry partner's home country office</li> <li>4 Identify expected outcomes from the research partnership to improve accountability and the business case, particularly for Ministry of Finance</li> <li>5 Research Institute communicates with staff to encourage and reward external collaboration and signing of agreements</li> </ol>	associated with external to internal knowledge flows	Contract group is established which follows a SOP on contract specification	
1.2.4	Strategy	Designing and implementing a future direction in terms of external to internal knowledge flows	<ol style="list-style-type: none"> <li>1 Understand the role of the Research Institute in terms of external to internal knowledge flows (they have different roles)</li> <li>2 Identify the knowledge to be captured from the external expert and include this in the contract (i.e. mutual benefit not just commercial transaction)</li> <li>3 Reduce or even eliminate dependence on external experts i.e. learn all that is needed from them</li> <li>4 Build on what is already known, not reinvent the wheel; identify future research, i.e. cutting edge (e.g. solar panels for air conditioning)</li> <li>5 Awareness of country differences in terms of knowledge flows (e.g. Japan is protective)</li> <li>6 Identify external partners who share similar goals or who are world's best</li> <li>7 Address market image of Saudi Arabia as a career path for overseas academics</li> <li>8 Career management – make external to internal knowledge flows part of annual career development reviews</li> </ol>	Develop shared vision about the purpose of external partnerships	Policy on each of these activities approved by the relevant Ministry	(10,7)

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			9 Job redesign i.e. allow research for teaching only staff 10 Invest in staff secondments with overseas universities to gain research experience (e.g. scholarships) 11 Aim for organisational culture based on continuous learning (e.g. Senge) and trying to catch the world's best			
1.2.5	Make v Buy	Decision about whether to acquire knowledge from external sources or develop it internally	1 Business case for making rather than buying, with risk assessment included 2 Determine competency gap; if large gap then acquisition decision 3 Define the ROI of the knowledge being acquired 4 Acquisition needs a tangible outcome (e.g. patenting) 5 Persuade external IP owners to share	Decision on ownership of the knowledge resource	Auditable process including submissions by subject matter experts and use of the decision model	(7, 9)

### 1.3 EXTERNAL TO INTERNAL: RESEARCH

1.3 Knowledge Flowing from External Partners to Saudi Research Institutes about Research [Sources: 36 / Quotes: 187]						
No.	Process	Description	Process Steps/Activities	Lean benefits to the KT process	Evidence to prove quality	(Value, Feasibility)
1.3.1	Awareness of the knowledge marketplace	Criteria to evaluate suitability of external experts for research collaboration	<ol style="list-style-type: none"> <li>1 Redundancy, i.e. working in similar knowledge domains creating overlapping knowledge</li> <li>2 Competence, i.e. relevant qualifications and experience</li> <li>3 Currency, i.e. building on existing knowledge</li> <li>4 Longevity, i.e. drip feed release to maintain interest</li> <li>5 Virtual community, i.e. on-line information exchange</li> <li>6 Competency gap, i.e. how much more do the external experts know?</li> <li>7 Motivation, i.e. funds to conduct research versus competitive grants in home country</li> <li>8 Absorptive capacity, i.e. ability to send (external) and receive/learn (internal) knowledge</li> <li>9 Tacitness, i.e. really valuable knowledge is not published; it must be discussed (nobody writes down all their secrets)</li> <li>10 Relationships, i.e. trust</li> </ol>	Awareness of behaviours, attitudes and competencies which may be used to make good selection decisions about external partners	Criteria is approved and applied in selection process	(8, 4)
1.3.2	Evaluating suitability of Internal Researchers	Criteria to evaluate suitability of internal experts for research collaboration	<ol style="list-style-type: none"> <li>1 Language, i.e. English speaking skills</li> <li>2 Awareness of competency gaps, so you can try to fill them by learning from the external expert</li> <li>3 Capture the knowledge from the external expert, i.e. so you can do it yourself without them</li> <li>4 Relevant qualifications and experience, so you can begin to learn</li> <li>5 Motivation, i.e. discipline and hard</li> </ol>	Awareness of behaviours, attitudes and competencies which may be used to make good selection decisions about internal staff suitable to work with external partners	Criteria is approved and applied in selection process	(9, 10)

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			<p>work ethic, subject matter interest, willingness to learn</p> <p>6 Currency, i.e. keep up to date with literature, academic networks, industry</p> <p>7 Peer review, i.e. ask and learn before doing (e.g. writing grants)</p> <p>8 Networking, i.e. attend conferences and join societies to meet and build relationships</p> <p>9 Awareness of national benefit</p>			
<b>1.3.3</b>	Nature of External Internal Research Process	Activities which enhance the flow of knowledge about research externally to internally	<p>1 Contract specification, i.e. Negotiate suitable agreements</p> <p>2 Imitation, i.e. copy external experts</p> <p>3 Tailoring, i.e. apply best practice to the Saudi environment</p> <p>4 Socialisation, i.e. Interacting with external experts</p> <p>5 Project meetings, presentations on both sides, discussion, exchange of ideas, feedback</p> <p>6 Communication via email, telephone, video conference, Skype</p> <p>7 Regular visits to check on progress and give feedback, e.g. every 3 months</p> <p>8 Documentation (codification), local application, experiments are checked by external expert</p> <p>9 Visit them to work with them on their site e.g. labs</p> <p>10 Establish and fund internal Research Centres to attract collaboration with external experts</p> <p>11 Expert opinion or feedback on local work</p>	Effective implementation of these activities will increase research collaboration and create better knowledge flows	Activities are implemented via Standard Operating Procedures and evidence to prove SOP compliance	(7, 3)
<b>1.3.4</b>	Availing research Tools	Systems to enable research collaboration with external experts	<p>1 Networks, i.e. memberships of societies, attend conferences</p> <p>2 Leading edge equipment/labs</p> <p>3 Expert registers, databases</p> <p>4 Virtual communities, i.e. on-line</p>	Systems will increase the connectivity of knowledge providers (external experts) and seekers (institute staff)	Systems exist, supported by Standard Operating Procedures, and annual audit	(8, 9)

## 1.4 EXTERNAL TO INTERNAL: TEACHING

1.4 Knowledge Flowing from External Partners to Saudi Research Institutes about Teaching [Sources: 15 / Quotes: 31]						
No.	Process	Description	Process Steps/Activities	Lean benefits to the KT process	Evidence to prove quality	(Value, Feasibility)
1.4.1	Exchange	Sending people overseas to learn	<ol style="list-style-type: none"> <li>1 Staff and student exchange</li> <li>2 Scholarships to enhance training in overseas universities</li> </ol>	Learn from best practice and return to diffuse the knowledge	No of exchanges, quality of overseas university, knowledge learned report on posting completion	(10, 10)
1.4.2	Academic staff teaching skills	Training on teaching process for academic staff	<ol style="list-style-type: none"> <li>1 Establish competency gaps, particularly across disciplines or subject matter expertise, and fill them via lectures by relevant experts (e.g. Bioinformatics).</li> <li>2 Overseas training programs</li> <li>3 Local training courses on specific topics</li> <li>4 Learn by doing, i.e. reading, asking questions, on-line (teach yourself)</li> <li>5 Seminars by teaching experts</li> </ol>	Academic staff know current content in their lectures, and teach students following best practice methods	Subject and student surveys which measure both content and process, independent peer review	(9, 5)
1.4.3	HDR student supervision skills	Training for academic staff on supervising higher degree research students	<ol style="list-style-type: none"> <li>1 Secondments or scholarships in leading overseas research centre to learn how they supervise HDRs</li> <li>2 Regular interactive student research group meetings</li> <li>3 Virtual communities (e.g. videoconferencing)</li> <li>4 Working with industry e.g. field trips</li> <li>5 Involvement in grants and research projects</li> </ol>	Academic staff have skills to increase HDR completion rates and minimum time to complete	HDR annual reports, student feedback, student progress, student exposure to the range of activities which provide external sources of knowledge	(10, 5)

## 2.1 INTERNAL TO INTERNAL: ACADEMIC GOVERNANCE

2.1 Academic Governance of Knowledge Flowing from staff within Saudi Research Institutes to other staff [Sources: 30 / Quotes: 119]						
No.	Process	Description	Process Steps/Activities	Lean benefits to the KT process	Evidence to prove quality	(Value, Feasibility)
2.1.1	Knowledge brokers	Formalising the role of knowledge sharing for academic staff responsible for diffusion	1 Liaison: Inform all stakeholders 2 Job redesign: Diffusion of knowledge included in job descriptions	Embed knowledge sharing into job descriptions making people accountable	Staff designated as knowledge brokers, jobs redesigned to reflect this role, audit of broker role	(4, 10)
2.1.2	Performance Metrics	Measurement of knowledge sharing behaviours, attitudes, and activities	1 Measure outcomes of knowledge sharing via codified outputs (e.g. papers, patents) 2 Breadth of staff engagement, i.e. no. of people demonstrating desired behaviours and activities 3 ROI on research expenditure, e.g. projects, income, publications, collaborations, number of students 4 Collaboration activities, e.g. joint supervisions, joint projects,	Development of lead (how do we do it) and lag (did we do it) indicators can identify knowledge sharing that will be recognised and rewarded (i.e. motivation) and track progress	Lead and lag indicators established. Monitored, reported, and audited	(10, 7)
2.1.3	Knowledge protection	Management of intellectual capital and protection of commercially valuable outputs of collaboration	1 Identify intellectual property, i.e. idea that might be patented 2 Liaise with Patent Office or Intellectual Capital Processing Office 3 Writing agreements or patent proposals 4 Process patents	Speed of translating a good idea to Intellectual Property means valuable knowledge sharing outputs can be protected	No. of commercial research ideas, no. of patents, no. of projects with the Patent Office	(10, 4)
2.1.4	Enabling systems	Supporting activities to facilitate knowledge sharing and connect this with organisational and personal gain	1 Knowledge strategy, i.e. how to differentiate between the needs of different research domains and prioritise funding using an objective decision model (i.e. pick winners) 2 Funding levels, i.e. how to prepare business cases 3 Technology, i.e. how to bid for	Provide the resources and resource management (e.g. strategy, funding, technology, human resources) to facilitate knowledge sharing, supported by cultural change	Documents, policies, procedures to demonstrate standard operating procedures in each of these	(10, 7)

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			<p>equipment and lab budgets etc.</p> <p>4 Human resources, i.e. workforce planning at finite levels based on competency gap analysis</p> <p>5 Cooperation across research institutes, e.g. share technology and equipment, as well as ideas</p> <p>6 Career management, i.e. classifying the workforce in terms of senior, mid, and junior, and aligning their career goals with value for the institute</p> <p>7 Involvement in decision making, i.e. democratic committees</p>		areas, monitored, audited	
2.1.5	Secretarial support services	Administrative support for the codification process	<p>1 Provide templates</p> <p>2 Writing or other communication support (aid codification)</p>	Consistent approach to codification methods and free up resources (staff) for other more creative work	Resources and methods distributed	(7, 3)



## 2.2 INTERNAL TO INTERNAL: ADMINISTRATION

Notes: These are activities that might be performed by a central administration at the host organisations.

2.2 Knowledge Flowing from staff within Saudi research host organisations to other staff about Administration [Sources: 28 / Quotes: 122]						
No.	Process	Description	Process Steps/Activities	Lean benefits to the KT process	Evidence to prove quality	(Value, Feasibility)
2.2.1	Management Standard Operating Procedures (SOPs)	Guidance for academic staff promoted to management positions	<ol style="list-style-type: none"> <li>1 Instructions on key management tasks</li> <li>2 Instructions on new tasks (i.e. competency gaps)</li> <li>3 Guide researchers on how to be managers</li> <li>4 Accountability, i.e. performance metrics to measure management</li> </ol>	Competency and experience gaps in key organisational capabilities, i.e. management, are filled	SOPs are designed, approved, implemented, monitored and audited	(8, 7)
2.2.2	Strategic management	Principles of strategic leadership	<ol style="list-style-type: none"> <li>1 Compete, i.e. establish rules of competition, e.g. skills, performance, funding, monitoring</li> <li>2 Motivate, i.e. reward and recognition systems</li> <li>3 Grow, i.e. Increase internal knowledge sharing to build internal capability</li> </ol>	Establish the foundations of effective management	LOC audit, independent audit of management skills	(10, 4)
2.2.3	Community Engagement	How to work with the community on a goodwill basis	<ol style="list-style-type: none"> <li>1 Identify and capture opportunities for volunteer work</li> </ol>	Build external networks within the community	No. of community contacts, no. of community projects, community feedback	(4, 3)

## 2.3 INTERNAL TO INTERNAL: RESEARCH

2.3 Knowledge Flowing from staff within Saudi research host organisations to other staff about Research [Sources: 40 / Quotes: 262]						
No.	Process	Description	Process Steps/Activities	Lean benefits to the KT process	Evidence to prove quality	(Value, Feasibility)
2.3.1	Researcher attributes	How to persuade staff to share knowledge with other staff	<ol style="list-style-type: none"> <li>1 Reward systems</li> <li>2 Mentoring, i.e. bridge gap between experienced and junior researchers</li> <li>3 Person gain must be made clear</li> <li>4 Long term motivation, i.e. why develop young people when they leave eventually</li> <li>5 Differentiate benefits of doing it yourself v external collaboration v internal collaboration</li> <li>6 Socialisation, i.e. attend committee meetings</li> </ol>	Awareness of behaviours, attitudes and competencies which may be used to evaluate internal staff knowledge sharing	Criteria is approved and applied in career development review process	(10, 4)
2.3.2	Organisational Leadership of research	Activities necessary to facilitate knowledge sharing between staff	<ol style="list-style-type: none"> <li>1 Develop shared vision, i.e. research centre goals (incl. long-term, i.e. patience)</li> <li>2 Establish and communicate performance metrics, i.e. input (e.g. funding) and output (e.g. publications, patents) expectations</li> <li>3 Establish specialist research centres, (i.e. pick winners)</li> <li>4 Establish cooperation between research centres</li> <li>5 Provide autonomy, intellectual freedom</li> <li>6 Standard Operating Procedures for collaboration, i.e. how people should work together</li> <li>7 Provide incentives for collaboration</li> <li>8 Provide incentives for research output, e.g. papers, patents etc.</li> <li>9 Provide fixed grants, rather than externally competitive</li> <li>10 Provide different levels of grant funding to facilitate research at multiple paths (i.e. senior, mid, and junior staff development)</li> <li>11 Complete research infrastructure, i.e. all labs established</li> </ol>	Structural and cultural systems to direct knowledge sharing	Activities are implemented, linked to performance metrics	(10, 9)

			12 Weekly research seminars to share ideas 13 Knowledge retention, i.e. invest in growing and keeping people			
2.3.3	Individual Initiative/Roles	How individuals can research	14 Conduct literature review, use existing body of knowledge to solve problems and identify opportunities 15 Generate research ideas or projects (begin with problem) 16 Advance the existing body of knowledge 17 Innovation, i.e. the knowledge creation process itself 18 Learning by doing, i.e. reading, asking questions, do it yourself 19 If there is a knowledge gap, i.e. the researcher needs help, then find an internal expert(s) 20 Establish a team, organise a start-up meeting 21 Identify researchers across research centres, institutes who can help solve the problem 22 Establish interest, common ground, motivation to work together 23 Establish trust and respect 24 Associate with key senior people who can share their experience (i.e. build social networks) 25 Share knowledge/work with HDR students 26 Once issues are identified, contact relevant experts from other research centres, persuade them to give up time from their current projects to work on yours 27 Learn organisational tacit knowledge, i.e. how the system works around here 28 Gain support from committees, council, for funding or resources 29 Writing grant applications 30 Research promotion, e.g. via publications or reports, to demonstrate capability and the types of research/problems being	Experience shared, accelerated learning curve, productivity increases	Activities are performed, input and output measures of research productivity	(10, 6)

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			solved			
<b>2.3.4</b>	Group Accountability/Roles	How groups can research together	31 Effective group work, collaboration, cooperation, team work 32 Willingness to share people (knowledge resources) rather than hoard them 33 Reciprocity, i.e. building trust based on mutual benefit (social exchange theory)	Research synergies, redundancy (positive overlap), team learning	Activities are performed, input and output measures of research productivity, social network analysis	(10, 6)
<b>2.3.5</b>	Conducting research	How to work with industry	34 Acquiring data 35 Research industry to understand their problems and research need 36 Conduct field experiments, applied research (e.g. chemistry nano and bio example) 37 Conduct research for industry, i.e. users of our experiments 38 Establish absorptive capacity, i.e. knowledge levels (inputs), talk at the same level, go back to basics if necessary 39 Provide help with interpretation, analysing, technical problems with the equipment or testing 40 Solve problems for people who ask for help, e.g. nano wires example, sharing experience to save time 41 Produce tangible outcomes e.g. prototypes, products, patents that we can sell 42 Distinguish between what must be protected (e.g. patents) and what can be disclosed via publications (tacitness here)	Effective and efficient research collaborations with local industry	Activities are performed, input and output measures of research productivity, social network analysis	(10, 3)

## 2.4 INTERNAL TO INTERNAL: TEACHING

2.4 Knowledge Flowing from staff within Saudi research host organisations to other staff about Teaching [Sources: 27 / Quotes: 70]						
No.	Process	Description	Process Steps/Activities	Lean benefits to the KT process	Evidence to prove quality	(Value, Feasibility)
2.4.1	Building a research team	Growing research team capability against requirements	<ol style="list-style-type: none"> <li>1. Workforce planning: identify existing and future resources</li> <li>2. Identify competency gaps; learning curve approach: those at the lower levels need more help</li> <li>3. Applied guidance, i.e. clarify help needed, work with team on testing, examine results, check, feedback loop, task completion (seeker is happy)</li> </ol>	Meet capability requirements quicker	Workforce plan, demonstrated knowledge sharing activity from knower to seeker, competency gap reduced	(9, 9)
2.4.2	Training junior researchers	Teaching individual researchers how to research	<ol style="list-style-type: none"> <li>1. Lectures</li> <li>2. Workshops/seminars</li> <li>3. Clarify training strategy, Saudi way is to spoon-feed (e.g. give books, discuss, explain) while Chinese is to give guidelines and tell them to do it themselves with feedback loop</li> <li>4. Absorptive capacity, find their level and talk at that level</li> <li>4. Show how to use/apply the knowledge e.g. use technology or equipment (senior person gets training and then shows team of juniors how to use it)</li> <li>5. Tasks, i.e. practice skills</li> <li>6. Provide opportunities to work with industry</li> </ol>	Accelerated learning curve, competency reached quicker	Training activities, peer and 360 degree review, independent audit	(8, 6)
2.4.3	Formal training	Conducting staff training in classroom environment	<ol style="list-style-type: none"> <li>1. Training programs in specialist subjects, e.g. computer science or how to use a particular tool</li> <li>2. Request a course, often conducted by an overseas expert (e.g. Chinese)</li> </ol>	Connectivity and efficiency with training, i.e. reach more people quickly	Training content and process evaluated against participant feedback and independent audit	(7, 8)

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2.4.4	Training the experts	Learning for senior staff	<ol style="list-style-type: none"> <li>1. Teaching others provides learning</li> <li>2. Challenging tasks, e.g. designing senior projects</li> </ol>	Innovation, i.e. leading edge knowledge resources will be grown by these staff	Demonstrated activity, evaluation by participants and independent audit	(7, 9)
2.4.5	Building a teaching team	Growing teaching team capability against requirements	<ol style="list-style-type: none"> <li>1 Workforce planning: departments may be staffed by junior HDR or postgraduate students, difficulty in attracting Saudis, visa issues etc.</li> <li>2 Career management: identify roles that best suit the career goals and skills of individual staff e.g. a world class researcher may wish to do research rather than administration simply because he is a senior</li> </ol>	Meet capability requirements quicker, student satisfaction	Workforce plan, link with career management and review, competency gap reduced	(7, 9)
2.4.6	Lecturing	Designing and delivering teaching content for research students	<ol style="list-style-type: none"> <li>1. Developing course content (filtering)</li> <li>2. Using on-line material, e.g. case studies, videos etc.</li> <li>3. Literature review, summarising, presenting the current body of knowledge for students (e.g. journals)</li> <li>4. Consultation hours, be available to help students</li> <li>5. Student engagement: how to understand and address student attendance and participation in class</li> </ol>	Quality teaching, student satisfaction	Student and subject surveys, peer review	(10, 9)
2.4.7	Teaching Governance	Establish teaching support group/unit	<ol style="list-style-type: none"> <li>1. Establish an Advanced Learning Centre to facilitate courses and training for both research and teaching skills</li> </ol>	Expertise in teaching as a process is diffused	Centre is established, no. of interactions with staff, quality of interactions	(9, 9)

### 3.1 INTERNAL TO EXTERNAL: ACADEMIC GOVERNANCE

3.1 Academic Governance of Knowledge Flowing from Saudi Research Institutes staff to External Industry Partners [Sources: 8 / Quotes: 19]						
No.	Process	Description	Process Steps/Activities	Lean benefits to the KT process	Evidence to prove quality	(Value, Feasibility)
3.1.1	Regulation of external partnerships	Leadership of partnerships with local industry	<ol style="list-style-type: none"> <li>1 Govt. Leadership, i.e. coordination of industry partnerships by relevant Ministries</li> <li>2 Coordinate cooperation between Research Institutes</li> <li>3 Regulate International Cooperation Agreements</li> <li>4 Involve all stakeholders (e.g. incl. Ministry of Higher Education)</li> <li>5 Contract management: specification of tangible outcomes plus protection if things go wrong (e.g. incl. legal support)</li> <li>6 Design and monitor performance metrics for industry partnerships, i.e. inputs (funding etc.) and outputs (papers, patents)</li> <li>7 Feedback loop, i.e. survey industry partners at project completion</li> </ol>	Consistent approach to managing research with industry, national benefit is coordinated	Demonstration of these activities	(9, 3)
3.1.2	Identify industry partners	Finding suitable research opportunities with local industry	<ol style="list-style-type: none"> <li>1 Identify firms where they have a problem and you can provide a solution</li> <li>2 Target specific industries and build industry expertise, e.g. petroleum</li> <li>3 If no local industry, identify overseas partner</li> <li>4 Design research which meets the needs of local industry (start from customer perspective)</li> <li>5 Visit industry to evaluate their equipment/technology and buy whatever they have that you do not (demonstrating capability)</li> </ol>	Search efficiency, eliminate duplicated effort, coordinated approach based on demonstrating industry and firm understanding	Database established, industry and firm files established, no. of visits, no. of successful outcomes per visit, social network analysis	(10, 5)

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			6	Build and use social networks to identify issues and problems within industry			
3.1.3	Attract local industry partners	Persuading local industry to agree to research partnerships	1	Communicate that we are looking for industry partners (i.e. marketing)	Search effectiveness, less time to persuade industry to collaborate, better partnerships, better research outcomes	Business case, track record portfolios, quality of value propositions	(10, 2)
			2	Business case persuading private sector of the benefit in supporting scientific research; i.e. business people want quick revenues or profit as opposed to ideas (need value proposition)			
			3	Evidence of track record or expertise (e.g. publications etc.)			
			4	Clarify the nature of the problem: industry often want to partner on technology (e.g. producing solar panels), while researchers want to study the problems associated with applying the technology (need to find a bridge)			
			5	Differentiate between operations (i.e. just keeping the factory running) and improvement (i.e. doing things better); the latter is where researchers can help most			
			6	Let industry tailor your idea to best meet their needs			
			7	Persuade industry to use you rather than overseas researchers			
3.1.4	Relationship Management	Establish trust-based sustainable relationships with local industry	1	Organise a meeting to generate initial interest, then follow up with a second meeting and a presentation, then do a proposal or draft agreement, close the deal, i.e. partnership	Improved social capital, shared social capital, longer lasting relationships	Social network analysis, social capital scores	(10, 6)
			2	Address insiderness, i.e. persuading industry to trust you and share their secrets			
			3	Become an insider, i.e. trust-based rather than transaction based relationship			
3.1.5	Project	Managing the research	1	Establish a Project Management Team	Efficient research progress,	Management	(8, 8)



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	Management	project with industry	(PMT) 2 Hold regular PMT meetings	Effective research outcomes	meetings occur, meeting minutes, meeting outcomes	
3.1.6	Commercial Research Unit	Administrative support for external research partnerships	1 Establish a group to support researchers conduct all of activities necessary for industry partnerships 2 Contract specification, particularly IP protection 3 How to commercialise research e.g. a patent 4 How researchers can protect initial ideas from being stolen from them (i.e. before a contract is signed)	Expert advice on matters outside researchers' normal competencies, free up researchers to spend time on their research	Unit is established, no. of commercial advice activities, researcher feedback	(10, 7)
3.1.7	Human resources	Provide capability to resource projects	1 Provide the researcher with enough staff so that he can manage rather than operate, and the industry partner is persuaded of capability	Resource planning	Resource plans, industry feedback	(9, 6)

### 3.2 INTERNAL TO EXTERNAL: ADMINISTRATION

4.2 Knowledge Flowing from Saudi Research Institutes staff to External Industry Partners about Administration [Sources: 10 / Quotes: 18]						
No.	Process	Description	Process Steps/Activities	Lean benefits to the KT process	Evidence to prove quality	(Value, Feasibility)
3.2.1	Funding	Funding policy in conducting research with industry partners	1 Explaining to industry how research funding works	Avoid confusion associated with funding requirements or expectations	Policy exists, policy is distributed to industry	(8, 9)
3.2.2	Intellectual Property	Policy on intellectual property involving research with local industry	1 Policy on international intellectual property laws 2 Policy on fair distribution of intellectual property arising from research with local industry	Avoid confusion associated with intellectual property	Policy exists, policy is distributed to industry	(10, 7)
3.2.3	Approvals	Criteria for approval of research with local industry	1 Establish criteria based on outputs, i.e. expected research outcomes 2 Risk assessment incl.	Avoid confusion associated with research output, better ROI for both the Research Institute and the industry partner	Criteria exists and is followed when developing and approving research projects	(9, 9)
3.2.4	Commercialisation	Creating revenue from research with local industry	1 Selling IP outputs, e.g. patents, to industry 2 Spin-Off Companies	Focus on tangible outcomes	Demonstrated effort to commercialise, revenues, no. of projects	(5, 4)
3.2.5	Community Engagement	Volunteering activity to help the local community	1 Give short courses 2 Give public lectures on matters of interest 3 Attend community group meetings 4 Industry recognition that supporting the Research Institutes is part of their community engagement	Shared awareness, social networks growth, social capital, reputation	Volunteering activities, feedback from the community	(3, 4)

### 3.3 INTERNAL TO EXTERNAL: RESEARCH

3.3 Knowledge Flowing from Saudi Research Institutes staff to External Industry Partners about Research [Sources: 17 / Quotes: 66]						
No.	Process	Description	Process Steps/Activities	Lean benefits to the KT process	Evidence to prove quality	(Value, Feasibility)
3.3.1	Applied Research	Analyse industry data	1 Processing data for industry partner	Research productivity	Standard Operating Procedure	(8, 9)
3.3.2	Create commercial opportunities	Make revenues from research	1 Create patents which industry develop further for commercialisation 2 Develop consultancies 3 If industry needs to know something we know, they will pay for it	Research revenues	No. of projects generating funds, total revenues	(7, 5)
3.3.3	National benefit	Identify importance of research	1 Identify how research can benefit the Kingdom	Research recognised by Ministry	Ministry feedback	(10, 4)
3.3.4	Leading edge research	Communicate expertise	1 Explain the latest research to industry e.g. materials, coatings, solar, wind energy, petrochemicals, polymers etc.	Research recognised by industry	Industry feedback	(10, 4)
3.3.5	Knowledge flow mechanisms	Ways to engage with industry	1 Hold meetings (usually groups from both sides) 2 Conduct workshops and seminars	Social capital	Social network structure and quality metrics	(10, 4)
3.3.6	Performance Metrics	Measurement of research with local industry	1 No. of projects 2 Publications, patents etc. 3 Knowledge diffusion e.g. workshops, seminars, public lectures	Performance expectation is transparent	No. of metrics achieved	(9, 10)

### 3.4 INTERNAL TO EXTERNAL: TEACHING

3.4 Knowledge Flowing from Saudi Research Institutes staff to External Industry Partners about Teaching [Sources: 5 / Quotes: 9]						
No.	Process	Description	Process Steps/Activities	Lean benefits to the KT process	Evidence to prove quality	Value, Feasibility
3.4.1	Train the local industry	Industry staff to work with researchers on campus	1 Allow industry staff to work in Research Institutes on secondment 2 Conduct short courses	Learn how to tailor research for industry use	No. of industry secondments, outcomes	(10, 4)

## HOST ORGANISATIONS BUSINESS PROCESS MAPS USING LEAN/ BPR METRICS TO IMPROVE THE PROCESS OF KT

### 4.1 SYSTEM 1: EXTERNAL TO INTERNAL: Academic Governance

Process Name	Process Description	BPR Process Issues (As Is)	Issue Rectification (To Be)
<b>1.1.1 National Coordination</b>	Ministry of Education coordinates external partnerships	Waiting (approvals): Highly sensitive/political	Stakeholder review conducted by independent third party
<b>1.1.2 Identify External Partner</b>	Evaluate potential partners and the value they can bring	Defects (correcting): blind spots, cognitive bias	Criteria established, relational capital database established, transparent scoring method to prioritize targets
<b>1.1.3 Contract</b>	Prepare appropriate specification supported by international law	Waiting (approvals): Highly sensitive/political	Commercialization Unit should manage this for the researchers
<b>1.1.4 Agent</b>	Person(s) to identify partners and negotiate contracts	Defects (correcting): unaware of value	Commercialization Unit should manage this for the researchers
<b>1.1.5 Attract Visitors</b>	Bringing partners for a short period	Transportation: time to organize	Social network analysis, database, specific knowledge acquisition strategy
<b>1.1.6 Attract Collaborators</b>	Recruit partners for a full-time period	Transportation: time to organize	Social network analysis, database, specific knowledge acquisition strategy
<b>1.1.7 Attract Partner organisations</b>	Recruiting joint ventures	Defects (correcting): inadequate social capital	Social capital and knowledge acquisition strategy, linked to competency gaps and knowledge strategy
<b>1.1.8 Commercial research</b>	Paying partners for knowledge	Defects (correcting): inadequate knowledge strategy	Make v buy model, linked to career management and the broader knowledge strategy
<b>1.1.9 Measurement</b>	Metrics to report knowledge sharing activity	Defects (correcting): inadequate metrics	Metrics to be designed, communicated, audited

## 4.2 SYSTEM 1: EXTERNAL TO INTERNAL: Administration

Process Name	Process Description	Process Issues (As Is)	Issue Rectification (To Be)
<b>1.2.1 Attributes of Executives</b>	Skills to identify and capture opportunities regarding external knowledge	Waiting (approvals): Highly sensitive/political	Competency mapping linked with career management Objective skills audit
<b>1.2.2 International Best Practice</b>	Imitate the way leading international universities manage their external to internal knowledge flows	Defects (incorrect information): Blind spots	Establish necessary administrative support units and/or improve function of existing units Write Standard Operating Procedures (SOPs) for these activities Objective annual audit
<b>1.2.3 Knowledge Sharing Approvals</b>	The process of approving external to internal knowledge flows	Waiting (approvals): Highly sensitive/political Defects (incorrect information): Blind spots	Establish a Contract group responsible for specification Write Standard Operating Procedures (SOPs) for this activity Objective annual audit
<b>1.2.4 Strategy</b>	Designing and implementing a future direction in terms of external to internal knowledge flows	Waiting (approvals): Value confusion Defects (incorrect information): Blind spots	Develop policy and procedures to establish shared vision about use of external experts
<b>1.2.5 Make v Buy Decision</b>	Decision about whether to acquire knowledge from external sources or develop it internally	Waiting (approvals): Lack direction and policy on this Defects (incorrect information): No criteria	Establish decision criteria, invite submissions, evaluate submissions against criteria, make decisions on resource ownership, i.e. external v internal

### 4.3 SYSTEM 1: EXTERNAL TO INTERNAL: Research

Process Name	Process Description	Process Issues (As Is)	Issue Rectification (To Be)
<b>1.3.1 Attributes of External Researchers</b>	Criteria to evaluate suitability of <i>external</i> experts for research collaboration	Waiting (approvals): No standard method used Defects (incorrect information): No criteria	Establish criteria, approval, and applied in selection process; cost benefit analysis
<b>1.3.2 Attributes of Internal Researchers</b>	Criteria to evaluate suitability of <i>internal</i> experts for research collaboration	Waiting (approvals): No standard method used Defects (incorrect information): No criteria	Establish criteria, approval, and apply in selection process; cost benefit analysis
<b>1.3.3 Nature of External to Internal Research Process</b>	Activities which enhance the flow of knowledge about research externally to internally	Waiting (batching): economies of scale Transportation: different time perspectives	Design Standard Operating Procedures (SOPs) in these activities, resource the activity, embed behaviors in job redesign, monitor via annual audit and include in career development review
<b>1.3.4 Research Tools</b>	Systems to enable research collaboration with external experts	Defects (correcting): Unaware of best way	Design systems in these areas, implement, resource, monitor via annual audit

### 4.3 SYSTEM 1: EXTERNAL TO INTERNAL: Teaching

Process Name	Process Description	Process Issues (As Is)	Issue Rectification (To Be)
<b>1.4.1 Exchange</b>	Sending people overseas to learn	Transportation: Takes time to learn this way Defects (incorrect information): Tangible outcomes unclear or unspecified	Specify outcomes, capture outcomes, measure tangible learning benefit at organisational and individual gain levels
<b>1.4.2 Academic staff teaching skills</b>	Training on teaching process for academic staff	Defects (incorrect information): focusing on the wrong process (content)	Establish teaching excellence support center with teaching experts brought in to train staff, resourced, monitored, and audited via subject and student surveys, as well as peer review
<b>1.4.3 HDR student supervision skills</b>	Training for academic staff on supervising higher degree research students	Defects (incorrect information): focusing on the wrong process (student exposure to external sources, rather than academic staff exposure to external HDR process)	Establish HDR support center with teaching experts brought in to train staff, resourced, monitored, and audited via HDR annual reports, student feedback and progress, and external peer review



## 5.1 SYSTEM 2: INTERNAL TO INTERNAL: Academic Governance

Process Name	Process Description	Process Issues (As Is)	Issue Rectification (To Be)
<b>2.1.1 Knowledge brokers</b>	Formalising the role of knowledge sharing for certain academic staff responsible for diffusion	Defects (correcting): Role undefined	Identify suitable staff, appoint role, provide role description, embed in job redesign, provide resources and system support, link with career development review metrics, monitor and audit
<b>2.1.2 Performance Metrics</b>	Measurement of knowledge sharing behaviours, attitudes, and activities	Defects (correcting): Existing metrics are unclear and incorrect	Lead and lag indicators need to be established, formalized, monitored, and audited
<b>2.1.3 Knowledge protection</b>	Management of intellectual capital and protection of commercially valuable outputs of collaboration	Defects (correcting): Existing processes are incomplete so people are unclear about what to do	Review and improve role of Patent Office, establish Commercialization Unit to lead the value created by research collaboration with appropriate resources, monitoring, and audit
<b>2.1.4 Enabling systems</b>	Supporting activities to facilitate knowledge sharing and connect this with organisational and personal gain	Defects (correcting): Existing processes are incomplete so people are unclear about what to do	Design necessary activities, invest, manage, monitor, audit
<b>2.1.5 Secretarial support services</b>	Administrative support for the codification process	Defects (correcting): Templates are inadequate	Design templates and other supporting activities, resource, monitor

## 5.2 SYSTEM 2: INTERNAL TO INTERNAL: Administration

Process Name	Process Description	Process Issues (As Is)	Issue Rectification (To Be)
<b>2.2.1 Management Standard Operating Procedures (SOPs)</b>	Guidance for academic staff promoted to management positions	Defects (correcting): existing processes are missing or incomplete so people are unclear about what to do Under-utilized people: experience is not shared	Competency mapping linked with career management Staff training Objective skills audit
<b>2.2.2 Strategic management</b>	Principles of strategic leadership	Defects (correcting): existing processes are missing or incomplete so people are unclear about what to do Under-utilized people: experience is not shared	Competency mapping linked with career management Staff training Objective skills audit
<b>2.2.3 Community Engagement</b>	How to work with the community on a goodwill basis	Waiting (batching): delay until it seems worthwhile amount of work	Link with career management, audit

### 5.3 SYSTEM 2: INTERNAL TO INTERNAL: Research

Process Name	Process Description	Process Issues (As Is)	Issue Rectification (To Be)
<b>2.3.1 Researcher attributes</b>	How to persuade staff to share knowledge with other staff	Under-utilized people: staff not sharing experience	Establish criteria, approval, and applied in career development process, audit
<b>2.3.2 Organisational/Leadership</b>	Activities necessary to facilitate knowledge sharing between staff, which can be performed	Defects: (correcting) staff unsure what to do	Establish vision; strategy and procedures for cooperation at inter, intra, and individual levels of knowledge sharing; incentives; mechanisms; and establish infrastructure
<b>2.3.3 Individual Initiative/Roles</b>	How individuals can research	Defects: (correcting) blind spots Underutilized people: people not sufficiently sharing available knowledge	Staff understand their role as researchers and how to do it efficiently and effectively
<b>2.3.4 Group Accountability/Roles</b>	How groups can research together	Defects: (correcting) hoarding	Groups understand their role in doing collaborative research and how to do it efficiently and effectively
<b>2.3.5 Conducting Research</b>	How to become a strong researcher	Underutilized people: people not sufficiently sharing available knowledge	Individuals understand how to accelerate their learning in becoming world class researchers

## 5.4 SYSTEM 2: INTERNAL TO INTERNAL: Teaching

Process Name	Process Description	Process Issues (As Is)	Issue Rectification (To Be)
<b>2.4.1 Building a research team</b>	Growing research team capability against requirements	Under-utilized people: staff not sharing experience	Establish criteria, approval, and applied in career development process, audit
<b>2.4.2 Training junior researchers</b>	Teaching individual researchers how to research	Transportation: seniors too busy	Motivation for seniors
<b>2.4.3 Formal training</b>	Conducting staff training in classroom environment	Waiting (approvals): action learning principles	Small group workplace learning into performance approach, double-loop learning culture
<b>2.4.4 Training the experts</b>	Learning for senior staff	Transportation: time required to develop this advanced knowledge	Link to career management, reward and recognition mechanisms
<b>2.4.5 Building a teaching team</b>	Growing teaching team capability against requirements	Defects (correcting): inadequate process	Establish criteria, approval, and applied in career development process, audit
<b>2.4.6 Lecturing</b>	Designing and delivering teaching content for students	Under-utilized people: staff not sharing experience	Peer review, communities of practice
<b>2.4.7 Teaching Governance</b>	Establish teaching support group/unit	Overproduction: need to persuade staff of usefulness	Establish and monitor Teaching Support Unit

## 6.1 SYSTEM 3: INTERNAL TO EXTERNAL: Academic Governance

Process Name	Process Description	Process Issues (As Is)	Issue Rectification (To Be)
<b>3.1.1 Regulation of external partnerships</b>	Leadership of partnerships with local industry	Waiting (approvals): delays Defects (correcting): disagreement over direction	Stakeholder review, policy developed, Ministry approval, dissemination, implementation
<b>3.1.2 Identify industry partners</b>	Finding suitable research opportunities with local industry	Defects (correcting): blind spots	Targeted, systematic approach e.g. establish industry database and social network mapping
<b>3.1.3 Attract industry partners</b>	Persuading local industry to agree to research partnerships	Transportation: results take too long	Value proposition
<b>3.1.4 Relationship Management</b>	Establish trust-based sustainable relationships with local industry	Waiting (batching): time invested based on value perception	Relationship management training
<b>3.1.5 Project Management</b>	Managing the research project with industry	Defects (correcting): information not gathered	Project Management training
<b>3.1.6 Human resources</b>	Provide capability to resource projects	Waiting (approvals): inadequate resource planning	Resource planning decision tool

## 6.2 SYSTEM 3: INTERNAL TO EXTERNAL : Administration

Process Name	Process Description	Process Issues (As Is)	Issue Rectification (To Be)
<b>3.2.1 Funding</b>	Funding policy in conducting research with industry partners	Defects (correcting): confusion	Policy developed and implemented
<b>3.2.2 Intellectual Property</b>	Policy on intellectual property involving research with local industry	Defects (correcting): confusion	Policy developed and implemented
<b>3.2.3 Approvals</b>	Criteria for approval of research with local industry	Defects (correcting): criteria is inadequate	Criteria developed and implemented
<b>3.2.4 Commercialisation</b>	Creating revenue from research with local industry	Transportation: time taken to realize value Defects (correcting): blind spots	Create commercialisation unit
<b>3.2.5 Community Engagement</b>	Volunteering activity to help the local community	Over-production: value unclear	Community engagement

### 6.3 SYSTEM 3: INTERNAL TO EXTERNAL: Research

Process Name	Process Description	Process Issues (As Is)	Issue Rectification (To Be)
<b>3.3.1 Applied Research</b>	Analyse industry data	Under-utilized people: people not sharing	Standard Operating Procedure to capture best practice
<b>3.3.2 Create commercial opportunities</b>	Make revenues from research	Transportation: time required	Commercialisation Unit to drive
<b>3.3.3 National benefit</b>	Identify importance of research	Defects (correcting): blind spots	Commercialisation Unit to drive
<b>3.3.4 Leading edge research</b>	Communicate expertise	Over-production: value unclear, too complex	Commercialisation Unit to drive
<b>3.3.5 Knowledge flow mechanisms</b>	Ways to engage with industry	Over-production: inadequate socialization	Commercialisation Unit to drive
<b>3.3.6 Performance Metrics</b>	Measurement of research with local industry	Defects (correcting): blind spots	Commercialisation Unit to drive

## 6.4 SYSTEM 3: INTERNAL TO EXTERNAL : Teaching

Process Name	Process Description	Process Issues (As Is)	Issue Rectification (To Be)
3.4.1 Train industry	Industry staff to work with researchers on campus	Under-utilized people: people not sharing	HRM strategy, linked to competency gaps and broader knowledge strategy



## HOST ORGANISATIONS BUSINESS PROCESS MAPS USING KM AND TQM TO IMPROVE THE PROCESS OF KT

### 7.1 SYSTEM 1: EXTERNAL TO INTERNAL: Academic Governance

Process Name	Process Description	Process Issues classification	KM/TQM Rectification Considerations	TQM Rating
<b>1.1.1 National Coordination</b>	Ministry of Education coordinates external partnerships	<i>KM</i> Subjectivity: Highly tacit Incomplete coverage: blind spots	Stakeholder review conducted by independent third party	Red
<b>1.1.2 Identify External Partner</b>	Evaluate potential partners and the value they can bring	<i>KM</i> Subjectivity: Highly tacit Under-utilized people: intelligence not shared	Criteria established, relational capital database established, transparent scoring method to prioritize targets	Orange
<b>1.1.3 Contract</b>	Prepare appropriate specification supported by international law	<i>KM</i> System fault: legal processes are inadequate	Commercialization Unit should manage this for the researchers	Orange
<b>1.1.4 Agent</b>	Person(s) to identify partners and negotiate contracts	<i>KM</i> Subjectivity: Highly tacit	Commercialization Unit should manage this for the researchers	Red
<b>1.1.5 Attract Visitors</b>	Bringing partners for a short period	<i>KM</i> Subjectivity: Highly tacit (social capital) Systems fault: reactive not proactive	Social network analysis, database, specific knowledge acquisition strategy	Red (but seasonal Program at organisation Z is promising)
<b>1.1.6 Attract Collaborators</b>	Recruit partners for a full-time period	<i>KM</i> Subjectivity: Highly tacit (social capital) Systems fault: reactive not proactive	Social network analysis, database, specific knowledge acquisition strategy	Green
<b>1.1.7 Attract Partner organisations</b>	Recruiting joint ventures	<i>KM</i> Incomplete coverage: blind spots	Social capital and knowledge acquisition strategy, linked to competency gaps and knowledge strategy	Red
<b>1.1.8 Commercial research</b>	Paying partners for knowledge	<i>KM</i> Incomplete coverage: blind spots	Make v buy model, linked to career management and the broader knowledge strategy	Red
<b>1.1.9 Measurement</b>	Metrics to report knowledge sharing activity	<i>KM</i> Systems fault: no process TQM fault: no lead or lag indicators	Metrics to be designed, communicated, audited	Red

## 7.2 SYSTEM 1: EXTERNAL TO INTERNAL: Administration

Process Name	Process Description	Process Issue classification	KM/TQM Rectification Considerations	TQM Rating
<b>1.2.1 Attributes of Executives</b>	Skills to identify and capture opportunities regarding external knowledge	<i>KM</i> Subjectivity: Highly tacit Incomplete coverage: unaware of skill gaps	Competency mapping linked with career management Objective skills audit	Red
<b>1.2.2 International Best Practice</b>	Imitate the way leading international universities manage their external to internal knowledge flows	<i>KM</i> Subjectivity: Highly tacit System Fault: Systems lacking	Establish necessary administrative support units and/or improve function of existing units Write Standard Operating Procedures (SOPs) for these activities Objective annual audit	Red
<b>1.2.3 Knowledge Sharing Approvals</b>	The process of approving external to internal knowledge flows	<i>KM</i> Incomplete coverage: unaware of skill gaps System Fault: Systems lacking	Establish a Contract group responsible for specification Write Standard Operating Procedures (SOPs) for this activity Objective annual audit	Red
<b>1.2.4 Strategy</b>	Designing and implementing a future direction in terms of external to internal knowledge flows	<i>KM</i> Incomplete coverage: unaware of skill gaps System Fault: systems lacking Duplication: reinventing the wheel	Develop policy and procedures to establish shared vision about use of external experts	Red
<b>1.2.5 Make v Buy Decision</b>	Decision about whether to acquire knowledge from external sources or develop it internally	<i>KM</i> Incomplete coverage: no objective decision model System Fault: systems lacking TQM fault: no criteria to measure	Establish decision criteria, invite submissions, evaluate submissions against criteria, make decisions on resource ownership, i.e. external v internal	Red

### 7.3 SYSTEM 1: EXTERNAL TO INTERNAL: Research

Process Name	Process Description	Process Issue classification	KM/TQM Rectification Considerations	TQM Rating
<b>1.3.1 Attributes of External Researchers</b>	Criteria to evaluate suitability of external experts for research collaboration	<i>KM</i> Incomplete coverage: blind spots System Fault: systems lacking TQM fault: no criteria to measure	Establish criteria, approval, and applied in selection process; cost benefit analysis	Orange
<b>1.3.2 Attributes of Internal Researchers</b>	Criteria to evaluate suitability of internal experts for research collaboration	<i>KM</i> Incomplete coverage: blind spots System Fault: systems lacking TQM fault: no criteria to measure	Establish criteria, approval, and applied in selection process; cost benefit analysis	Red
<b>1.3.3 Nature of External to Internal Research Process</b>	Activities which enhance the flow of knowledge about research externally to internally	<i>KM</i> Incomplete coverage: blind spots Duplication: reinventing the wheel System Fault: systems lacking	Design Standard Operating Procedures (SOPs) in these activities, resource the activity, embed behaviors in job redesign, monitor via annual audit and include in career development review	Orange
<b>1.3.4 Research Tools</b>	Systems to enable research collaboration with external experts	<i>KM</i> System Fault: systems lacking TQM fault: no criteria to measure	Design systems in these areas, implement, resource, monitor via annual audit	Red

## 7.4 SYSTEM 1: EXTERNAL TO INTERNAL: Teaching

Process Name	Process Description	Process Issue classification	KM/TQM Rectification Considerations	TQM Rating
<b>1.4.1 Exchange</b>	Sending people overseas to learn	<i>KM</i> TQM fault: no criteria to measure outcomes or cost benefit	Specify outcomes, capture outcomes, measure tangible learning benefit at organisational and individual gain levels	Orange
<b>1.4.2 Academic staff teaching skills</b>	Training on teaching process for academic staff	<i>KM</i> Incomplete coverage: teaching process seems to be ignored	Establish teaching excellence support center with teaching experts brought in to train staff, resourced, monitored, and audited via subject and student surveys, as well as peer review	Orange
<b>1.4.3 HDR student supervision skills</b>	Training for academic staff on supervising higher degree research students	<i>KM</i> Incomplete coverage: HDR supervision process seems to be ignored	Establish HDR support center with teaching experts brought in to train staff, resourced, monitored, and audited via HDR annual reports, student feedback and progress, and external peer review	Orange

## 8.1 SYSTEM 2: INTERNAL TO INTERNAL: Academic Governance

Process Name	Process Description	Process Issue classification	KM/TQM Rectification Considerations	TQM Rating
<b>2.1.1 Knowledge brokers</b>	Formalising the role of knowledge sharing for certain academic staff responsible for diffusion	<i>KM</i> Systems fault: Does not exist formally, only voluntarily TQM fault: no accountability, performance measures	Identify suitable staff, appoint role, provide role description, embed in job redesign, provide resources and system support, link with career development review metrics, monitor and audit	Red
<b>2.1.2 Performance Metrics</b>	Measurement of knowledge sharing behaviours, attitudes, and activities	<i>KM</i> Incomplete coverage: metrics do not measure the full picture Systems fault: Does not exist formally, only voluntarily TQM fault: no accountability, performance measures	Lead and lag indicators need to be established, formalized, monitored, and audited	Orange
<b>2.1.3 Knowledge protection</b>	Management of intellectual capital and protection of commercially valuable outputs of collaboration	<i>KM</i> Systems fault: patents represent a limited view of IP output TQM fault: no connection with input measures, e.g. research budget etc.	Review and improve role of Patent Office, establish Commercialization Unit to lead the value created by research collaboration with appropriate resources, monitoring, and audit	Orange
<b>2.1.4 Enabling systems</b>	Supporting activities to facilitate knowledge sharing and connect this with organisational and personal gain	<i>KM</i> Systems fault: incomplete processes TQM fault: inadequate metrics	Design necessary activities, invest, manage, monitor, audit	Red
<b>2.1.5 Secretarial support services</b>	Administrative support for the codification process	<i>KM</i> Systems fault: incomplete processes TQM fault: inadequate metrics	Design templates and other supporting activities, resource, monitor	Red

## 8.2 SYSTEM 2: INTERNAL TO INTERNAL: Administration

Process Name	Process Description	Process Issue classification	KM/TQM Rectification Considerations	TQM Rating
<b>2.2.1 Management Standard Operating Procedures (SOPs)</b>	Guidance for academic staff promoted to management positions	<i>KM</i> Systems fault: incomplete processes TQM fault: inadequate metrics Knowledge loss/decay: learning by doing knowledge is not maintained or handed over	Competency mapping linked with career management Staff training Objective skills audit	Red
<b>2.2.2 Strategic management</b>	Principles of strategic leadership	<i>KM</i> Systems fault: incomplete processes TQM fault: inadequate metrics	Competency mapping linked with career management Staff training Objective skills audit	Red
<b>2.2.3 Community Engagement</b>	How to work with the community on a goodwill basis	<i>KM</i> Systems fault: incomplete processes TQM fault: inadequate metrics	Link with career management, audit	Red

### 8.3 SYSTEM 2: INTERNAL TO INTERNAL: Research

Process Name	Process Description	Process Issue classification	KM/TQM Rectification Considerations	TQM Rating
<b>2.3.1 Researcher attributes</b>	How to persuade staff to share knowledge with other staff	<i>KM</i> Duplication: work repeated unnecessarily System Fault: systems lacking TQM fault: no criteria to measure	Establish criteria, approval, and applied in career development process, audit	Red
<b>2.3.2 Organisational/Leadership</b>	Activities necessary to facilitate knowledge sharing between staff, which can be performed	<i>KM</i> System Fault: systems lacking TQM fault: no criteria to measure	Vision established; strategy and procedures for cooperation at inter, intra, and individual levels of knowledge sharing; incentives; mechanisms; and infrastructure established	Red
<b>2.3.3 Individual Initiative/Roles</b>	How individuals can research	<i>KM</i> Subjectivity: highly tacit Duplication: reinventing the wheel Knowledge loss: experience not shared	Staff understand their role as researchers and how to do it efficiently and effectively	Orange
<b>2.3.4 Group Accountability/Roles</b>	How groups can research together	<i>KM</i> TQM fault: not monitored	Groups understand their role in doing collaborative research and how to do it efficiently and effectively	Orange
<b>2.3.5 Conducting Research</b>	How to become a strong researcher	<i>KM</i> Incomplete coverage: blind spots Duplication: work that reinvents the wheel	Individuals understand how to accelerate their learning in becoming world class researchers	Red

## 8.4 SYSTEM 2: INTERNAL TO INTERNAL: Teaching

Process Name	Process Description	Process Issue classification	KM/TQM Rectification Considerations	TQM Rating
<b>2.4.1 Building a research team</b>	Growing research team capability against requirements	<i>KM</i> Subjective: tacitness Knowledge loss: experience not retained	Establish criteria, approval, and applied in career development process, audit	Orange
<b>2.4.2 Training junior researchers</b>	Teaching individual researchers how to research	<i>KM</i> Subjective: tacitness System fault: no reward and recognition	Motivation for seniors	Orange
<b>2.4.3 Formal training</b>	Conducting staff training in classroom environment	<i>KM</i> Incomplete coverage: lacks on-the-job context, immediacy	Small group workplace learning into performance approach, double-loop learning culture	Green
<b>2.4.4 Training the experts</b>	Learning for senior staff	<i>KM</i> Subjective: tacitness	Link to career management, reward and recognition mechanisms	Green
<b>2.4.5 Building a teaching team</b>	Growing teaching team capability against requirements	<i>KM</i> System fault: lack of metrics	Establish criteria, approval, and applied in career development process, audit	Orange
<b>2.4.6 Lecturing</b>	Designing and delivering teaching content for students	<i>KM</i> Subjective: tacitness Knowledge loss: experience not retained	Peer review, communities of practice	Orange
<b>2.4.7 Teaching Governance</b>	Establish teaching support group/unit	<i>KM</i> System fault: value unclear	Establish and monitor Teaching Support Unit	Red



## 9.1 SYSTEM 3: INTERNAL TO EXTERNAL: Academic Governance

Process Name	Process Description	Process Issue classification	KM/TQM Rectification Considerations	TQM Rating
<b>3.1.1 Regulation of external partnerships</b>	Leadership of partnerships with local industry	<i>KM</i> Incomplete coverage: value unclear	Stakeholder review, policy developed, Ministry approval, dissemination, implementation	Red
<b>3.1.2 Identify industry partners</b>	Finding suitable research opportunities with local industry	<i>KM</i> Subjectivity: highly tacit System fault: no reward and recognition	Targeted, systematic approach e.g. establish industry database and social network mapping	Orange
<b>3.1.3 Attract industry partners</b>	Persuading local industry to agree to research partnerships	<i>KM</i> Incomplete coverage: value unclear	Value proposition	Orange
<b>3.1.4 Relationship Management</b>	Establish trust-based sustainable relationships with local industry	<i>KM</i> Subjectivity: highly tacit	Relationship management training	Orange
<b>3.1.5 Project Management</b>	Managing the research project with industry	<i>KM</i> TQM fault: no metrics	Project Management training	Orange
<b>3.1.6 Commercial research unit</b>	Administrative support for external research partnerships	<i>KM</i> System fault: inadequate decision tools	Resource planning decision tool	Red
<b>3.1.7 Human resources</b>	Provide capability to resource projects			Red

## 9.2 SYSTEM 3: INTERNAL TO EXTERNAL: Administration

Process Name	Process Description	Process Issue classification	KM/TQM Rectification Considerations	KM/TQM Rating
<b>3.2.1 Funding</b>	Funding policy in conducting research with industry partners	<i>KM</i> System fault: information is inadequate	Policy developed and implemented	Red
<b>3.2.2 Intellectual Property</b>	Policy on intellectual property involving research with local industry	<i>KM</i> System fault: information is inadequate	Policy developed and implemented	Red
<b>3.2.3 Approvals</b>	Criteria for approval of research with local industry	<i>KM</i> System fault: process does not exist	Criteria developed and implemented	Red
<b>3.2.4 Commercialisation</b>	Creating revenue from research with local industry	<i>KM</i> System fault: unit does not exist	Create commercialisation unit	Orange
<b>3.2.5 Community Engagement</b>	Volunteering activity to help the local community	<i>KM</i> Subjectivity: tacitness	Community engagement	Orange

### 9.3 SYSTEM 3: INTERNAL TO EXTERNAL: Research

Process Name	Process Description	Process Issue classification	KM/TQM Rectification Considerations	TQM Rating
<b>3.3.1 Applied Research</b>	Analyse industry data	<i>KM</i> Subjectivity: tacitness	Standard Operating Procedure to capture best practice	Green
<b>3.3.2 Create commercial opportunities</b>	Make revenues from research	<i>KM</i> TQM fault: no measurement	Commercialisation Unit to drive	Orange
<b>3.3.3 National benefit</b>	Identify importance of research	<i>KM</i> TQM fault: no measurement	Commercialisation Unit to drive	Orange
<b>3.3.4 Leading edge research</b>	Communication expertise	<i>KM</i> TQM fault: no measurement	Commercialisation Unit to drive	Red
<b>3.3.5 Knowledge flow mechanisms</b>	Ways to engage with industry	<i>KM</i> Duplication: inefficient means of communication	Commercialisation Unit to drive	Orange
<b>3.3.6 Performance Metrics</b>	Measurement of research with local industry	<i>KM</i> TQM fault: no measurement	Commercialisation Unit to drive	Red

### 9.4 SYSTEM 3: INTERNAL TO EXTERNAL: Teaching

Process Name	Process Description	Process Issue classification	KM/TQM Rectification Considerations	TQM Rating
3.4.1 Train industry	Industry staff to work with researchers on campus	<i>KM</i> Subjectivity: tacitness	HRM strategy, linked to competency gaps and broader knowledge strategy	Red

## **APPENDIX (D)**

### **AR CYCLE 3 INSTRUMENT (INTERVIEW QUESTIONS)**

**KNOWLEDGE TRANSFER STUDY  
EXPLORING KT BLOCKAGES AT CASE-STUDY ORGANISATIONS AS  
PART OF AR CYCLE 3**

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INTERVIEW QUESTIONS TO ENGINEERING RESEARCHERS

**CONSENT FORM FOR PARTICIPANT**

THIS CONSENT FORM WILL BE HELD FOR A PERIOD OF 5 YEARS

Title: Engineering knowledge transfer: A proposed system for Saudi research institutions

Researcher: Moshary Al-Holaibi

- I have been given and have understood an explanation of this research project. I have had an opportunity to ask questions and have them answered.
- I understand that I may withdraw myself or any information traceable to me at any time up to one month from the date of the interview without giving a reason.
- I agree to be interviewed for the purposes of this research.
- I agree that the interview will be audio taped, and understand that, I may choose to have the recorder turned off at any time.
- I understand that if I have agreed to be interviewed, I may request to view and amend the transcripts of the interview.
- I understand that if I have agreed to be interviewed, a transcriptionist will hear the tapes. I understand that the transcriptionist will sign a confidentiality agreement ensuring the confidentiality of my information.

Signed: Signed by the participant (hard copy available)

Name:

Email:

(Please print clearly)

Date:

APPROVED BY THE RESEARCH SUPERVISOR

..... ON .....

*Remark: This interview follows a semi-structured design. The questions have been set having in mind flexibility to move horizontally or vertically during the interview, which is dependent on the respondent answers and the researchers' assessment during the interview. The attached transcription presents answers to each pre-set question –from the design stage- and follows it with what actually was said between the researcher and the interviewee during the interview in relation to the pre-set question.*

**Section 1: Respondent Details (Demographics)**

1. Name:
2. Organisation:

---

3. Position: (Tick one)

Research assistant  
 Researcher  
 Associate Lecturer  
 Lecturer  
 Senior Lecturer  
 Associate Professor  
 Professor  
 Assistant professor

4. Research Centre Affiliation:

5. Qualifications (Knowledge):

6. What is your main area of expertise? Please write up to four key words/phrases.

(Experience)

7. How long have you been employed as an academic?

8. How long have you been employed at your current University/Research Institute

---

(Personal Details)

9. Gender: Male/Female

10. Age:

**Section 3: Knowledge Flow**

This section asks you about the way knowledge flow internally and externally at your organisation.

Please tick each relevant one. Please note by knowledge transfer we mean that knowledge is exchanged, i.e. you send knowledge to another individual or group - or they send it to you (you receive knowledge).

Peter: As this is a face-to-face interview, am I supposed to ask these questions verbally and circle the respondents' choice during the interview? (YES)

11. When you consider the type of knowledge transfer *you personally* are involved with at work is it: (could be multiple response)

- a. Internal transfer, i.e. between you and your colleagues?
- b. A research collaboration between you and a knowledge provider? (no money is exchanged)
- c. A research collaboration between you and a knowledge user (e.g. Saudi engineering firm)?
- d. A commercial transaction, i.e. money is exchanged in return for knowledge?

12. If more than one, ask respondent to rank them in order of frequency using this table. Which of these do you do most frequently, which next, and so on.
- Internal transfer, i.e. between you and your colleagues?
  - A research collaboration between you and a knowledge provider? (no money is exchanged)
  - A research collaboration between you and a knowledge user (e.g. Saudi engineering firm)?
  - A commercial transaction, i.e. money is exchanged in return for knowledge?

Type of knowledge transfer	Involved (yes/no) Q15	Rank (1 <sup>st</sup> , 2 <sup>nd</sup> etc) Q16
Internal transfer, i.e. between you and your colleagues?		
A research collaboration between you and a knowledge provider? (no money is exchanged)		
A research collaboration between you and a knowledge user?		
A commercial transaction, i.e. money is exchanged in return for knowledge?		

I would now like to ask you some more questions about the type of knowledge transfer you are personally involved or two of the types of knowledge transfer you are involved with (if more than one answered in question 15). (maybe limit it to one if time is a problem in the interview)

Select main area from 15 or 16 above, e.g. internal transfer, then ask:

24. Does this mainly involve:

- you and one other person
- you and other people (by that we mean working with multiple others but one on one)
- you and a group of people
- your group and another group of people

25. Can you describe a situation where you were involved in knowledge transfer?

Now I'd like to explore this in more detail.

26. When did you recognise the need for knowledge transfer?

27. How was this knowledge transferred to you?

28. How did you use this knowledge?

29. How do you know the knowledge you gained works?

#### **Section 4: Barriers/Problems**

This section asks you about problems associated with knowledge flows internally and externally at your organisation.

##### ***Organisational Issues***

##### ***INTERNAL***



73. Do you feel the *organisational culture* encourages knowledge transfer between staff at your research institute? (Note: by culture we mean the behaviours and attitudes of staff, e.g. the normal way we do things around here)

- |            |   |
|------------|---|
| Yes        | 1 |
| No         | 2 |
| No comment | 3 |

74. Why do you feel that way?

### ***EXTERNAL***

75. Do you feel the *organisational culture* encourages knowledge transfer between staff at your research institute and external experts (i.e. people outside your organisation)? (Note: by culture we mean the behaviours and attitudes of staff, e.g. the normal way we do things around here)

- |            |   |
|------------|---|
| Yes        | 1 |
| No         | 2 |
| No comment | 3 |

76. Why do you feel that way?

77. Do you feel the *organisation provides you with the right tools* to support knowledge transfer between staff at your research institute? (Note: by tools we mean systems, technology, policies and procedures)

- |            |   |
|------------|---|
| Yes        | 1 |
| No         | 2 |
| No comment | 3 |

78. Why do you feel that way?

79. Do you feel the *organisation provides you with the right tools* to support knowledge transfer between staff at your research institute and external providers? (Note: by tools we mean systems, technology, policies and procedures)

- |            |   |
|------------|---|
| Yes        | 1 |
| No         | 2 |
| No comment | 3 |

80. Why do you feel that way?

### **Individual Issues**

As already discussed, Knowledge Transfer often involves an exchange between a person(s) with knowledge (knowledge provider) and a person seeking knowledge (knowledge seeker). I would now like to ask some further questions regarding your experiences as a knowledge seeker. Please refer to the following table to complete responses.

**INTERNAL KNOWLEDGE TRANSFER**

81. How important is the following factor to you when you are seeking knowledge from another colleague at your research institute? (i.e. internal knowledge transfer)?

Please rate the importance of each factor using this scale:

Not at all important	1
Not very important	2
Not important	3
Important	4
Very important	5
Extremely important	6

82. How important is the following factor to the other person, you believe, when you are seeking knowledge from another colleague at your research institute? (i.e. internal knowledge transfer)?

Please rate the importance of each factor using this scale:

Not at all important	1
Not very important	2
Not important	3
Important	4
Very important	5
Extremely important	6

**EXTERNAL KNOWLEDGE TRANSFER**

83. How important is the following factor to you when you are seeking knowledge from an external expert? (i.e. external knowledge transfer)?

Please rate the importance of each factor using this scale:

Not at all important	1
Not very important	2
Not important	3
Important	4
Very important	5
Extremely important	6

84. How important is the following factor to the other person when you are seeking knowledge from an external expert? (i.e. external knowledge transfer)?

Please rate the importance of each factor using this scale:

Not at all important	1
Not very important	2
Not important	3
Important	4
Very important	5
Extremely important	6

Table: Importance of Individual Factors				
Factor	Internal		External	
	Knowledge Seeker (You) Q 33	Knowledge Provider (Colleague) Q34	Knowledge Seeker (You) Q35	Knowledge Provider (External Expert) Q36
<i>Motivation</i>				
Trust in the other person				
High performance (good knowledge transfer) will be rewarded <i>Calculative reward</i>				
High performance (good knowledge transfer) will be recognised <i>Calculative approval</i>				
It will make a difference to the organisation <i>Personal outcome expectancy</i>				
The people involved are highly competent <i>Collective efficacy beliefs</i>				
The people involved produce high quality work <i>Collective outcome expectancy</i>				
<i>Ability</i>				
Effective communication skills				
Explaining <i>what</i> to do				
Explaining <i>how</i> to do something				
Explaining <i>why</i> something is done				
Small <i>gap</i> in understanding of the topic, rather than a large gap				
<i>Psychological Contract</i>				
Control over the process (i.e. how knowledge transfer is happening) <i>Locus of control</i>				
Democracy in the relationship (i.e. equal decision making or power) <i>Network constraints</i>				
Organisational commitment (positive emotional relationship with the organisation they work for) <i>Affective attachment</i>				
Job satisfaction (how much they enjoy their job) <i>Employee Satisfaction</i>				
Trust leadership of their organisation <i>Trust</i>				
Have a long-term career plan with their organisation (i.e. want to stay)				

<i>Careerism</i>				
<i>Knowledge Usage</i>				
Whether the knowledge will be used				

Now let us discuss some of these issues in more detail.

We will focus on one of the topics from each perspective. (Moshary you should choose one of the topics rated the highest (i.e. most important) by the respondent, for each question).

85. When we discussed internal knowledge transfer, you mentioned

\_\_\_\_\_ (mention topic and write it down) as one of the more important issues for you. Would you please tell me more about why this is important to you when you are seeking knowledge from a colleague (i.e. internal source).

86. When we discussed internal knowledge transfer, you mentioned

\_\_\_\_\_ (mention topic and write it down) as one of the more important issues for the other person. Would you please tell me more about why you think this is important to others when you are seeking knowledge from a colleague (i.e. internal source).

87. When we discussed external knowledge transfer, you mentioned

\_\_\_\_\_ (mention topic and write it down) as one of the more important issues for you. Would you please tell me more about why this is important to you when you are seeking knowledge from an external expert (i.e. external source).

88. When we discussed external knowledge transfer, you mentioned

\_\_\_\_\_ (mention topic and write it down) as one of the more important issues for the other person. Would you please tell me more about why you think this is important to others when you are seeking knowledge from an external expert (i.e. external source).

### ***Knowledge Issues***

89. Do you think the knowledge itself is a problem in knowledge transfer, i.e. is it just difficult to explain?

Yes	1
No	2
No comment	3

90. Why do you feel that way?

### ***National Issues***

91. Do you feel the *national culture* creates problems associated with knowledge transfer between staff at your research institute and external knowledge suppliers,

e.g. overseas universities, consultancies, or other external experts? (By national culture we mean the values and norms of the society).

- |            |   |
|------------|---|
| Yes        | 1 |
| No         | 2 |
| No comment | 3 |

92. Why do you feel that way?

93. Overall, how well is knowledge transferred within your organisation, i.e., between staff working for your institute? [Please note by knowledge transfer we mean that knowledge is exchanged, i.e. you send knowledge to another individual or group, or they send it to you (you receive knowledge).]

- |   |                            |
|---|----------------------------|
| 1 | Extremely unsatisfactorily |
| 2 | Very unsatisfactorily      |
| 3 | Unsatisfactorily           |
| 4 | Satisfactorily             |
| 5 | Very satisfactorily        |
| 6 | Extremely satisfactorily   |

94. Why do you feel that way?

95. How do you feel this situation could be improved?

96. Overall, how well is knowledge transferred between your organisation and knowledge suppliers, i.e. other universities, consultancies, or other external experts?

- |   |                            |
|---|----------------------------|
| 1 | Extremely unsatisfactorily |
| 2 | Very unsatisfactorily      |
| 3 | Unsatisfactorily           |
| 4 | Satisfactorily             |
| 5 | Very satisfactorily        |
| 6 | Extremely satisfactorily   |

97. Why do you feel that way?

98. How do you feel this situation could be improved?

99. Overall, how well is knowledge transferred between your organisation and knowledge users, i.e. Saudi firms?

- |   |                            |
|---|----------------------------|
| 1 | Extremely unsatisfactorily |
| 2 | Very unsatisfactorily      |
| 3 | Unsatisfactorily           |
| 4 | Satisfactorily             |
| 5 | Very satisfactorily        |
| 6 | Extremely satisfactorily   |

100. Why do you feel that way?

## Section 5: Roles

### INTERNAL TRANSFER

101. Is internal knowledge transfer - i.e. the exchange of knowledge with your colleagues at the Research Institute – a formal part of your job? (By formal we mean it is part of your job description)

- |            |   |
|------------|---|
| Yes        | 1 |
| No         | 2 |
| No comment | 3 |

If no, ask Q 54, otherwise go to Q55.

102. Should internal knowledge transfer be a formal part of your job? (By formal we mean it is part of your job description)

- |            |   |
|------------|---|
| Yes        | 1 |
| No         | 2 |
| No comment | 3 |

103. Why do you feel that way?

104. Should your research institute appoint staff as specialists to facilitate the flow of knowledge inside your organisation?

- |            |   |
|------------|---|
| Yes        | 1 |
| No         | 2 |
| No comment | 3 |

105. Why do you feel that way?

### EXTERNAL TRANSFER

106. Is external knowledge transfer - i.e. the exchange of knowledge with external experts – a formal part of your job? (By formal we mean it is part of your job description)

- |            |   |
|------------|---|
| Yes        | 1 |
| No         | 2 |
| No comment | 3 |

If no, ask Q 59, otherwise go to Q60.

107. Should external knowledge transfer be a formal part of your job? (By formal we mean it is part of your job description)

- |            |   |
|------------|---|
| Yes        | 1 |
| No         | 2 |
| No comment | 3 |

108. Why do you feel that way?

109. Should your research institute appoint staff as specialists to facilitate the flow of knowledge from external experts into your organisation?

- |            |   |
|------------|---|
| Yes        | 1 |
| No         | 2 |
| No comment | 3 |

110. Why do you feel that way?

## Section 6: SOLUTIONS

### ORGANISATIONAL ISSUES

If respondent answered no to Q27, ask Q63, otherwise ask Q64.

111. You mentioned in Q27 that organisational culture was a problem with knowledge transfer at your Research Institute, how do you think this situation could be resolved?

If respondent answered yes to Q27, ask Q64, otherwise ask Q65.

112. You mentioned in Q27 that organisational culture was NOT a problem with knowledge transfer at your Research Institute, how else do you think the organisation could improve knowledge transfer?

### INDIVIDUAL ISSUES

(you will need to go quickly back to the answers recorded for Q37 and Q38)

113. You mentioned in Q37 and Q38 that \_\_\_\_\_  
(mention the key issues) was a problem in INTERNAL knowledge transfer, how do you think the situation could be improved?

(Go quickly back to the answers recorded for Q39 and Q40)

114. You mentioned in Q39 and Q40 that \_\_\_\_\_  
(mention the key issues) was a problem in EXTERNAL knowledge transfer, how do you think the situation could be improved?

### KNOWLEDGE CHARACTERISTIC ISSUES

115. You mentioned in Q41 that \_\_\_\_\_ (mention the key issues) was a problem associated with the knowledge itself in knowledge transfer, how do you think the situation could be improved?

## Section 7: Conclusion

116. Are you convinced that Saudi Arabian research institutions still require knowledge transfer in order to be competitive on a global scale, or do you believe that they are already internationally competitive?

- |   |   |
|---|---|
| 1 | Still need for more knowledge from external knowledge suppliers |
| 2 | We no longer need external knowledge suppliers                  |
| 3 | No comment  |

117. Why do you feel that way?

118. Are Saudi Arabian firms satisfied with the performance of Saudi Arabian research institutions in providing knowledge that is equivalent to what they might obtain from other institutions in other countries?

- Extremely unsatisfied with the knowledge provided by Saudi institutes 1  
2 Very unsatisfied with the knowledge provided by Saudi institutes  
3 Unsatisfied with the knowledge provided by Saudi institutes  
4 Satisfied with the knowledge provided by Saudi institutes  
5 Very satisfied with the knowledge provided by Saudi institutes  
6 Extremely satisfied with the knowledge provided by Saudi institutes  
119. Why do you feel that way?  
120. Do you have any further comments or anything we have missed?



# APPENDIX (E)

## KT BARRIERS

### HOST ORGANISATIONS KNOWLEDGE BLOCKAGES FINDINGS AND ANALYSIS

**Note:** the code numbers are based on a complex coding process that is not presented in this appendix. Code numbers do not necessarily follow the numerical sequence of each section.

#### 1. KNOWLEDGE CHARACTERISTICS LEVEL OF ANALYSIS

3.2 KNOWLEDGE CHARACTERISTICS/CAUSAL AMBIGUITY [Sources: 16 / Quotes: 54]					
Code	Knowledge blockage	Analysis summary	Sample coded reference quote/s	Analysis	Rating
3.2.1	Ambiguity As To Choice Of Domain	A knowledge domain needs to be identified for KT. Trying to transfer all kinds of knowledge with the same intensity will only result in dividing the intensity on more flow streams, hence, less speed of knowledge flow.	“we are not sure ...You might say [that the most important knowledge focus for the organization is] space research, or I might suggest it is the petrochemical research. We are not sure...”	Domain concerns the nature and scope of the knowledge to be transferred. Organisational members expressed the need for guidance in (1) the identification of focus areas; and (2) the allocation of resources and implementation of procedures. Currently, members seem not to know what knowledge is most important to their organisations. It is a situation which gives rise to a lack of focus and clarity, which, in turn, represented a barrier to results. Similarly, trying to transfer various kinds of knowledge at the same level of intensity may result in dividing the intensity on each flow stream, hence, reducing the speed of transfer. Although there are defined	Orange

3.2 KNOWLEDGE CHARACTERISTICS/CAUSAL AMBIGUITY [Sources: 16 / Quotes: 54]					
Code	Knowledge blockage	Analysis summary	Sample coded reference quote/s	Analysis	Rating
				targeted technologies in the host organisations, AR participants see them as neither clearly nor strategically defined.	
3.2.2	Knowing The Meaning of KT	Most participants do not recognize the framework of KT and what it entails from an understanding perspective.	"... you have to first define what you mean by KT, is it existing knowledge? I understand that KT is that a technology existing in a western university for example is transferred to Saudi Arabia and then used for technological and commercial purposes but what does that really mean..."	Interviews conducted at the three host organisations, revealed an obvious lack of understanding of what KT is about. The definition of KT, as well as its purpose, goal and domain were vague to respondents in research positions, who expressed necessity for explanation. Such barrier also might lead to other obstruction such as resisting change to programs, which serve the objectives of KT as opposed to viewing it as a vague and ambiguous concept.	Orange
3.2.3	Basic Knowledge As Prerequisite For KT	Given the vast knowledge levels in engineering and technology, it is confusing to researchers what knowledge depth level they need to start at to proceed with building their capabilities to reaching the goal.	"We may be able to buy the IP for commercial based knowledge but it is not possible to get strategic based knowledge even if we wanted to pay for the IP because its not for sale. The [a Western country] wanted to retain their nuclear power technology IP. We realized that we needed to craft cooperation agreements very professionally to achieve successful KT "  "it's not the president, it's the ministry of finance who will need justifications for what they would consider ill decisions. They might simply question why are you conducting research with risk that is costing us 5 billion, at a time that you can wait and buy it ready made for the same price from its IP owners with no risk of getting out with nothing,	The data indicates that lack of direction in pursuit of advanced knowledge presents a costly barrier to KT. External research organisations express the attitude that Saudi researchers possess little of the basic knowledge in order to qualify as collaborators. In order to compete over strategic knowledge, basic competence must first be demonstrated. Only then will others engage in the process of mutual exchange. The issue here is that researchers do not possess the knowledge and direction to recognize what they are looking for (i.e. a comprehensive process) for achieving KT at the advanced technological level. This has implications for decision-makers involved in "make vs. buy" calculations, where the decision whether to generate, or simply to buy, the IP of a scientific area may arise. Advantages and disadvantages must be weighed and clearly understood. Sustainability and building capability may be considered in these decisions, but certainly causal ambiguity of what is necessary and needed and what is practically not is a real barrier to guide KT activities, especially given the fact that generating knowledge for a wider purpose may be advantageous despite higher risk.	Orange

3.2 KNOWLEDGE CHARACTERISTICS/CAUSAL AMBIGUITY [Sources: 16 / Quotes: 54]					
Code	Knowledge blockage	Analysis summary	Sample coded reference quote/s	Analysis	Rating
			like you did now? So they ask why do you start from scratch?"		
3.2.4	Ambiguity As To Competitiveness And Problem-Solving	There is unclear direction on what knowledge to build internally and what knowledge to acquire	<p>"the way I see the problem... is that we are focusing on one issue and forgetting the other issues... we are not really doing much or we are not learning from other countries experience... Why [Organisation Y], from my view is finding difficulty competing? Three things: (1) Professional: the human resources that are available are not enough to perform these highly skilled tasks that are required by companies. (2) The performance needs to be high and (3) ofcourse the rewards or the money or the financial support needs to be regulated"</p> <p>"What they miss is [pause] actually I don't really know..."</p>	Management failed to demonstrate understanding of competitiveness at a level sufficient to communicate to their researchers where such competitiveness could practically be sourced. Not knowing where competitiveness lies resulted in confusion among leaders and researchers which in turn obstructs KT. Momentum in KT requires clear definition as to the nature and source of competitiveness. Partial or selective consideration of interrelated issues is problematic. A related challenge lies in the failure to assess and diagnosis problems and the consequent inability to solve them. Such inability affects researchers' morale and causes them to lose trust in activities related to processes such as KT due to the many problems that they perceive KT alone cannot solve.	Orange
3.2.5	Contextual Uniqueness Distance-Related Ambiguity	The relationship between knowledge ambiguity and distance seems proportional as a KT barrier	"Being at a distance from the sources of science and technology, we continue to do research and our research programs every year are in the form of international journal publications, conference proceedings, patents and getting more projects from the industries. They are all by themselves unique. This is the uniqueness."	Because it is difficult to simply imitate leading international research institutes with the hope of establishing replicas in Saudi Arabia, ambiguity in how the host organisations can achieve such standard of operability is a barrier to the KT process. Close proximity facilitates high-fidelity transmission (i.e. complete information with negligible noise). On the other hand, as the distance separating the source and the receiver increases, the recipient is required to fill in gaps and correct transmission errors in the knowledge conveyed. Ambiguity compounds the cost and difficulty of transmission, as it renders information less susceptible to search, hence frustrating diffusion. High-fidelity transmission gives proximate actors sufficient insight to receive and build on	Red

3.2 KNOWLEDGE CHARACTERISTICS/CAUSAL AMBIGUITY [Sources: 16 / Quotes: 54]					
Code	Knowledge blockage	Analysis summary	Sample coded reference quote/s	Analysis	Rating
				knowledge, where on the other hand, more distant actors fail, which proposition is supported in the responses.	
3.2.6	Ambiguity In Explaining Ideas	When people do not understand research ideas, they avoid it. This includes the leadership at host organisations where they hesitate to risk resources for the same of unclear ideas.	"The only thing is that how you can apply it [knowledge], and convincing people that this will really work. Right now if I tell you make your house operated by solar, then you might put a big question mark and you might not sleep at night. For me, this is a really good investment for the future but for you, oh god, is this going to work or not, what if something wrong happens, it will be waste for me"	KT requires initiatives and experimentation as to what works for researchers and what does not. When researchers experience ambiguity about new initiatives, they tend to avoid such 'experimentation'. This leads to be a barrier to KT ideas.	Red

<b>3.3.1 KNOWLEDGE CHARACTERISTICS /COMPLEXITY</b>					
<b>Code</b>	<b>Knowledge blockage</b>	<b>Analysis summary</b>	<b>Sample coded reference quote/s</b>	<b>Analysis</b>	<b>Rating</b>
<b>3.3.1.1</b>	Advanced Technology IP Issues	The lack of ownership over advanced technology at host organisations resulted in IP issues when conducting joint research because the overseas partner usually has a strong IP record while host organisations don't.	"But for example the Nano technology, because it is an advanced technology, we mostly get the knowledge on this subject from external sources... I find IP issues to be the main issue. We are required to look after many IP issues that could prevent KT due to non-ownership of knowledge."	Countries with achievements in specific fields acknowledge these capabilities as strategic and subject to protection as IP. The host organisations seek advanced technologies but cannot reciprocate in kind; instead opting to purchase such knowledge. In many cases, however, money is insufficient as a means of exchange; i.e. the knowledge at issue is not for sale. The barrier here is not mere complexity itself, but the strategic value of that complexity, hence the reluctance of certain entities to share this knowledge. This barrier is particularly acute when host organisations deal with research institutions across national borders and where different governments may have different positions on political matters.	Red
<b>3.3.1.2</b>	Accountability to Participate	Host organisations engage in many joint research projects but they acknowledge that their contribution is limited in comparison with counter partners. This causes complexities.	"... [t]he problem in this case is that you have to participate in the research activity and ensure that it will end up with patenting.".	Where research is collaborative, KT should benefit the collaborators on a substantially equal basis. Complex knowledge presents a barrier where there is imbalance of capabilities. The data reveal that diminished capabilities by host organisations caused them to fall behind in research, take fewer shares in the work, and hence gain fewer benefits of KT. This cataclysm is compounded over time and through the accumulation of projects running in this manner. The main objective of the collaboration is therefore altered.	Red
<b>3.3.1.3</b>	Individual Limitations	Complexity partially occurs when individuals have to figure out multidisciplinary issues.	"... there are efforts that cannot be achieved on an individual level."	One of the real barriers to KT related to complexity is the multidisciplinary nature of the knowledge to be transferred. Multiple disciplinary requirements demand involvement of teams or groups, which mean	Red

3.3.1 KNOWLEDGE CHARACTERISTICS /COMPLEXITY					
Code	Knowledge blockage	Analysis summary	Sample coded reference quote/s	Analysis	Rating
		<p>Researchers find little synergy to deal with complex engineering problems due to non-availability of a multidisciplinary team. They have difficulty finding overseas experts when they realise that a niche area expert is not available on board.</p>	<p>"... as you know, if I'm a geophysicist and I want to build a system, then I need electrical engineers, electrical communication engineers, because this is not my field. For that reason we join other people to help us in some steps"</p> <p>"It's not only useful, it's a must. In research, there's no way you can do research by your own nowadays you cannot find one single successful professor either like a normal professor without global collaboration and multidiscipline collaboration. We need nowadays a multidisciplinary collaboration; we need something from computer background, in mathematical, biology, chemistry. In our field, we are seven different divisions. We run several samples from different areas of collaborations. This is a must."</p>	<p>more management and logistical skills and resources. It is extremely difficult to transfer complex knowledge via KT using only one individual.</p>	
3.3.1.4	Economical Feasibility, Capacity And Limitations Of Time	The high costs involved in advanced technology, coupled with uncertainty in outcomes create a considerable barrier to KT	"The problem is therefore, they will not object to start with us on anything from scratch. The problem from our side, is that if we go in this risky path, then would this cooperation result in obtaining a new technology or something tangible and useful? This is the gamble. We don't know. We would have to pay a lot of money, establish the research, fund it, and then we might reach nothing, and that's the main hurdle in making these decisions. The problem is that there is high possibility that big research efforts can have no results at the end. This may cause inability to justify all the money spent and this could cause problems for the executives with the government."	Even if all the above were dealt with efficiently; economic feasibility is in many cases the final arbiter. The high costs involved in advanced technology, coupled with uncertainty in outcomes create a considerable barrier to KT, especially in an environment dominated by so-called high-tech experts. A related barrier to KT is therefore lack of capacity to use or apply complex knowledge. Why would someone or a group of researchers put tremendous efforts to transfer complex knowledge when the infrastructure on the national grounds does not allow for it to be sued or applied? Lack of capacity impacts the transfer of complex knowledge. Clearly, readiness of infrastructures to accept complexity of technology exists as a barrier. Time is	Orange

3.3.1 KNOWLEDGE CHARACTERISTICS /COMPLEXITY					
Code	Knowledge blockage	Analysis summary	Sample coded reference quote/s	Analysis	Rating
			<p>"The US one was too difficult for us to accept or implement. It was too difficult to be applied here... the administrative process was complex. For example, would the Australian process be similar to ours?... The kingdom is different than many parts of the world in terms of the environment and in terms of the facilities that we have."</p> <p>"if the technology is difficult or complex then it will require a long time to be acquired and be applied."</p>	also at issue, as complex knowledge requires time to explain and disseminate among a team of researchers, especially where AC is low as in the case of new researchers. Such time and AC factors may severely affect the KT activity. Delays can occur due to the complexity nature of knowledge as well as add additional stress. The matter of time planning needs to be addressed.	
3.3.1.5	Local Industry Issues	Although the case-study organisations are non-profit governmental bodies, they seem to position themselves as profit-oriented when dealing with the local industry.	<p>"[B]ecause of the competencies. I mean you cannot deny that. You cannot compare the outcome coming from Organisation Y or other local universities with research outcomes coming out from MIT or Stanford, or Cambridge or those guys. The positions of these universities is different so, naturally the results and the competencies they have is different and for those industrial firms like ARAMCO and SABIC, who have the money, they can request any experience house to do the research for them so, its an open market."</p> <p>"[W]e are talking about companies. Companies need performance. Performance needs skilled professionals. If we cannot perform outside in the industry then we cannot compete as they ... I mean, if we cannot have the same resources as our competitors, then we cannot perform... we don't have the knowledge."</p>	Although the case-study organisations are non-profit governmental bodies, they seem to position themselves as profit-oriented. They assign relatively less attention to strategic research, for research sake, as compared with their counterparts in Europe and North America. Despite large sums of money at their disposal, the organisations seem to expect national initiative in such research. As a consequence, the host organisations expressed inability to share experience and knowledge with local industries, especially in advanced domains due to the focus on profit-oriented results as opposed to process. On the other hand, from the organizations' perspective, local researchers are less competitive as compared to international research advisers, which limits KT as between the case-study organisations and the local industries. The host organisations acknowledge this barrier but have yet to address it clearly. This barrier needs to be addressed in order to facilitate KT with the local industry.	Orange

<b>3.3.1 KNOWLEDGE CHARACTERISTICS /COMPLEXITY</b>					
<b>Code</b>	<b>Knowledge blockage</b>	<b>Analysis summary</b>	<b>Sample coded reference quote/s</b>	<b>Analysis</b>	<b>Rating</b>
<b>3.3.1.6</b>	Documentation Issues	Documentation is not formalized nor standardized across the case-study organisations.	"If you retain it here, then you can do it, but if you don't have the steps to build, design then you don't have development knowledge with you."	In order to retain the KT experience, it is important to document the knowledge being transferred. When the knowledge of focus is complex, documentation becomes complex as well and need much further effort to correctly represent it. This slows down the process of KT and could become a barrier to its development. Documentation is an important part of KT and requires preparation to ensure KT is taking its full momentum with an efficient documentation practice. At the moment, documentation procedures are not formalized nor standardized across the host organisations' research centers, individuals and units.	Orange
<b>3.3.1.7</b>	Legal Issues	IP department find the area of IP governance complex and outsource the job to overseas experts. Building this capability is seen as too complex.	"In fact, we went to Organisation Xs' IP department recently to improve this agreement for future use and we found that they don't have knowledge about this, really."	As documentation is difficult to encapsulate complex knowledge so is bounding the knowledge flow of complex knowledge in a legal structure that could guarantee the effectiveness and commitment of parties involved to conduct an efficient KT process. There are so many details when complexity of knowledge exists and unless these details are addressed legally, there is possibility that important knowledge may not be transferred properly. The legal aspect is considered a barrier to KT of complex knowledge. This needs to be addressed.	Orange
<b>3.3.1.8</b>	Human Factor Reaction To Complexity	Low motivation to challenge the issues faced in research occurs at host organisations. A main reason for this is the complexity of some issues that require persistent experimentations and support	"in most of the cases, I just skip this knowledge and look for other resources."  "In some cases and some areas yes. People here, I have people here working with us and are experts for lets say around 30 years but he is an expert in one particular subject. If you want him to open a new dimension you will always feel he is hesitant and he doesn't want to really go their."	Researchers need to be ready on how to deal with complex knowledge. They need to be aware of the complications and correct course of action when encountering research difficulties. Many opt to give up without anyone knowing. They would just pass through the project to reach an end, and get over with it. However, the main objective of many of the case study organisations research projects is to generate knowledge and not just to reach the final stage. The attitude and practices of researchers need to be visited	Orange



3.3.1 KNOWLEDGE CHARACTERISTICS /COMPLEXITY					
Code	Knowledge blockage	Analysis summary	Sample coded reference quote/s	Analysis	Rating
				to align it with what knowledge complexity might require. This needs to be addressed. Otherwise, in a few years time, most researchers would have skipped all the important knowledge and only have a shallow understanding of their fields. This kind of attitude if sustained could be a great barrier to KT in complexity situations. In a response to this issue, a respondent raises the attitude of not only new researchers but also senior researchers who have been used to the technologies and methods they were used to. They have felt attached to what they do for decades and do not want to advance their knowledge if it will mean a transformational change will take place.	
3.3.1.9	Research Partnership Issues	Knowing more about the market of research institutions is critical in assessing the selection and tactics to engage. This area is not provided sufficient attention.	"I should have a wide range of knowledge about external research centers. I should have knowledge about the legal issues. I should have knowledge about the requirements for each institute."	When researchers work on complex KT, they require tools to help them gather information, data and relevant knowledge. It is important not to undermine the importance of assistance when needed, to avoid slowing down the process. In order to back up the researchers with necessary support, it is important to make available many resources to them. The absence of such information, which is the case now, is considered a barrier to effective KT of complex knowledge.	Green
3.3.1.10	Scale And Funding	Instead of using allocated governmental feed-in every year, some internal staff feel that profits should be emphasized.	"Of course this is on large scale and we are working now on a couple of projects that we will talk about later as how we can scale it."  "... I mean we should not be a profitable organisation, firstly. This is an academia ...".	The host organisations are non-profit governmental bodies with guaranteed budgets, but they feel they should make profits to reduce their financial dependence on the Saudi government. Instead of using allocated governmental feed-in every year, some internal staff feel that profits should be emphasized. The matter of restructuring the allocation of resources needs to be addressed.	Orange

3.3.2 KNOWLEDGE CHARACTERISTICS/ KNOWLEDGE COMPETENCY / KNOWLEDGE SPECIFICITY					
Code	Knowledge blockage	Analysis summary	Sample coded reference quote/s	Analysis	Rating
3.3.2.2	Contextualising knowledge from overseas	Inheriting experience from others who are in far proximity is difficult to contextualise because some knowledge has high specificity to where it is located.	We asked them to provide us with case studies of other nations experiences in this field [KT] and we told them we wanted the [] experience to be inherited. They gave us several options to choose from ... The US one was too difficult for us to accept or implement. It was too difficult to be applied here.	The data findings suggest that specificity is attributed with distance, which is one of the major KT issues for Saudi Arabia. AR participants find it difficult to contextualize knowledge transferred from overseas locations. The distance between the knower and seeker is an important condition for translating ideas because it is attributed with high specificity. This suggests that finding ways to reduce the geographical or spatial gap between the knower and the seeker may reduce the specificity of knowledge.	

<b>3.3.3 KNOWLEDGE CHARACTERISTICS / TACITNESS</b>					
<b>Code</b>	<b>Knowledge blockage</b>	<b>Analysis summary</b>	<b>Sample coded reference quote/s</b>	<b>Analysis</b>	<b>Rating</b>
<b>3.3.3.1</b>	Difficulty Of Expression	Many researchers explained that clarity of expression is an issue to them both internally and externally.	"Its difficult to explain ... what I'm trying to say is that... may be I'll try to think of an example, later on."	KT takes place when effective communication is maintained. Effective communication is maintained when clarity in expression is practiced. Clarity in expression is practiced when the person expressing an idea presumably understand the idea very well to the level that his or her cognitive abilities allow linking the idea to reality so others can see this link and understand the concept behind it. People understand an idea or concept very well when they internalize knowledge such as experts or professionals in the field. The barrier in KT is therefore layered in the stages explained above. Many researchers explained that clarity of expression is an issue to them both internally and externally. It is a barrier to KT that experts sometimes do not know how to express what they know to specific types of audience or unable to link what they know to reality that makes sense to the seeker.	Red
<b>3.3.3.2</b>	Unlearning tacit knowledge	It is very difficult to unlearn tacit knowledge. This is because it became part of the unconscious cognitive memory. Participants find difficulty in replacing transferred knowledge with their tacit knowledge.	"In each main phase, we have clear steps that we are used to. We ask him the question of: how to change them ? "  "If you develop a project with a partner and you can't repeat it [you only repeat what you were used to before] then this is not real development. I hope you agree with me."	Many engineering disciplines rely on practical expertise such as delicate experimental processes that are very difficult to explain on paper. They have been doing those experiments for years in a way they were used to. When sharing knowledge of this sort even if the expression barrier was lifted as suggested in section (3.3.3.1), it is still difficult for the seeker to adapt to new practices without additional interacting practice. This kind of interaction, if absent, is suggested to cause a barrier to KT. In many collaborations, although well explained and codified, researchers are not able to replicate the experimental knowledge they transferred from external experts after a research project is completed because they are not able to unlearn their original practice. Lack of hands-on practice to adopt new tacit knowledge was seen as a main reason. This is why they continue to rely on external experts and	Red

<b>3.3.3 KNOWLEDGE CHARACTERISTICS / TACITNESS</b>					
<b>Code</b>	<b>Knowledge blockage</b>	<b>Analysis summary</b>	<b>Sample coded reference quote/s</b>	<b>Analysis</b>	<b>Rating</b>
				demand further guidance.	
<b>3.3.3.3</b>	Personal Ownership Of Tacit Knowledge	It is a barrier to KT when tacit knowledge holders prefer to store it in their minds.	"There is no way to force someone internal here to give knowledge."	Transfer of knowledge could take the form of sharing documents, designs and drawings, guidelines in the form of audio or video recordings, etc. However, most tacit knowledge is characterized to be held by its owners in their minds. This stigma requires their full cooperation to disseminate this knowledge to others using meetings, speeches and hand-on workshops. This kind of approach to share tacit knowledge requires the provider to be willing, motivated and helpful to allow others to absorb the knowledge domain. It is a barrier to KT when tacit knowledge holders prefer to store it in their minds. This means the organization has no control of over this kind of knowing, which becomes a barrier to KT.	Orange
<b>3.3.3.4</b>	Transforming Tacit Knowledge To Explicit Resources	tacit knowledge to be documented would require huge encyclopaedias to cover all possibilities.	"Almost everyday, to give you multiple examples like the other day a student came over and she had a very small piece of aluminium and she had glued some Nano wires on top of it and she wanted to be able to stick it on a bigger piece so that they can do critical point drying, like, it should be frozen at a certain temperature for it to be activated at you know while they are doing an electrical testing so the small piece had to be stuck in such a way that when it is spinning at high-speed it shouldn't be crashing out and you wouldn't exactly want to put tape on it because when you remove the tape, the Nano wires come out and then we just gave her two options. One is that we don't exactly glue because silicon wafers are very thin and if sticks and you try to remove	Trouble shooting documents usually cover specific step-by-step procedures to overcome technical difficulties. These resources face the tough challenge that it is very specific and cannot apply to even the slightest differences. Such tacit knowledge to be documented would require huge encyclopaedias to cover all possibilities for troubleshooting situations for example. Such kind of KT faces the barrier of chronic incompleteness. This needs to be addressed.	Red

3.3.3 KNOWLEDGE CHARACTERISTICS / TACITNESS					
Code	Knowledge blockage	Analysis summary	Sample coded reference quote/s	Analysis	Rating
			<p>then it will crack the wafer, you are wasting a bran new wafer for nothing, so, we gave them an idea like using a photo resist called SU8 or another film called folium vacuum".</p> <p>"The only thing is that how you can apply it, and convincing people that this will really work."</p>		

<b>3.4 FINDINGS ON KNOWLEDGE CHARACTERISTICS OF LANGUAGE</b>					
<b>Code</b>	<b>Knowledge blockage</b>	<b>Analysis summary</b>	<b>Sample coded reference quote/s</b>	<b>Analysis</b>	<b>Rating</b>
<b>3.4.1</b>	Expertise In Legal Translation	One of the difficult challenges for collaboration agreements is the Arabic element since it requires a legal and precise translation to the scripts provided by US consultants because collaboration agreements are usually reviewed by foreign partners in English.	"I believe this is the most important element and the biggest barrier in the sense that the agreement language follows the legal precise wording in both languages. For example, you can write the agreement in English using correct legal terms but when it comes to translating it, legally, to Arabic, then it is very difficult. Even for the Experts Committee in the Ministry Council, which is headed by the Prime Minister (the King), it is missing this expertise."	In the host organisations, international collaboration agreements cannot only be drawn in the national language only when attempting to sign with foreign countries. English must be used on the basis that it is the international language for business. However, national law requires that the Arabic language is present in any legal document developed in or for Saudi Arabian business. This includes research agreements. As KT makes great advantage from international collaborations, any barriers to these agreements realization would reflect as barriers to KT. One of the difficult challenges for these agreements is the Arabic element since it requires a legal and precise translation to the scripts provided by US consultants.	Red
<b>3.4.2</b>	KT Between Speakers Of Different Languages	A major set back to effective KT is lack of clear and precise communication between people involved in KT.	"Most of the experts who come here speak English and its difficult for most of the researchers here to understand them since they are young and most of them are not or cannot speak English ... I got the feeling or have the feeling that ... there is 10-15% who can speak English and understand it very well, but others on a scale of 1 to 6 are 2 to 3."  "... not punishment, of course the words that I am using are not professional, I understand... there are some difficulties in the KT, one of them is the language."	A major set back to effective KT is lack of clear and precise communication between people involved in KT. Many expert researchers have invaluable knowledge but cannot be absorbed by national researchers due to language barriers. Many researchers do not know the meaning of simple words like benefit or situation which means even day to day communications is not possible for them with English speaking individuals. Even professors at the case study organisations suffer chronic difficulties when communicating in English.	Orange
<b>3.4.3</b>	Ability To Seek KT Relationships	The implications of language on relationships represents a KT barrier	"it could really help many researchers because of the lack of communication skills that they have..."	In order to establish a relationship with someone and before business or KT is in the picture, an individual or an organization would need to explore opportunities and potential relationships to house a KT activity. This is not possible if the English communication skills of the host organisation are not	Green

<b>3.4 FINDINGS ON KNOWLEDGE CHARACTERISTICS OF LANGUAGE</b>					
<b>Code</b>	<b>Knowledge blockage</b>	<b>Analysis summary</b>	<b>Sample coded reference quote/s</b>	<b>Analysis</b>	<b>Rating</b>
				competent in English. This barrier could lead to missing numerous opportunities to establish worthwhile and sometimes essential relationships in which KT could flourish. The host organisations do not have much support in this area and still did not offer any solutions.	
<b>3.4.4</b>	Selecting External Experts Based On English Communication Skills	The multi-national perspective of KT represents a KT barrier	"The communication also played a role. When some of the Chinese came here, they couldn't speak good English. He is excellent in the lab work but his English is not good. So the English and also some Saudi did not speak good English. So it was from both sides."	Although engineering and sciences expertise are found in many non-English speaking countries such as Russia, France, Italy, Japan, and China, it was considered a barrier to transfer knowledge from them if they only spoke their mother tongue language. It was very daunting to have two individuals to discuss a matter of engineering discipline without the presence of a common language. How could an external knowledge provider arrive to Saudi if he has no English nor Arabic language skills. This is a management mistake to spend resources on someone who cannot communicate with local researchers. This needs to be addressed.	Green
<b>3.4.5</b>	Willingness Of the Knower To Cooperate	Since the knower possess more power in the KT relationship, this represents a KT barrier to the case-study organisations	"75% of the time it is easy, 25% comes usually when there is a slight language barrier, second you have to always remember that you're dealing with someone who has not have experience so you have to like know you go back to kindergarten with him and you to explain every single thing to him to understand."	Knowledge providers usually are cooperative in general. However, this takes a serious turn when the provider finds himself struggling to get the language through. It develops irritation and frustration to pass on each piece of knowledge, which ultimately results to a bad experience and perhaps end the cooperation and willingness of the knower to proceed with the KT process. It is unwise to put poorly English speaking researchers with English experts as it would cause embarrassment to the researcher and frustration on the knower who might be paid a lot for this task. This needs to be addressed.	Green

## INDIVIDUAL LEVEL OF ANALYSIS

4.2.1 INDIVIDUAL LEVEL / CAPABILITY / ABSORPTIVE CAPACITY					
Code	Knowledge blockage	Analysis summary	Sample coded reference quote/s	Analysis	Rating
4.2.1.1	Internal Restrictions To Individual Exposure	Respondents feel that preventing them from signing individual agreements with external researchers is inhibiting their absorptive capacity and motivation to excel their research activities.	"all [collaboration] agreements must be by [organisation X], not by the scientist"	When internal researchers interact with overseas experts on matters of strategic importance, a legal document for IP rights often becomes necessary. The host organisations are mandating an organisation-to-organisation agreement as the sole basis of any IP engagement. The barrier present here is that researchers are not allowed to formally engage, in an individual capacity, in sharing strategic knowledge with external experts, and are required to engage in tedious processes and approval chains to which not all researchers are willing to subject themselves. The AC of these researchers would, from the very start be inhibited, i.e. not have a chance to be exploited.	Red
4.2.1.2	Leadership Negative Hypothesis	Respondents claim that the leadership on focuses on IP production rather than exploiting the absorptive capacity of researchers during collaborative work.	"... most important thing [in the joint collaborations with external experts] is getting IP"	AR participants report a presumption made by the management that if research collaborations do not result in IP then there is no benefit from these collaborations. AR participants report however that even where there is no evident IP, there is still the benefit of engagement and KT. AR participants indicate that management proceeds from mistrust that researchers had the AC and work ethic to produce IP. The lack of any method or formal tools to measure collaborative work output discounts the power of this process in enhancing knowledge stock within the organisations. Under current conditions, KT is secondary to IP which further inhibits the development of AC.	Red
4.2.1.3	Barrier Of Elitism	Exposing internal researchers to eminent external experts in their fields could hinder the KT process and become a barrier to the process due to the K-	"... I would not make an effort to seek knowledge if the gap is small. I'd love to see a gap that is very big..."	KT is dependent upon the balance of knowledge flow and the AC of the seeker. Nevertheless, some respondents appear comfortable with a sizeable knowledge gap while engaging with an expert. They also are comfortable working with experts from disciplines other than their own. This raises the critical question of whether the seeker comprehends the need for initially owning an acceptable expertise level in order to absorb advanced knowledge from the knower. It	Red



4.2.1 INDIVIDUAL LEVEL / CAPABILITY / ABSORPTIVE CAPACITY					
Code	Knowledge blockage	Analysis summary	Sample coded reference	Analysis	Rating
		gap.		might be less expensive and more effective to select peer universities rather than those of the top tier. There seems to exist the barrier of being tempted to seek higher status by associating with MIT, for example. The possibility of status-hungry researchers bent on collaborations with MIT, Yale, Caltech and other elite Universities, what I will term the barrier of elitism, requires investigation. In turn, this distracts the absorbance of knowledge, affecting KT by default. Respondents might well limit KT issues in large-knowledge-gap situations if more appropriate collaborators were sought from across the borders of the organisation.	
4.2.1.4	AC Aging	Internal mature respondents view younger researchers as having low absorptive capacity. They prefer to work with people of their age to avoid wasting time.	"It's obvious that we have young researchers who are starting their research careers and if the technology is difficult or complex then it will require them a long time to be acquired and be applied."	Senior researchers demonstrate a lack of empathy and express discomfort toward knowledge flow vis a vis young researchers. This kind of attitude could restrain KT processes and therefore needs to be addressed. There is an understanding that young researchers do not have the AC to interact with experts. This assumption raises a link between young researchers and AC. It is claimed that mature researchers acquire knowledge more efficiently than younger researchers, as expressed by senior respondents. Linking AC to age could prevent opportunities for KT and become a barrier to young learners.	Orange
4.2.1.5	Quality Of National Universities	The absorptive capacity is under utilized in local learning institutions; hence KT faces the barrier of less exposure (i.e. absorptive capacity > sending capacity).	"I did not expect any benefit from them [local professors at a local university]".	Some respondents distinguish between researchers of domestic training and those from abroad. This perception assumes the average AC of domestic learners is not equal to the average AC of those who have received education and training abroad. Because the sample population in both categories is very large, such an assumption implicates Sending Transfer Capacity (STC) rather than AC or Receiving Transfer Capacity (RTC). This requires an assessment of foreign and domestic institutions. I would assume that the sending capacity is larger abroad than that in the domestic institutions. Learners sent abroad have a better opportunity to knowledge exposure, which allows them to experience an intensive knowledge-sending flow. The problem local learners face when studying in national institutions is that their teachers do not provide them with the value of	Orange

<b>4.2.1 INDIVIDUAL LEVEL / CAPABILITY / ABSORPTIVE CAPACITY</b>					
<b>Code</b>	<b>Knowledge blockage</b>	<b>Analysis summary</b>	<b>Sample coded reference quote/s</b>	<b>Analysis</b>	<b>Rating</b>
				practical and tacit knowledge they need to participate actively in engineering research in their future careers. Teachers abroad are perceived as better knowledge senders because they approach the learners with 'practical' knowledge that is easily absorbed. This disparity needs to be addressed.	
<b>4.2.1.6</b>	Work Pressure	Respondents see work pressure as a hindering element to KT, which affect their absorptive capacity from an input measure, make them lose focus and detach from the learning process.	<i>Finding based on observation</i>	The data reveal that when excessive pressure is exerted on individuals, they begin to prioritize based on tangible deliverables. By contrast, knowledge absorption - and capability building- are neither visible nor deliverable on set deadlines. As such, host organisations assign to them a lower priority as reported by AR participants. In order for individuals to maximize AC, they require more focus and fewer miscellaneous distractions at work. The issue of whether the elimination of such tasks will restore AC to full capacity should be addressed and defined.	Orange
<b>4.2.1.7</b>	Pace Of Research Activities	Respondents demand low pace of research activity to help them cope with new knowledge. They see fast development as a KT barrier.	<i>Finding based on observation</i>	One respondent suggested that slowing down research work activities could improve comprehension and increase AC. This assumes that AC is low among individual members given the speed of research activity and, therefore, the organization needs to reduce the research speed to allow the individual AC to maintain reasonable levels of knowledge absorbance. Implicit is the assumption that a relationship exists between high internal AC and the number of projects being executed at the same time. AR participants have not reported any measure conducted at the host organizations to regulate research pace and therefore this needs to be investigated.	Orange
<b>4.2.1.8</b>	Measurement And Benchmarking Of AC	Respondents see AC to improve with clear measurement tools that visualizes their AC levels. The absence of these tool are considered barriers to better AC and KT.	<i>Finding based on observation</i>	Measuring the AC of individuals in the host organisations is essential to defining the parameters – and hence measuring improvement of – AC. Some respondents suggest that the number of products or IP property produced from KT engagements within a specific period of time is a good indicator of both individual and group AC. But there is no qualitative basis for such an assessment. A benchmark to measure acceptable AC level needs to be realized for research groups. This will allow clear targets and measurable achievements. On the other hand,	Red

<b>4.2.1 INDIVIDUAL LEVEL / CAPABILITY / ABSORPTIVE CAPACITY</b>					
<b>Code</b>	<b>Knowledge blockage</b>	<b>Analysis summary</b>	<b>Sample coded reference</b>	<b>Analysis</b>	<b>Rating</b>
				the absence of measurement tools allows KT to be arbitrary and create barriers to improvement.	
<b>4.2.1.9</b>	Disciplinary Limitations	Respondents find incompatibility in KT when engaging with researchers from other disciplines which reduce their AC and prove as a barrier to knowledge sharing.	<i>Finding based on observation</i>	AR participants report that the AC of an individual, functions optimally only where he or she is dealing with people from his or her own field. Changes in the technical language tend to defeat AC. Respondents raises concerns that some research groups tend to avoid engaging researchers from outside specialties. This could have implications on social capital and interdisciplinary projects, as well as on the culture of the organization as a whole as well. Such implications should be addressed.	Red
<b>4.2.1.10</b>	Documenting And Reporting	Some respondents see documenting an alternative to deep understanding of research details. Other respondents rejected that and found documenting as a bad alternative to human understanding. Insisting on solely documenting is a barrier to effective KT.	<i>Finding based on observation</i>	AR participants reflect the belief that documentation itself is a substitute for comprehension. It was noted that that many researchers make little effort to understand tacit, conceptual knowledge, which requires root comprehension, on the basis that everything is documented and therefore is presumed to be understood. Because documenting is used as the primary tool for capturing knowledge without exerting critical thinking and comprehension, then it is possible that the knowledge may not have been captured in the documenting process in the first instance and has been lost. Another AR participants touched on the related issue of reconstructing a project on the documentation alone. AR participants indicated this as somewhat of a challenge or test of their skills, where success would mean they have absorbed the knowledge. A clear-cut standard must be realized in this area as misunderstanding the role documentation can result in serious failure and hence prove to be a barrier to KT.	Orange
<b>4.2.1.11</b>	Disparity In The Quality Of Researchers	Some respondents feel hindered by peer researchers who are not serious enough to allow their full AC to function. They feel this AC discrepancy is a barrier to KT.	<i>Finding based on observation</i>	Disparity in the quality and motivation of researchers hinders the AC of others. Professional qualities such as discipline, punctuality, diligence, attention, interest and loyalty vary from individual to individual. Poor qualities in peer researchers have affected serious researchers' interest in sharing knowledge and exchanging ideas, which is problem compounded in areas where projects are interdisciplinary. Many researchers feel others are slowing them down and hindering their own AC.	Orange

<b>4.2.1 INDIVIDUAL LEVEL / CAPABILITY / ABSORPTIVE CAPACITY</b>					
<b>Code</b>	<b>Knowledge blockage</b>	<b>Analysis summary</b>	<b>Sample coded reference quote/s</b>	<b>Analysis</b>	<b>Rating</b>
<b>4.2.1.12</b>	Medium of Communication and Knowledge Acquisition	Some respondents find the lack of efficient tools for KT as well as a lack of common language as a real challenge for their AC, hence as a barrier to KT.	<i>Finding based on observation</i>	Difference is noted in AR participants' AC according to the medium of dissemination. In other words, AC is a variable depending on whether they talk to other people online, by email, or chatting. A Chinese respondent stated that online communication is extremely efficient and serves his KT purposes to complete his research at Organisation X. However, other researchers in Organisation X may view online communication as a distraction to AC. Researchers seem they have no guidance as to the best medium or tools to efficiently absorb knowledge.	Orange
<b>4.2.1.13</b>	Linking Academic Knowledge With Real-Life Research Practice	New researchers do not pick up new knowledge at their research organisations due to incompatibility between academic and actual research knowledge. This in some cases creates barriers to KT due to individual AC fragmentation.	"When I came here I understood the language but I found there are still many things that I don't understand. I started up by asking and reading more so.. I have learned a lot".	One participant stated that, as a new Masters' graduate from Sydney University, he still found it difficult to absorb new knowledge, even in his area of expertise. The respondent displayed a lot of energy and appeared genuinely excited to expand and improve his AC. Personal interest in the subject did help him to maintain a high AC and prevail against the challenges that could have inhibited a less-motivated researcher, any researchers fall in the black hole of disparity as between academic knowledge and the demands of real-life research practice. This needs to be addressed.	Red
<b>4.2.1.14</b>	Internal Researchers coping ability with External Researchers	Some respondents find the high speed of knowledge transfer with external experts is too fast for internal researchers and exceeds their AC.	"We share a lot of the blame and low speed is on our [recipient researchers] side".	One controversy concerns the pace of research activity vis-a-vis outside experts and their local counterparts. Respondent's sentiment is that eminent experts will not engage in research at a slower pace, which threatens the existence of KT between internal and external researchers from the very start. That's why this is a barrier to KT with external experts and is to be blamed to the internal culture. However, it may be that the AC of internal researchers cannot realistically keep pace with the speed of knowledge flow. It may be incapable of high productivity and hence incapable of meeting deadlines. This is a barrier to KT and needs to be addressed.	Orange
<b>4.2.1.15</b>	Personal Styles In Receiving	Participants graduating from local educational	<i>Finding based on observation</i>	One respondent from Organisation X reported a lack of critical thinking skills as a result of poor teaching practices locally.	Red

<b>4.2.1 INDIVIDUAL LEVEL / CAPABILITY / ABSORPTIVE CAPACITY</b>					
<b>Code</b>	<b>Knowledge blockage</b>	<b>Analysis summary</b>	<b>Sample coded reference</b>	<b>Analysis</b>	<b>Rating</b>
	Knowledge	institutions feel unable to cope with the style of action learning by external experts due to the poor educational systems they have been raised in.		Respondent stated that education and training abroad are superior and thus preferable whether at basic or more advanced levels. Other respondents commented on the link between individual AC and poor teaching practices resulting in a generation of shallow thinkers who have a low AC. Such difficulty is considered by respondents as a barrier to better KT and needs to be addressed.	
<b>4.2.1.16</b>	Milestones For Productivity Indicators	Respondents from senior researchers claim that the currently available individual AC within their centers will require decades to build capability. KT is therefore going to transfer knowledge slowly due to AC limitations.	<i>Finding based on observation</i>	Respondents identify lack of productivity at the subject institutes as a barrier. Some research leaders reflect satisfaction with reliance upon external experts and advocate the status quo for learning. However respondents reveal that dependence upon external researchers is structural, as management pushed results as opposed to KT, hence hobbling second-line research leaders who are not able to produce such results. They claim that the AC of their individuals mandates that they continue to provide external experts to continue KT and building internal capability. There is however no clear road map or milestones in place to break free from this cycle of dependence, which must be addressed between the upper management and research center leaders.	

4.2.2 INDIVIDUAL LEVEL / CAPABILITY / INNOVATION					
Code	Knowledge blockage	Analysis summary	Sample coded reference quote/s	Analysis	Rating
4.2.2.1	Research investment timeframes	Some respondents claim that the absence of time for conceptual development prevents them from assessing their innovative performance.	<i>Finding based on observation</i>	Innovation requires providing researchers with time to explore and develop thinking around research topics. However, there are currently no time measures or guidelines governing the development of new ideas, especially in relation to time constraints. The sequence of steps and indicators to idea generation is not addressed. Such lack of focus often results in financial loss and administrative failure to encourage researchers to innovate. Researchers are subsequently blamed and some individuals in leadership positions are concerned.	Orange
4.2.2.2	International Engagement And Connection With Local Industry	Respondents find that innovation comes about from intensive KT from external experts. Most respondents find the intensity of engagement with external experts as low.	<p>"I mean if they never went out of Saudi then it [innovation] is some less quality."</p> <p>"Something can be developed here [if KT is enforced]"</p> <p>"we need to take it [research] to the next level"</p>	Overseas experts identified the relative isolation of Saudi researchers as a factor to limiting KT that leads to innovation. The exchange of knowledge between external researchers and internal researchers is undertaken with the aim of fostering innovative thinking among internal researchers. This requires intensive exposure to external innovation. Intensiveness may be the key to realize results in this regard. A related issue is the need to establish and maintain contact with innovate local industries. Some respondents identified potential for innovation at Organisation Y, including the chance of igniting innovative outcomes. However, in order to foster such innovation, respondents articulate the need for a connection with local industries, expressing the need to bring research to the "next level" by connecting with innovative actors in the knowledge marketplace. Currently, there is little ability for the establishment of such a connection with clear directives, which respondents report as a barrier. Connecting with innovative industry partners in the region will allow researchers to have a wider perspective on national research needs and allow them to better select the correct path of development that links overseas research with the local industry.	Red
4.2.2.3	Shortage of human resources	Respondents find lack of interdisciplinary specialists in their research projects as a	"If we are opening the way to collaborate [to seek innovation], we don't have the manpower. Manpower is limited here..."	For innovation to convert knowledge to a usable purpose, it requires a collection of minds. In scientific applications, innovative solutions require interdisciplinary perspective, which if not available could be a barrier to the innovation process as a whole. The issue of making the	Red

4.2.2 INDIVIDUAL LEVEL / CAPABILITY / INNOVATION					
Code	Knowledge blockage	Analysis summary	Sample coded reference	Analysis	Rating
		barrier to effective KT and innovative ideas. They feel their teams are incomplete.		right number of minds available is essential to developing innovation.	
4.2.2.4	IP Support Services	Innovation services office is very weak in helping researchers commercialize and transform their ideas to innovative developments. KT to bring innovation is absent.	"I'm talking about not taking research to the next level. There is no spin of accomplishment yet. We just started, but hopefully in the coming year because there is a great potential. A great, great, great potential..."	Some respondents refer to the innovation office at Organisation Y as merely an IP paper based processing office, which lacks the focus to generate ideas or provide support for individual innovation. This is an individual level barrier because researchers lose affiliation when they reach the commercialization stage of their research. They become constrained and frustrated to deal with their individual research projects alone. The role of the innovation office is subordinated to that of a processing centre, which coordinates patents and related IP matters. Specifically, the IP department at organization Y acts as a liaison between internal researchers and a U.S. consultancy that deals with IP matters. There is no idea-formulation support or concept brainstorming services that innovation services would normally provide.	Orange

<b>4.2.3 INDIVIDUAL LEVEL / CAPABILITY / COMMUNICATION BARRIERS</b>					
<b>Code</b>	<b>Knowledge blockage</b>	<b>Analysis summary</b>	<b>Sample coded reference quote/s</b>	<b>Analysis</b>	<b>Rating</b>
<b>4.2.3.1</b>	Proximity, Tools And Allocation Of Resources	Respondents find communication with research partners outside their local areas as a barrier due to proximity issues. They find distance from their research partners as a barrier to KT.	<p>"Since we are isolated in [city] in terms of being away from the stakeholders or most of the stakeholders in the kingdom, this barrier is an important factor."</p> <p>"It's, I would say, it's really hard here to say the least, because we are physically or geographically far from a lot of research activities. So if you are in Europe or America or in Australia, there is a lot of research activities going around which means more lectures, more conferences, more workshops, so this is a barrier, we have to understand this fact..."</p>	Some respondents cite distance between host organisations and on-site data collection locations as a significant barrier to KT. This barrier is compounded by collaborations with overseas partners involving long distances as well. Communication tools arise as both an issue and a challenge, where face-to-face interaction is difficult or impossible. Tools to facilitate live interaction between researchers in Saudi Arabia and eminent scientists overseas are not being used on a wide scale within the case-study organisations. The barriers this creates are of concern to the respondents and fear of being disconnected from the research and scientific community does arise among local researchers. Communication coordinators are an essential tool and an oft-overlooked solution to this barrier. Additionally, a lack of administrative support staff is problematic in that it tends to divert researchers' attention from research tasks in favour of more mundane secretarial work, including non-essential communications. This matter requires a comprehensive assessment.	Orange



4.2.3 INDIVIDUAL LEVEL / CAPABILITY / COMMUNICATION BARRIERS					
Code	Knowledge blockage	Analysis summary	Sample coded reference quote/s	Analysis	Rating
4.2.3.2	Individual authority	KT between local research institutes faces barriers of authoritative support. Formally established communication could synergize national research efforts but it currently lacks, causing a barrier to KT.	"At the moment, there is no communication between individuals in research institutes in Saudi Arabia because they don't fall under one umbrella."	The inability to establish formal communication between research organisations in Saudi Arabia was suggested to possibly eliminate KT activities. Without official support and the implementation of clear lines of authority, invitations to share knowledge among organizations may be frustrated. An AR participants recounts that whenever he approaches a researcher from another national institution, it is difficult to develop immediate positive responses due to the contact being informal. Unless formal channels exist and the conduit is erected by authoritative entities on both sides, respondent believes no effective communication can take place. A related issue as reported by respondents is that insufficient time is allocated for effective communication between different research centers in order to discuss industry issues. Other respondents cite insufficient time to engage experts. Respondents express the view that insufficient allocation of time for communication within the organization as well as with other local researchers and overseas experts is a barrier to KT. Finally, lack of involvement by junior Saudi nationals was noted. Much of the communication requiring interaction between case-study organisations and overseas research organisations did not involve junior Saudi nationals and were therefore unsuccessful from a national perspective. Respondents report frustration in that external experts appear to engage more often with local expatriate counterparts and that Saudi researchers are thereby excluded. The issue of exclusion intersects with language and cultural barriers. However, the wholesale exclusion of Saudi researchers is inconsistent with the objectives of KT. Compounding this issue is a higher rate of turnover among expatriates than among local researchers. The privilege of communicating with external experts seems therefore not open for everyone, which is a barrier in itself.	Orange
4.2.3.3	Communication Structuring	Respondent noticed difficulty to manage unstructured KT. They feel that unplanned communication	<i>Finding based on observation</i>	Respondents articulate the absence of a system governing: (1) intra-organisational communication; as well as (2) communication with overseas experts. However on an individual level, the same respondents report inability to manage the intensive intellectual engagement required for such interactions. Further, many respondents cite a lack of	Orange

4.2.3 INDIVIDUAL LEVEL / CAPABILITY / COMMUNICATION BARRIERS					
Code	Knowledge blockage	Analysis summary	Sample coded reference	Analysis	Rating
		engagement produce less quality results and may be a barrier to KT		<p>experience in dealing with pre-eminent experts as well as a lack of understanding of the protocol required in view of legal issues related to scientific research. The lack of such skills is, in and of itself, a profound barrier to KT. It is therefore imperative to put into place structural protocol with an aim to identify the appropriate individuals with whom to communicate and then the efficacy of such communication. In assessing efficacy, we look to intensity; regularity; frequency; duration; and method</p> <p>Respondents report that communication is largely unstructured and such lack of structure is a barrier to effective KT. By that they mean that leaving the method, intensity and content of the KT activities open to researchers could lead to confusion, ineffectiveness and intangible results. These issues need to be cleared away for setting the right atmosphere for communication in all directions. Training sessions for example, could standardize the communication process and bring about tangible results.</p>	
4.2.3.4	Quality Of communication Links	Respondents find the relationship between departments and research centers as weak and is affecting positive communication, hence, it is creating barriers to KT.	<i>Finding based on observation</i>	Most respondents agreed that communication within an organisation was of greatest importance due to its frequency. However, the respondents raised quality concerns. The fact that it is not easy to approach a colleague in a member institute or research section of the organisation is creating a barrier that is leading to fragmented efforts and leading to KT defect. Tension arises when the individual's need to engage in such communication is defeated by its prevention and meaningful KT is cut off. Further research is required on both the individual and organizational levels.	Orange
4.2.3.5	Trust Influences On Communication	Although rarely recorded, some cases show that trust issues negatively affect communication practices and therefore is avoided and becomes a barrier to effective	<i>Finding based on observation</i>	Lack of trust is cited by respondents as a barrier to the transfer of specialized knowledge. Some respondents linked the level of attention and fidelity in communication with trustworthiness. That is to say that when the conveyor demonstrates interest and faithfulness while communicating a piece of knowledge, then it is likely that the person is trustworthy and that there is low risk that the information is unreliable. But respondents expressed little confidence in the integrity of communication of specialized knowledge, even to the point of self-	Red

4.2.3 INDIVIDUAL LEVEL / CAPABILITY / COMMUNICATION BARRIERS							
Code	Knowledge blockage	Analysis summary	Sample quote/s	coded	reference	Analysis	Rating
		KT.				doubt. Without proper trust in the content of this communication, then the utility of the communication is implicated. This issue especially on the internal level must be addressed. Researchers', working in an environment of mutual suspicion and mistrust, is rather a poisoning situation.	

4.2.4 INDIVIDUAL LEVEL / CAPABILITY / WORK INTENSITY BARRIERS					
Code	Knowledge blockage	Analysis summary	Sample coded reference quote/s	Analysis	Rating
4.2.4.1	Low Dedication Of Local Researchers	Many respondents find lack of dedication as a main reason for low work intensity including work related to KT. This lack of dedication is therefore a barrier to KT.	<p>"... the interest [of researchers] is there, but the willingness and the dedication is not ...".</p> <p>"... the researchers are not dedicated, these researchers are not dedicated to the transfer of knowledge or to learning. "</p> <p>" ... many people don't work hard. I think the people in Organisation X are very rich and they don't work hard because they don't need to work hard."</p>	Respondents report a generalized lack of dedication and willingness to work hard. Respondents cite such lack of dedication as a barrier to Saudi researchers in reaching tangible results, in absorbing valuable knowledge, and in establishing the sought-after international reputation. Hard work requires long hours combined with intellectual focus and high levels of personal interest to result in success. In other words, they are neither willing nor interested to be dedicating themselves to work hard. The underlying individual reasons for this have been identified as motivation; economic need and work culture. Respondents report that hard work requires a certain "driving force" motivation, which currently evades researchers at the case-study organisations. Some respondents cite the absence of efficient and well-designed regulations as stifling motivation and, by extension, Other respondents, particularly those from foreign origins, cite lack of economic need for failing to ignite impetus for hard work. An expatriate AR participant articulated that individual researchers' wealth and the prosperity of the country as a whole had a negative effect on hard work. Knowledge and its transfer seem simply disregarded by those at higher socio-economic levels. Also, the data uncovered that Saudi researchers simply do not know how to work more intensively, a product largely of ingrained work practices. This issue may be linked to dependence on foreign expertise and labour in Saudi Arabia. It is understood that less dependence of researchers on external experts means more hard work on their side. This hard work is essential to achieve independence from external experts in research work. It is also known that independence may require exploration of non-trivial scientific areas that may necessitate trial and error experiments or iterative problem solving. Trying to avoid repetitive experimentation to reach an answer by asking for the solution from experts is considered a barrier to learning and building in-depth understanding of the subject knowledge. Without learning by doing, they loose their stake in the	Orange

4.2.4 INDIVIDUAL LEVEL / CAPABILITY / WORK INTENSITY BARRIERS					
Code	Knowledge blockage	Analysis summary	Sample coded reference	Analysis	Rating
				knowledge-sharing process. Researchers work patterns are therefore considered a barrier to KT.	
4.2.4.2	Internal Researchers, management and External Experts And The Push Strategy	Respondents report that hard work is not genuine in producing tangible results due to push strategies in the work place by management and external experts. This situation makes KT produce poor results and thus push factors for hard work is considered a barrier.	<i>Finding based on observation</i>	Respondents report variable individual reactions to a “push strategy” by management and external experts. On the one hand, there is a competitive instinct to maintain pace in the presence of external experts who, as respondents report, require more work from the side of researchers. Also there is a need to instil the confidence of external experts in order to participate as a potential partner in research. The result of this situation is often passive-aggressive in that researchers seem to increase work intensity, but productivity actually falls due to individual resistance. Psychological and cultural barriers to keeping pace with that of external experts should be explored.	Red

4.2.5 INDIVIDUAL LEVEL / CAPABILITY / SKILLS BARRIERS					
Code	Knowledge blockage	Analysis summary	Sample coded reference quote/s	Analysis	Rating
4.2.5.1	Leadership Skills	Respondents blame lack of skills among its members to the leadership. Not knowing how to manage researchers from a people perspective will not allow leaders to know how to solve the skills problem among organizational members and its impacts on KT.	<p>"most of the managers are not real managers ... I believe that we should develop leaders in research... the directors of the research centers, and the executives are researchers who haven't been exposed to academic training on research management."</p> <p>"If you have strong resources but not a good management then you will not be successful ... we need good management who really has good experience in managing research projects."</p>	Management demonstrated generalized detachment from the reality and needs of the research, as both reported by respondents and as demonstrated by its own responses. Respondents reported management's diminished capacity in knowledge capture, generation and dissemination. Management demonstrated an abject inability to innovate. Respondents further claim that the skill of leading a research institution at the level of the host organisations is absent from the current management. Although respondents failed to identify the skills required of a research institute leader, they did feel the pain of absence. Defining those skills clearly and precisely needs to be addressed. This is because top management is the driving force forward to success. For all members to prosper, a driving force with clarity of purpose is essential.	Red
4.2.5.2	Delegation Tasks	Of It has been recorded that some respondents explicitly stated that they delegate their subordinates to take major tasks of their own to avoid exerting more effort in their work. This attitude might be due to less competence in delivering this task, which might result in less quality deliverables by the delegate. Tasks related to KT might suffer this issue.	<i>Finding based on observation</i>	The purpose of delegation is not to cover for weak skills. Supervisors and leaders in general need to delegate to be able to allow staff to participate in decision-making and allow empowerment of staff. However, when researchers are delegated to take on leadership tasks to relieve the responsible person from doing his work then this creates an ethical and efficiency entanglement, as most subordinates, however unqualified would not refuse the delegation of a task. One of the host organisations research directors pushed the task of managing projects to "someone" to avoid management follow-ups coming directly to him. This problem is twofold: (1) either this centre leader does not have the skill to manage research projects properly and therefore avoided that by using a cover (2) or he finds that management follow-up attitude is unreasonable and is not in a position to be able to skilfully communicate this to his leaders.	Orange

4.2.5 INDIVIDUAL LEVEL / CAPABILITY / SKILLS BARRIERS					
Code	Knowledge blockage	Analysis summary	Sample coded reference quote/s	Analysis	Rating
4.2.5.3	Measuring KT Deliverables	Respondents support that center directors do not know how to measure KT. Not being able to formalise a standard for measuring KT as a research center director could be a barrier to successfully reach a given KT target. This is a KT barrier	"... May be I am not personally qualified or entitled or even maybe I am not interested to do this [KT tasks]. So when you have this as an obligation as part of the job, then that's gonna find resistance of the individuals."	<p>Respondents object to the assignment of KT to a center director because he might not be qualified for this task. However, many respondents holding the post of research center director do agree that this task is a by-product for center directors and it is part of their mission. This raises an issue: if KT is part of the mission of center directors and they are not qualified to do this kind of work then how is this mission going to be accomplished?</p> <p>The respondent makes it clear that the skill of measuring KT deliverables might not be present with research center directors. Currently, methods to measure KT within the case study organisations rely on statistically gathering data on their projects which includes projects completed, publications generated, etc. Although these are meaningful measures, KT is more than that. Not being able to formalise a standard for measuring KT as a research center director could be a barrier to successfully reach a given KT target.</p>	Red
4.2.5.4	Lack Of Mentoring By Senior Researchers	Respondents from senior researchers who are skilled do not want to train unskilled new researchers since their job descriptions do not require them to. New researchers remain unskilled for extended durations and KT becomes at a minimum level.	<i>Finding based on observation</i>	Qualified senior researchers express little interest in developing unskilled researchers in part because it is not justified by the results. Further, such efforts are reported as tedious and frustrating, as well as outside the job description. Instead, senior researchers actually slow down the research process by limiting the number of projects undertaken, while the junior researchers are concomitantly deprived of the more advanced aspects of those projects. This perpetuates the skills barrier. Although new researchers do learn by time, their development progresses slowly and haphazardly, affecting productivity at the organizational level.	Orange
4.2.5.5	Skills Link To Competitiveness Barriers	The main focus of most respondents was around scientific knowledge, while there is less weight given to soft people skills. They only focus on the engineering science but not how to manage it. This is a	<i>Finding based on observation</i>	Some respondents surmise that if time, scientific knowledge and resources were more widely available then the case-study organisations would increase in competitiveness. The data support another conclusion; namely, that without skill, the above-referenced elements do not result in a necessary and automatic increase in competitiveness Knowledge-sharing and effective communication skills are imperative to the exploitation of these elements.	Red

4.2.5 INDIVIDUAL LEVEL / CAPABILITY / SKILLS BARRIERS					
Code	Knowledge blockage	Analysis summary	Sample coded reference quote/s	Analysis	Rating
		main barrier to successful KM.			
4.2.5.6	Documenting And Reporting Skills	Avoiding to identify what skills are needed in individuals who are to be able to document research activities is a barrier to effective and beneficial KT and needs to be addressed.	<i>Finding based on observation</i>	Respondents discount the skill of documenting as easy, and report delegating the documentation of entire projects to new researchers. However, neither training nor instructions are given, despite limitations as to the capacity to understand the project, all based on the perception that documenting is a routine and simple job. The selected new engineer proceeds with documentation and gets his skills in documenting on the go. Failure to identify what skills are needed to be able to document correctly a research activity is a barrier to effective and beneficial KT and needs to be addressed.	Red
4.2.5.7	Planning Skills	The fact that researchers lack project planning and management skills creates a great barrier to KT when it comes to achieving the knowledge building objectives of a project.	"... we don't have the people with good experience to run the project and know what exactly they should do".	Lacking the knowledge or skills to develop a clear plan for a research project as well as to meet the numerous targets within that plan is a barrier to the objectives and purpose of the project. The fact that researchers lack planning and management skills creates a great barrier to KT when it comes to achieving the knowledge building objectives of the project.	Orange
4.2.5.8	Benchmarking Individual Skills	Researchers do not have self-assessment tools to benchmark their individual skills. Given that many do know that they have a gap, they tend to lose interest in learning and KT.	<i>Finding based on observation</i>	Many researchers are overconfident and do not question their skills until forced to assess them. This, however, may take place only after years of ignorance of weaknesses and gaps in their skill sets. Other respondents acknowledge weaknesses but lack to identify or understand them. In this case again, the organization does not provide support to provide individuals with comprehensive audits to identify their individual weak skills. When a researcher is unaware of what exactly he or she is missing and how to fill that gap, it may lead to a loss of confidence, passivity and lower productivity. It is vital for the skills barriers section to explicitly define what is exactly the set of skills missing in each organizational member. Once these skills are defined then a consensus is needed to address them.	Orange
4.2.5.9	KT Coordinating Skills	Researchers do not have specialization skills to include KT in research projects. Projects are also	"Yes, we already have one [a research coordinator] here. He coordinates what projects are done as project management	A respondent from Organisation Z reported that the organization does not offer KT an explicit point of the research work. The skills in managing research in terms of coordinating KT activities requires specific understanding of knowledge flow attributes and knowledge dissemination	Red



4.2.5 INDIVIDUAL LEVEL / CAPABILITY / SKILLS BARRIERS					
Code	Knowledge blockage	Analysis summary	Sample coded reference	Analysis	Rating
		not provided with skilled KT coordinators. This is a barrier to successful KT.	but not as KT..."	techniques. By contrast, project management techniques focuses on getting the job done without much emphasis on knowledge flow between individuals and its aggregation to the organizational level. Researchers do not have specialization skills to include this element in their research projects and therefore it goes without consideration due to the lack of skills in this area. This is a barrier to successful KT in research projects at the case-study organisations.	
4.2.5.10	Problem Formulation Skills	KT starts with defining objectives and deliverables. Respondents found that they have weaknesses in formulating problems for research purposes. This will not allow KT to function in a structured fashion since the problem definition may be incorrect leading to incorrect learning patterns. This is a barrier to KT best practices.	<i>Finding based on observation</i>	How problems are framed and formulated is essential to ensuring KT as well as to ensuring that research activities result in productive outcomes. If this task is not managed skilfully, then it will become a barrier to innovation, as well as result in decreased productivity. Moreover, researchers who lack this skill will not inspire confidence and trust as the failure to formulate an issue betrays superficial understanding of the problem as well as a lack of insight as to how problems are solved.	Orange
4.2.5.11	Literature Review Skills	Respondents find little advanced research skills among researchers as an early barrier for projects to tap on advanced knowledge, possibly misleading the way towards valuable KT and research innovation. Lack of knowing how to find useful literature is	<i>Finding based on observation</i>	Where researchers are not very familiar with best practices in literature review methods then the quality and scope of the project will fall short of international standards and may affect international collaborations. This, in part, is because external experts ascribe to low-quality literature reviews a fundamental lack of competence on the part of researchers. There is, however, little oversight of literature-review methods at the case-study organisations. Writing standards and availability of professional reviewers is also lacking. This task requires more attention in order to avoid it being an early barrier to research and to KT in general.	Green

4.2.5 INDIVIDUAL LEVEL / CAPABILITY / SKILLS BARRIERS					
Code	Knowledge blockage	Analysis summary	Sample coded reference quote/s	Analysis	Rating
		considered a knowledge blockage for researchers and possibly a reason to miss on valuable grants that may lead to strategic KT activities with external experts.			
4.2.5.12	Recognition Issues	Some respondents claim that local citizens working in research with expatriate researchers try to receive recognition from the expatriates work rather their own. KT therefore is not targeted since the aim is to mark research outcomes to their name even if they did not have the capabilities to produce it. Claims that this is rare have been raised.	"... you see, the way nationals are trained ... is like that we want to reflect ourselves big in front of our administration without really making themselves big and then presenting themselves to the administration that they are big...".	Ethical violations have arisen because of a lack of recognition. The disparity of skill sets as between local researchers and their expatriate counterparts result not only in low productivity and quality but also in the acceptance of credit for work which is actually the result of efforts by foreign nationals. Respondents report that most expatriates work under national citizens, so there is a possibility to attribute to the team leaders achievements of the team. Despite bitter denials, lack of skill in producing quality research leads to the use of others' work in the first instance. If this were exposed then national researchers might be forced to rely on their own work and focus on genuine achievements. Denial of the problem constitutes a barrier in itself that requires redress.	Red
4.2.5.13	Capability Of Managers	Respondents suggest that most current managers do not have experience to ensure their skills would suffice for designing KT embedded activities. This is a barrier to KT.	"I would recommend a specialist person to handle this one [managing KT activities]. I will explain to you why: because it needs experience."	Respondents report that designing successful KT that is embedded in engineering research projects requires experience and skill that is beyond the capability of most managers at the case-study organisations. This skill will require deep understanding of KT methodologies, KT flow and implementation strategies. Respondents also report that recognising the absence of this skill is a barrier and secondly designing an organisation specific management program to address this is the other side of the problem. A respondent from institute 2 suggests that current managers do not have experience in this management area. The skill of embedding added value to research projects is not considered at the case study organisations. Managers are concerned with 'finishing' projects off and beginning new ones. The current trend at the case study organisations also ignores ensuring	Red

4.2.5 INDIVIDUAL LEVEL / CAPABILITY / SKILLS BARRIERS					
Code	Knowledge blockage	Analysis summary	Sample coded reference	Analysis	Rating
				sustained benefit for researchers from ongoing projects in terms of cascading knowledge building in a structured milestones fashion.	
4.2.5.14	Experts Recruitment	Respondents find in-house development difficult to achieve, however, they are finding difficulties to skilfully recruit specialized researchers in niche areas. Without these needed qualities, KT will be shallow and may fail.	<i>Finding based on observation</i>	Center Directors lack skill in selecting and recruiting those rare individuals in their respective fields. Respondents report this as a time-saving measure. However, we find that decades have passed without tangible improvement in the research quality, meaning that in practically, time is not the real factor challenge; instead it seems that people cannot develop themselves to improve at the case-study organisations. It seems that mismanagement either because of a lack of skills or a desire to save time is responsible for recruiting practices that result in the selection of individuals who do not possess the necessary and desired qualities. This issue has a big impact on the case-study organisations reputation especially when researchers engage in international collaborations and are involved in KT activities. However, since our main concern is skills affecting KT flow, the issue of specialisation is not about the degree, it is about the topic and tacit knowledge in the specific area. In order to ensure KT is efficient and gives results, expert researchers must have niche knowledge to be able to build internal capability in a specific area. Center directors do not have an objective framework in recruiting experts to realize KT effectiveness and they do not have a consensus on what makes an expert useful to their organisations.	Orange
4.2.5.15	Reconstruction Of Research	Respondents report that it is difficult for researchers to reconstruct engineering concepts newly published in the cutting edge of international publications. The skill needed for this is absent and making knowledge in such publications difficult to disseminate internally.	"... in publications all the time they don't mention critical issues. They keep it closed, even though they claim everything is there. Once you try to replicate what they are doing, you will find yourself in a really different world. People as they give you a talk, can provide you more information by the way, because they can tell you	What skills do our researchers have to enable them to reconstruct published research? Do they have the knowledge to comprehend what is published by eminent scientists and build upon it solid research project or do they really loose touch with the complexity of the knowledge and fall into confusion? Does this mean that case-study organisation researchers need international experts to be physically present at their research institutes to explain those publications to them and show them how to benefit from them for further development? The reliance on external experts seems obvious at this stage. What skills are needed to enable internal researchers from benefitting from internationally renowned journal articles on a self-reliance perspective? Identifying those skills and devoting effort to transfer them to researchers is of paramount importance. The current situation in terms of skill in this area	Red

4.2.5 INDIVIDUAL LEVEL / CAPABILITY / SKILLS BARRIERS					
Code	Knowledge blockage	Analysis summary	Sample coded reference quote/s	Analysis	Rating
			more tricks, but verbally. So, you should be wise to grasp it very very well and implement it as much as you can."	is a barrier that needs to be addressed.	
4.2.5.16	KT Methodologies On The Individual Level	Teaching and learning on the simplest individual level resemble the basic unit of analysis for KT. Respondents report weakness in this area which creates KT flow barriers.	<i>Finding based on observation</i>	One respondent believes that explaining concepts and ideas in teaching contexts is an individual talent irrespective of the level of expertise. This conflicts with another perspective in thinking that when a respondent said he believes that if someone is not able to explain a piece of knowledge then it is likely that he does not know or did not understand it properly in the first place. A senior research manager at one case-study organisation also believes that the seeker also has responsibilities towards the success of a KT activity by actively asking and avoiding shyness. This two-way skill from the sender and the receiver puts complexity in terms of KT taking place internally on an individual level at the case study organisations. In each KT individual engagement at host organisations two or more individuals will need to be equipped with skills to enable the KT process to succeed. In many case, respondents find these skills unavailable at one or sometimes at both ends. If the skill is absent from the provider or the seeker or both then it could be a barrier to KT and would need to be addressed.	Orange

4.2.6 INDIVIDUAL LEVEL / CAPABILITY / SOCIAL CAPITAL					
Code	Knowledge blockage	Analysis summary	Sample coded reference	Analysis	Rating
4.2.6.1	Managing Different Generations In The Organization	The new and the old generations at mature case study organizations are fragmented and are not able to synergize in effective KT activities.	<i>Finding based on observation</i>	The majority of case study organizations are mature organizations with stable number of staff numbers and research capacity. Suddenly, however, these organizations began to hire researchers in large numbers and massively expanded their scope of research, resulting in an “old guard” remnant of the previous period. AR participants consistently characterized new researchers as not unqualified, unskilled and scientifically weak. The age issue is itself creating a barrier in terms of personal relationships, as well as cultural tension on both the individual and organizational levels	Red
4.2.6.2	Expatriate Social Isolation	Local researchers and expatriates working internally are not able to establish social links to enable effective KT due to the isolation of expatriates and time pressure factors. Some are serious and do not have time to socialize.. This is a barrier to KT.	"I work here and sometimes I talk with them [Saudi researchers] but less than 1 hour in a day. I think I spend most of my time on my work and projects. I have many things to do..."	A respondent who is considered a serious and hard working expatriate researcher at Organisation X remarks on his social capital with Saudi researchers by arguing that interaction remains a barrier to KT for reasons that seem to relate to nationality.	Red
4.2.6.3	Social Capital And Trust	Intrinsic cultural differences between local researchers are not allowing for trust to build. KT is not enabled due to this social barrier.	"Lets go back to the trust. I think some researchers here trust researchers from outside more than the local. "	Social capital relies on trust between people. In order to become strong and productive, socialization activities must be deeply strengthened by trustworthy relationships, which are not present at the case-study organizations according to respondents across the board. The reason for this may be due to high cultural differences in a culture that is used to the unity of culture. When local researchers deal with external researchers who have not joined their institutions, they tend to be more flexible to trust them, once they get to know someone closely and realize the cultural differences, they tend to change. This raises the question of how to establish a KT culture if there is no established social network based on trust especially that the most important KT engagements should take place from culturally different individuals	Red

4.2.6 INDIVIDUAL LEVEL / CAPABILITY / SOCIAL CAPITAL					
Code	Knowledge blockage	Analysis summary	Sample coded reference quote/s	Analysis	Rating
				such as the expatriates and local researchers.	
4.2.6.4	The business of knowing people	Entering into social capital networks composing highly ranked researchers is not easy and if creating these teamwork networks was not successful then it could be a barrier to KT as a whole.	<p>"we don't know if there is here what you call teamwork."</p> <p>"Knowing men is business...".</p> <p>"[An external expert needs] ... to trust that you are someone with whom he can collaborate, especially when you are talking about people who working in top 10 institutions. They are very careful when it comes to working in collaborations. They do not collaborate with anyone because every collaboration is counted on him. He doesn't want to associate himself with someone having bad education in the field...".</p>	At Organisation Y, a respondent expresses his dissatisfaction with the level of social networks between researchers. He questions if the term "teamwork" has a meaning at his organisation. Building social capital at work is considered by the respondent as part of the business essentials. He explains that this means that the result of this social capital creates business and profits on the long run. People entering into a social relationship at work should know that. On the other hand, bad social relationships that are poisoned with mistrust could cause losses to the individual or even the organization as a whole. That's why many are careful to be associated with untrusted individuals because they know that this association could affect their career negatively if it proves incorrectly chosen. Entering into social capital networks composing highly ranked researchers is not easy and if not successful to be established could be a barrier to KT as a whole.	Green

<b>4.3.1 INDIVIDUAL LEVEL / MOTIVATION / LEADERSHIP PERFORMANCE BARRIERS</b>					
<b>Code</b>	<b>Knowledge blockage</b>	<b>Analysis summary</b>	<b>Sample coded reference quote/s</b>	<b>Analysis</b>	<b>Rating</b>
<b>4.3.1.1</b>	Leadership Failures In KM	Organisational structure has been erected by leadership, which resulted in keeping research groups segregated or prevented from sharing roles to collaborate. This is a barrier to KM and KT activities.	"There are instructions from executive management to have strong communications but practically that's not implemented. That's, I think, the main reason."	Senior researchers report lack of decision-making authority over which researchers serve on teams which they oversee. These respondents describe the problem in terms of a failure of management: specifically, haphazard decision making with regard to work assignments. respondents identify the underutilization of expertise and an imbalance in the distribution of tasks. They Respondents criticize management's preference for arbitrary rules which foster segregation as opposed to collaboration, despite paying lip-service to the principle. Such platitudes are rarely acted upon. Researchers note that efforts to document are met with mistrust, while little effort is made at disseminating and communicating the content. Even where notices are distributed, information is not effectively communicated. Some respondents attribute to this failure to loose leadership, resulting in a weak relationship between institutes at the case-study organizations. KM requires a higher priority and its processes must be re-engineered.	Orange
<b>4.3.1.2</b>	Collaboration And Involvement In Decision Making	Leadership is playing a barrier role in instituting shared decisions and are viewed by respondents to be preventing researchers to become affectionate of KT.	"of course it is not fair to us. for example, if you deserved to be involved in a project... then you should be involved in ... decisions. "	Trust is established when leadership involves in decision-making those who are affected by the process. Decision-making Such involvement builds transparency as well as confidence. Trust is undermined when decisions that affect staff are taken without taking their views, feedback or input. Leadership becomes a barrier where it is viewed by respondents as an obstacle to the product and function of research and its motivations are not communicated.	Orange
<b>4.3.1.3</b>	Explicit Articulation Of KT Requirements In Expressing KT Needs	Respondents claim leadership to not explicitly express their need to external visiting experts to share their knowledge with local researchers. Externals tend to ignore the importance	<i>Finding based on observation</i>	One expatriate researcher at institute 1 stated that, despite his willingness to engage in KT with internal staff, he was neither required nor approached about doing so. Failure to utilize such expertise is evidence that the KT activity is not accorded sufficient priority or strategic importance.	Orange

4.3.1 INDIVIDUAL LEVEL / MOTIVATION / LEADERSHIP PERFORMANCE BARRIERS					
Code	Knowledge blockage	Analysis summary	Sample coded reference quote/s	Analysis	Rating
		of this task on this basis, which creates barriers to local researchers.			
4.3.1.4	The Need For Leadership To Institute Systems	Respondents argue that the leadership is responsible for allowing too many gaps in the systems and processes of their daily routines which creates barriers to streamline their KT activities and meet associated goals and objectives.	<i>Finding based on observation</i>	This node illustrates discontinuity between leadership's stated intention to implement and to streamline processes governing organizational behaviour and its apparent actions. As an initial matter, respondents in rank-and-file research positions express frustration with a perceived lack of systems to organize their work assignments. Researchers describe lack of efficiency and assign fault to management for its lack of support and cumbersome approval requirements. Further, respondents cite the lack of efficient processes and systems for the many gaps in efficiency and the myriad failures which accompany a lack of systematic management of the organisation. Respondents articulate the need to re-engineer their processes to meet their KT goals and objectives.	Red
4.3.1.5	Need For Results-Oriented Leadership	Respondents argue that the leadership is not providing a results-oriented strategy for KT activities which is creating barriers to them to know what to achieve in this regard.	"I'm talking about not taking our research to the next level. There is no spin of accomplishment yet here..."	One research-center Director conceded a lack of tangible results. Accomplishment is directly linked to leadership's capable implementation of coherent strategy for KT. Without this, accomplishment of KT objectives can never be realized. Continued lip-service to KT principles without sincere and substantial efforts toward their objectives is itself a barrier	Red
4.3.1.6	Leadership Sharing Organizational Knowledge	Respondents argue that top management does not practice KT. Middle managers and researchers alike do not know what is taking place within their organization in terms of KT activities. This example sets a barrier	<i>Finding based on observation</i>	Respondents report a generalized communication black out, as middle management staff are unaware of what is going on in other parts of their organization, especially in terms of knowledge-capability building and KT. It is reported that communication of the organisation's accomplishments through the levels of hierarchy from the directors to the researchers is scarce and unreliable. Such failures raise issues of intention; i.e., whether leadership wants information disseminated in the first instance. Failure to remedy this failure could lead to misunderstanding, redundancy, duplicitous transfer and allegations of a lack of transparency.	Red



4.3.1 INDIVIDUAL LEVEL / MOTIVATION / LEADERSHIP PERFORMANCE BARRIERS					
Code	Knowledge blockage	Analysis summary	Sample coded reference quote/s	Analysis	Rating
		from leadership to KT practices.			
4.3.1.7	Leadership Attitude Issues	Respondents find the attitude of leadership to alter their own attitude towards KT since it some times requires creativity and freedom of expression, which the leadership does not encourage.	<i>Finding based on observation</i>	Respondents reported heightened awareness of, and sensitivity to, the gestures, body language, dealings, responses and tone of their managers. Respondents' perceptions concerning attitude are correlated to their perceptions of fairness, equity, and ethical management practices. . Staff members report difficulty in coping with management's irregular and infrequent interaction, as well as the chilling effect such irregularity has on free expression and open communication. Further, such infrequent interaction often is associated with problems, difficulty or interpersonal politics which respondents seek to avoid. The result is further inefficiency, lack of communication and other barriers to KT as part of the KT process.	Red
4.3.1.8	Leadership-Driven Harmony	Respondents feel that the leadership is not providing harmony due to wrong selection of supervisors and directors based on nationality discrimination which affects KT activities due to personal tensions created.	"... Am I the most qualified person to lead? I am not. Let me admit that... Am I the most experienced to be in a position like this? I would say no. There are other people who really have more than enough experience..."	Respondents report a lack of harmony in social dynamics, especially as between Saudi researchers and their expatriate counterparts. Issues concerning personal and professional recognition and respect, as well as fundamental fairness are raised by many respondents and require the leadership to address them. Some respondents admit that leadership takes a disparate and discriminatory view toward non-Saudis, and this issue has been noted as a matter of policy. And one respondent candidly admitted that he was not the best in the team to lead and that there were expatriates who are more qualified:	Red
4.3.1.9	Synchronizing The Research And The Academic Leadership	Respondents find academic and research department heads fragmented and do not serve to synergize the KT activities in a positive way. The leadership in both sectors do not support staff to share and work	"[as a research center director] I report to a head of academic department. He has nothing to do with me. I have nothing to do with him..."	Most researchers in case-study research groups, centers, or institutes have academic roles in their respective departments which entail teaching responsibilities that are not directly related to research, but do serve KT objectives. Similarly, these departments have chairmen who run the respective departments but have no direct relationship to research facilities or projects. The researchers, whether directors, deputy directors or the rank-and-file report to such chairmen for their teaching-related duties, but report to research management in relation to research projects. Between the research and academic sub-organisations exist structural barriers to authority, compatibility of subject matter and communication. Respondent articulates a total absence of overlapping	Orange

# APPENDIX

4.3.1 INDIVIDUAL LEVEL / MOTIVATION / LEADERSHIP PERFORMANCE BARRIERS					
Code	Knowledge blockage	Analysis summary	Sample coded reference quote/s	Analysis	Rating
		in teams.		function as between the research and academic divisions, as he was unable to identify a single task requiring interaction with his academic chairman.	
4.3.1.10	Leading With The Knowledge Base	Older generation respondents feel fed up with recurring change of policies and strategies. Strategies are not allowed to live enough to be realized because of changing leaderships. This is affecting KT and creating barriers to related activities.	<i>Finding based on observation</i>	Although change is to be expected in management within democratic organizations, respondents identify unusual frequency in leadership changes. Competing styles and perspectives create confusion and discontinuity, as well as disruption in existing research, to the extent there are strategic plans set by the previous leaders. Frequent leadership changes do not afford sufficient time for strategic plans to come to fruition. Plans change before their execution, which is problematic and causes many barriers to KT activities especially long-term transitional change programs. Change in priorities, research topics and managing logistics are just some examples of these changes. Senior researchers who are leaders in their fields and have spent decades in practice are the organisation's knowledge base. These researchers articulate a preference for research work and an aversion to involvement in administrative matters, report frustration in frequent management coups. These respondents report disappointment with irrational changes of strategy and a lack of serious attention to research needs from the successive generations of leaders. Such individuals require special attention from the management to encourage them again to be involved and to support KT within the strategic parameters for this purpose.	Orange
4.3.1.11	Resistance To Change Research Direction	The barrier here is the way in which new direction in research focus is introduced to senior researchers by management. The way things are introduced needs to be addressed as it is affecting KT focus.	"I have people here working with us and are experts for lets say around 30 years but he is an expert in one particular subject. If you want him to open a new dimension, you will always feel he is hesitant and he doesn't want to really go there..".	Many researchers express difficulty in coping with management's interference in the substance of research, outside the scope of administrative ability. Specifically, when leadership suddenly abandons a research topic or imposes an inappropriate or redundant substitute, seemingly at random and without any principled purpose. The problem is acute when researchers are not involved in providing feedback on possible research direction strategies. This leads to resistance to change and retaliation against management's haphazard directives. Senior researchers report that they are confronted with conflicting directives, as opposed to opportunities, and as a result morals affected. The barrier here is the way in which this new dimension was introduced to the senior researcher by his management.	Red
4.3.1.12	Leadership Not Accepting KT	Respondents from higher positions tend to	"[i]f it [KT] is part of my job and it is assigned formally	Research institutions are knowledge-intensive and require strategies to advance their knowledge base on a continuing basis. However, respondents in leadership	Red

4.3.1 INDIVIDUAL LEVEL / MOTIVATION / LEADERSHIP PERFORMANCE BARRIERS					
Code	Knowledge blockage	Analysis summary	Sample coded reference quote/s	Analysis	Rating
	Responsibility	resist having KT responsibilities listed formally in their job descriptions as if they want to take the role as optional. This is a barrier to keep KT activities as a priority at the case study organizations.	then I would feel the obligation. May be I am not personally qualified or entitled or even maybe I am not interested to do this. So when you have this as an obligation as part of the job, then that's gonna find resistance of the [leadership] individuals."	roles report that the development of knowledge-related strategies is not part of the job description at the case-study organisations. Not having this kind of high-level obligation in the leadership job description is considered by many respondents as planning for failure in the area of KT and related activities. Further, leadership expresses aversion to KT as a formalized obligation. The reason for this is that it is very easy for the leadership to undermine the importance of KT due to their heavy administrative commitments, which threaten KT outcomes. Tangentially, leadership using its authority to avoid formal assignment of such obligations needs to be addressed perhaps by higher authorities.	
4.3.1.13	Failure To Align Motivation With Accountability	The leadership imbalances between motivating researchers and keeping them accountable to what they do have caused negative effects to KT.	<i>Finding based on observation</i>	Leadership's inability to gauge the appropriate time for praise and for rebuke was also raised. Respondents reported heightened sensitivity to this issue. Leadership's skill of alternating and balancing motivation and accountability is lacking in the view of respondents. Such imbalance affects KT in that it is heavily reliant on motivation and accountability measures. This is an issue that needs to be addressed.	Red
4.3.1.14	Influence On Internal Distribution Of Responsibilities	Respondents express feeling lost and diluted with vague expectations in terms of responsibilities as a serious threat to effective KT.	"I believe that the management of the [host organization] should encourage institutionalizing the practices that are being followed by world-class universities, and benchmark to what extent we have been following those practices... The university needs to revisit the subject. What we feel here is a bottleneck, in that the [case study organization] has not yet clearly identified the responsibilities of the	Some respondents feel that leadership is not applying any measures to gauge or to improve the internal work conditions and the internal distribution of responsibilities. One respondent provides specific examples as to the lack of clarity or guidance in day-to-day work. Respondents express feeling lost and diluted with vague expectations in terms of responsibilities as a serious threat to effective KT. This issue needs to be addressed.	Orange

4.3.1 INDIVIDUAL LEVEL / MOTIVATION / LEADERSHIP PERFORMANCE BARRIERS					
Code	Knowledge blockage	Analysis summary	Sample coded reference quote/s	Analysis	Rating
			different categories of manpower. The senior people, the midcareer people, and the junior people, and how to thread that. The [case study organization] should try to get the maximum of each one of them."  "... for responsibilities that we devote to human resources, are they [the human resources] appropriately informed, acknowledged and are people instructed?..."		
4.3.1.15	Leadership Engagement With The Government	The way the leadership deals with governmental issues where some of them are considered nightmares for some researchers such as complicated funding schemes, visas, and ordering research sensitive materials is considered a barrier to KT.	"Is it [trying to change governmental policies] our honest intent, do we really want [to change those policies]? Then we can always make our own ways. Even to the government, we can propose. This is for the benefit of the nation. If changes are required, why not?"	Respondents express the need and propensity to exert pressure on the government in order to affect policy. Respondents expressed a belief that the government can change its policies if the case-study organisations exerted effort and provided justification for policy change at the governmental level. However, one respondent questioned whether leadership really wants change and claims that avoiding the government to avoid possible complications is not a legitimate rationale. The way the leadership deals with governmental issues where government practices are complicated and hence obstructive such as funding schemes, visas, ordering sensitive materials, needs to be addressed with strategic clarity.	Orange
4.3.1.16	Failure To Follow Up And Follow Through	Respondents see the problem existing in low leadership conscious	"...there has been so many changes. The institutional format, I don't see it existing	Respondents at the case-study organisations report lack of continuity, consistency and uniformity in implementing KT processes and activities. Many internal processes, enforced initially, seem to fade from view after time. One	Orange

4.3.1 INDIVIDUAL LEVEL / MOTIVATION / LEADERSHIP PERFORMANCE BARRIERS					
Code	Knowledge blockage	Analysis summary	Sample coded reference	Analysis	Rating
		look out for consistency in business practice. The change in process and irregular practices confuses and causes barriers to systemized KT practices.	now."	respondent recalls how meetings were active and regular at Organisation Y at all levels initially but that motivation is lacking. Meetings lack regularity. He adds that the whole structure was affected by this irregularity and that the format of dealings between leaders and staff has changed. Weak follow up systems, the absence of alerting systems, poor quality control systems, and, most importantly, management's lack of awareness of the value of consistency bring problems to bear upon KT in business practice. A related issue is the tendency of leaders to overlook KT due to its perceived lack of importance. Overwhelming responsibilities and other commitments compound this disregard, as management is averse to additional formal responsibilities. However, Leaders must look into their responsibilities in the perspective of thoroughness. Leaders also must express to their middle managers the importance of maintaining KT visibility to organizational members and to monitor them doing so. This is critical to KT and needs to be addressed.	
4.3.1.17	Inclination To Micromanage	Respondents find themselves contained in a controlled environment that is creating barriers to KT and restricts their creativity to share their experiences. Approvals are required in almost everything including KT which they find daunting for them.	"but I am too much controlled ... I feel as a senior researcher, too much control is counterproductive...".	Researchers report a lack of creative freedom. If researchers feel that they are encapsulated into a specific volume in a contained vacuum and that they have no right to penetrate these artificial borders then this will definitely halt their creativity and likes to share knowledge freely. Leadership has not allowed researchers to function freely and mandated that most tasks pass through their approval processes. Researchers fear that the low efficiency of processing tasks through leadership has even added a deeper barrier and perhaps resulted in many researchers to avoid engaging in activities that has to do with leadership approvals including KT-related activities.	Orange
4.3.1.18	Leadership Philosophy Towards Importing Expertise	Respondents find leadership focusing on quick results by importing external experts to make immediate deliverables without taking into	<i>Finding based on observation</i>	One case-study Center Director of expressed that he had no long-term view toward building internal knowledge stocks. He instead advocated a recruitment strategy limited to the import of foreign experts in order to produce higher quality and less stressful end-of-year results. The respondent expressed his conviction that the employment and development of young minds is a waste of time, as is ensuring knowledge flow between colleagues or improving the capabilities of researchers. Respondent's candor highlighted the realities of	Orange

4.3.1 INDIVIDUAL LEVEL / MOTIVATION / LEADERSHIP PERFORMANCE BARRIERS					
Code	Knowledge blockage	Analysis summary	Sample coded reference	Analysis	Rating
		consideration that absence of embedded KT into research work eventually results in knowledge debts.		administrative priorities and the consequent pressures. However, the view is myopic in that external experts are – and will continue to be – a temporary stop-gap measure and unless their knowledge is disseminated among local researchers, the research center may fall into a knowledge-debt situation. This occurs where experts suddenly become unavailable due to shortages or changes in market conditions which can leave an institution vulnerable.	
4.3.1.19	Leadership Selection of Specialized Research Topics	Respondents report that the selection of research topics does not show any evidence of researchers participation. The selected topics show little evidence as to how it will be activated to produce end results in relation to knowledge building at organizational level.	<i>Finding based on observation</i>	Some respondents express that they cannot conduct engineering research through a wide-field spectrum. Respondents express the need for specificity in order to deliver quality results. They report that specialization with carefully selected engineering field topics would develop more valuable competitive advantage internal expertise on the long run. They argue that the leadership selection is sometimes incorrect and does not encourage research excellence as well as KT behaviour associated with such direction. This is a strategy point of view that researchers oppose to leadership to practice. They argue that if no details are distributed on how and why a research topic was selected for example over other options, then this would eventually cause frustration among researchers who would loose interest in KT since KT needs high motivation as well as high morale. Researchers express doubt as to whether there are rigorous selection criteria, as well as suspicion to the reasons they are excluded from the process. The selected topics are even sometimes fragmented from the available internal expertise and show little evidence as to how it will be activated to produce end results at organizational level. This is considered a barrier to effective KT and needs to be addressed.	Red
4.3.1.20	Leadership Commitment as Researchers	Respondents report that their excellent researchers become organizational leaders and then they loose interest in research they have always been good at due to time pressure and also have no time to KT with colleagues.	<i>Finding based on observation</i>	Leaders at the case-study organisations develop their management skills from within their research organisations as lecturers and researchers. They climb the hierarchy to reach leadership positions ultimately based on their research achievements and not on their management expertise. This means they are rewarded apples for making good oranges. This also means they have always been developing engineering research expertise and therefore are considered as the best in their research area. The loss for the organization is twofold: (1) losing a good researcher; and then (2) placing an unskilled individual in management positions. Therefore, it is not beneficial for the organisation that these successful researchers abandon their research activities to learn management. They are still	Red

4.3.1 INDIVIDUAL LEVEL / MOTIVATION / LEADERSHIP PERFORMANCE BARRIERS					
Code	Knowledge blockage	Analysis summary	Sample coded reference quote/s	Analysis	Rating
				needed by their organization more than ever before to contribute as researchers. The issue of maintenance of expert scientists in research must be addressed.	
4.3.1.21	Leadership Influenced By External Decisions	Respondents raise the issue that upper management is actually influenced to a large level by external decisions across the borders of their organisations, which raises concerns and should be addressed.	<i>Finding based on observation</i>	Respondents report that research activities within case-study organisations are divided in many projects funded by external bodies. This funding may influence or even alter internal leadership strategies, as a result of political power imposed by the funding entities. It is essential that these alterations in internal strategy do not affect the progress and, more importantly, the expansion of research activities both in scale and scope. However, respondents raise the issue that upper management is actually influenced to a large level to external decisions, which raises concerns and should be addressed.	Orange
4.3.1.22	Leadership Mission And Vision	Respondents find mission and vision developed by their corresponding leaderships to be unclear and as a consequence misplace their organization direction. This effect causes barriers to KT.	"[i]f you ask me what is the goals of your institute, I can give you a headline but I am not sure what it really means... For most of the guys, its not clear."  "If your mission is for money, take it from me now, close it [the research institute]. Dismantle it. If your mission is really to have technology, to have progress in a certain direction, to be really what you call a glory for specific areas then this is another issue."	Researchers at the case-study organisations share the problem of a lack of clarity or conception of the organizational mission. This lack of vision needs to be addressed. Members need to know why they are brought to work for the organisation and how they are adding value and in what ways they are to be able to build such value to the next level. The mission must be clear and must truly resemble transparency for the organization and its stakeholders.	Red
4.3.1.23	Leadership Requirements For	Respondents find imbalances to emerge from leadership	"I call them [leadership] crazy people, they will ask other entities to pay. They	Some respondents at the case-study organisations indicate that the leadership does not comprehend the shortcomings of its own organisation and tends to approach collaboration as if other organisations were actually sub-par.	Red

4.3.1 INDIVIDUAL LEVEL / MOTIVATION / LEADERSHIP PERFORMANCE BARRIERS					
Code	Knowledge blockage	Analysis summary	Sample coded reference quote/s	Analysis	Rating
	Collaborations	decisions to impose financial requirements when entering into scientific collaborations with external researchers. This slows down useful collaborations and affects KT.	will accept to continue joint research as long as they [external collaborators] are putting money, and this is not right, because they [external collaborators] are ahead of you, and you are behind them. You have to pay them until you reach them, so how come you ask for money from their side to give to you? for the sake of what they are going to be giving you money?"	Organisation Y, for example, requires collaboration to take place on its premises for a fee. Respondents claim that this is due to unwarranted ego on the part of management, which translates into demanding payment which is devoid of value. The strategy for collaborations must be clearly based on knowledge building and not on financial returns as the researchers highlight. Respondents feel that the case-study organisations should also be targeted for real collaborations that are not transactional either way to ensure the clarity of the knowledge goals. Researchers will also want to feel that they are in equal position with their collaborators across the borders of their organization. This current situation is considered a barrier to useful KT practices and need to be addressed properly based on realistic grounds.	
4.3.1.24	Leadership Expectations Related To Existing Internal Staff	Some respondents find good researchers to be attacked by the leadership to produce more research outcomes and to make up for the organisational weaknesses resulting in their exhaustion and altering them from allowing KT activities to be considered.	"if their salary is not up to their [researchers] standard then they should refuse, they should resign and leave."	There is clearly a consensus as reported by respondents that manpower issues exists and that the leadership has not addressed them, at least from a researcher's perspective. Since the leadership is not only hoping for quality results but a large sum of achievements then this consequently aggregates the problem from a quality only issue to a both quality and quantity issue, a double-loop problem. Pressure rises on few high quality individuals to produce larger scale results, which is perceived by respondents as causing possible exhaustion - i.e. resulting in employee dissatisfaction that is hitting the very best individuals. Such attitude from leadership towards some individuals has devolved into one of mistrust and hostility. One leader responded to the dilemma as follows. This tone shows how the situation has devolved and has become cyclical in its destructive aspects. The problem needs to be addressed.	Red
4.3.1.25	Methodology Hypothesis In Developing Leadership	Maintaining the satisfaction of leadership creates potential for the concerned researchers to receive promotion	"if I am now a center director and I want to go to a higher position, so I work short-term here until I satisfy everybody to make another step up and another step	Respondents appear to have developed a mindset as to the inner-workings of management and its methodology. Respondent describes a state of affairs where fear of upsetting those in higher levels and the avoidance of conflict are the formula for advancement. Middle management reports that any action that could upset higher leadership as a mistake regardless of its rationale. They avoid this by minimizing committing such "mistakes" to be able to reach higher leadership	Orange



4.3.1 INDIVIDUAL LEVEL / MOTIVATION / LEADERSHIP PERFORMANCE BARRIERS					
Code	Knowledge blockage	Analysis summary	Sample coded reference quote/s	Analysis	Rating
		and higher possibilities to climb the leadership ladder, respondents claim. Confronting leadership results in losing this chance. This is a threat to KT initiatives.	<p>up... Making people happy to move up... This is also part of our problems."</p> <p>"we have the ABC [anonymously hidden] research group, there is only one senior expert person who is active in his research and that's why there is a satellite around him, bullying him because one Vice Rector/president who is very weak in his research is blaming ... that they are doing the same thing for 20 years. Okay, if you are good, and he is not, then at least do as much, do the same, let us start with this point. We will not ask him to be better, start like from the level of the people you criticize, and then move, but because they are close-minded, there is more attack on this individual. Why not ask can we add more people to allow for diversity? Let us start new areas without bullying this researcher. This is how you flourish. This is not happening. I am telling you, this is another problem".</p>	levels. The management style is defensive; i.e., trying to do as little as possible to reduce mistakes. This sometimes becomes aggressive when someone might challenge this kind of management. Maintaining the satisfaction of leadership creates potential for the concerned researchers to receive promotion and higher possibilities to climb the leadership ladder, respondents claim. Confronting leadership results in the explained above as described. This matter claimed to be being committed by the leadership at the case study organisations needs to be addressed.	

<b>4.3.2 INDIVIDUAL LEVEL OF ANALYSIS / MOTIVATION / PERSONAL INTEREST</b>					
<b>Code</b>	<b>Knowledge blockage</b>	<b>Analysis summary</b>	<b>Sample coded reference quote/s</b>	<b>Analysis</b>	<b>Rating</b>
<b>4.3.2.1</b>	Researchers Individual Interests	Respondents report that researchers from faculty departments spend their time on scattered research areas based on their personal interests that do not either support targeted organizational knowledge nor organisational research goals.	<p>"The research in here, is basically... if you come to it, people are trying to do research based on interest, not on the need."</p> <p>"... You know we have many smart people here, but if they don't have interest then it's a problem for the KT..."</p>	Respondents report that many individual research activities are based on the personal interests of the researchers and do not, as a matter of design, follow a direction that is defined by the organization. Respondents report that researchers do not follow their organization's vision in selecting research topics. Case-study organisations seem to allow autonomous work to prevail in such research to the extent that it results in minimal value to the organisation's stated goals. KT is also obscured, as knowledge created from this individual research remains unnoticed in many situations. Therefore, having autonomous research conducted by individuals based on personal interest can be a barrier to efficient KT efforts. Researchers should spend time and effort collectively to achieve organisational and perhaps national goals, as opposed to the current state of affairs, in which arbitrary and capricious personal interests are paramount. This is an issue that needs to be addressed. Researchers are the main element in successful engineering breakthroughs. Researchers should have the drive to learn, to share and to generate beneficial knowledge for their organisations. Some respondents, however, fear that this is not the case at the organisations at issue. The alignment of individual and organizational interests is key to the success of group research activities as well as to successful group KT.	Green
<b>4.3.2.2</b>	Interest In Internal Projects	Respondents find most senior researchers interested to focus on publishing and patenting rather than building internal knowledge capability and sharing knowledge with junior researchers due to the common	"It's [unavailability of high quality junior researchers to support senior researchers] a big problem that made some of the expert researchers here end up with either being discouraged and try to do the whole work by themselves, or to cooperate with other institutes and participate in their projects instead of	Some respondents reported a lack of initiative in establishing and executing projects internally, which raises the issue as to whether there is a disincentive to do so. Ostensibly, respondents cite a lack of manpower, which causes senior researchers to pursue work outside of the organization. In reality it is an intentional result. Senior researchers express frustration with junior researchers and their lack of skills and articulate a desire to escape from them. The fact that respondents find senior researchers interested more in publishing and patenting rather than in building internal knowledge capability is a barrier to KT which	Green

4.3.2 INDIVIDUAL LEVEL OF ANALYSIS / MOTIVATION / PERSONAL INTEREST					
Code	Knowledge blockage	Analysis summary	Sample coded reference quote/s	Analysis	Rating
		atmosphere being not supportive.	initiating and running their projects inside Organisation X"	requires further analysis.	
4.3.2.3	Exertion Of Effort For Knowledge Sake	Respondents feel that the knowledge sharing process requires a culture of generosity but many internal and external senior researchers may find it an unnecessary task for them to spend their valuable time to share what they know. This attitude has developed several barriers to KT.	<i>Finding based on observation</i>	Self-esteem was reported as a barrier where embarrassment obstructed persistence to efficiently absorb knowledge as well as to engage others. Respondents articulated a perception that the knowledge-sharing process requires a culture of generosity, though in reality senior researchers did not engage with those on the periphery. This attitude has developed several barriers to KT. A respondent explains his course of action when he finds reluctance in the cooperation of others due to difference in age, skill or experience.	Orange
4.3.2.4	Resistance To Assuming KT Coordination Responsibilities	Many respondents feel that they would not feel comfortable working as agents for KT. Some feel it is a secretarial job and others feel it is too ambiguous and they know so little about it that they would feel unqualified to take it	"I don't want to put myself in the forefront ...may be I am not interested to do this [KT coordination]. So when you have this as an obligation as part of the job, then that's gonna find resistance of the individuals..."	Many respondents indicated a lack of comfort working as agents for KT. Some perceive it is a secretarial job unbefitting a scientist or an engineer, while others feel it is too ambiguous an undertaking given their background qualifications. Still others indicate that it is unnecessary or impossible to apply to a particular organisation because of its phenomenological nature.	Orange
4.3.2.5	Personal Initiatives In The Area of KT	Some respondents reported that the encouragement towards this direction must come from the management to	"They should ask me... If they asked me, I would do it [KT initiative thinking]..."	That researchers report a willingness to cooperate or share knowledge only if asked or approached explicitly betrays a lack of initiative and motivation as well as a total disregard for KT as a serious obligation. Some respondents reported that encouragement towards this direction must come from management to achieve legitimacy and to bring it from a personal objective to an objective one. The challenge is to	Orange

4.3.2 INDIVIDUAL LEVEL OF ANALYSIS / MOTIVATION / PERSONAL INTEREST					
Code	Knowledge blockage	Analysis summary	Sample coded reference	Analysis	Rating
		legitimize this personal motive.		uncover the real reasons behind low interest in KT initiatives among the case study organizations and their members. In the absence of disclosure, these motivations require further inquiry.	
4.3.2.6	Legacy Of National Curriculum	Respondents report that the KT related barriers that exist in the national culture, which is rooted in the national educational system, is brought to the case study organisations' research entities from ore-employment perceptions and cultural roots.	<i>Finding based on observation</i>	Respondents observe embedded cultural norms, which appear to have been inherited from the national education system. Respondents find many aspects of the national agenda reflected in the organizational cultures, which are rooted in the national educational system. A lack of productivity, critical thinking skills, individual initiative and original thinking arise from this inherited culture. A link is to be explored between organisational culture and national culture and the effects on individual interest. The realization of a population of uninterested researchers in KT due to cultural norms could have a significant impact on the KT effort and therefore become a persistent barrier to its improvement.	Red
4.3.2.7	Egoism Of Senior Researchers	Some respondents feel that their colleagues or even peers do not have much knowledge to offer them due to their high level of expertise. The act of sharing knowledge is therefore not of interest to them.	<i>Finding based on observation</i>	Some respondents avoid the KT process as they feel colleagues do not have much to offer due to their own high level of expertise. Although other respondents find this attitude counter-productive, it is nevertheless pervasive among more senior respondents. A necessary consequence of a mindset that avoids engagement is the lack of interest in sharing knowledge. Such respondents do not sense an obligation to share if there is no taking. "I have all the expertise...".Such egoism renders the prospects of intellectual exchange and sharing knowledge low and affects the KT sharing activity as a whole. Because this attitude has been noted to a degree of redundancy among senior researchers, it needs to be addressed.	Red
4.3.2.8	Interest In New-Knowledge venues	The issue of not having interest in finding new knowledge dimensions despite resistance to accept this concept and to the general view of putting generating	"I have people here working with us and are experts for lets say around 30 years but he is an expert in one particular subject. If you want him to open a new dimension you will always feel he is hesitant and he doesn't	One middle manager reported the tendency of senior researchers to continue in old habits and avoid adjusting to new knowledge needs. The technology evolvement in engineering fields requires personal interest in generating new knowledge. Respondents report low interest in this area. Lack of interest in finding new knowledge dimensions as well as resistance to accept the value of knowledge generation has become a barrier that needs to be addressed.	Orange

<b>4.3.2 INDIVIDUAL LEVEL OF ANALYSIS / MOTIVATION / PERSONAL INTEREST</b>					
<b>Code</b>	<b>Knowledge blockage</b>	<b>Analysis summary</b>	<b>Sample coded reference quote/s</b>	<b>Analysis</b>	<b>Rating</b>
		knowledge on low profile hinders knowledge sharing activities and becomes a barrier that needs to be addressed.	want to really go there ...".		
<b>4.3.2.9</b>	Expropriation Of Expatriate Work Product	Using joint work between local researchers and expatriates as undercover to make up for low interest and low contribution of local researchers is an issue that needs to be addressed. Expatriate respondents did express a bitter feeling regarding implementing KT in an unethical way to personally benefit local researchers.	"They should not transfer the success of the expats to them in this way... and pretend that they did it. This is actually not going to help this nation."	In rare cases, local nationals expropriate work done by others, especially expatriate researchers, obtained through personal joint work. Some respondents reported that the local researchers have low interest in contribution but a much higher interest in credited for research work, irrespective of its source. As a whole, this is an ethical issue that is linked to personal interests to receive false recognition. Using joint work, which is supposed to add synergy to the research activities in a way that tends to cover for low interest and low contribution of local researchers, is an issue that needs to be addressed. Expatriate respondents did express a bitter feeling regarding the expropriation of work product in an unethical.	Orange
<b>4.3.2.10</b>	Interest In Working Alone	Respondents reported that there are researchers who have no interest to work in teams or do research activities with colleagues. Instead, these researchers prefer to work alone, overseeing their	"... I see they [some organizational members] oversee the grounds and I also see that they oversee the obligations. I still see some loners, people who do research by themselves... there are people at which they are being ..., I mean reached to saturation. No matter how much you push	Many researchers have no interest in working in teams or conducting research activities with colleagues. Instead, these researchers prefer to work alone, overseeing their obligation to KT. As the respondent explains, they have no interest to work with others. This matter needs to be addressed.	Orange

4.3.2 INDIVIDUAL LEVEL OF ANALYSIS / MOTIVATION / PERSONAL INTEREST					
Code	Knowledge blockage	Analysis summary	Sample coded reference quote/s	Analysis	Rating
		obligation to KT.	them, they prefer to work alone ..."		
4.3.2.11	Interest In Taking Scientific Obligations	Taking the sense of obligation towards scientific responsibility is considered a motive for KT activities. The lack of action to take sense feeling to the next level created a hidden barrier for KT. Respondents justify this situation by the absence of scientific strategy to convert this individual obligation into useful action.	"...because its part of being a scientist. You have to collaborate, you have to network, you have to exchange knowledge with people, if you are not doing this then a big chunk of your responsibility is missing...".	Most researchers at the case-study organisations acknowledge that the profession entails some sort of scientific obligation toward the creation of knowledge and its sharing. They report understanding that engineering research is unique and normally builds incrementally upon knowledge shared in scientific circles. Some respondents also demonstrate comprehension that this profession is creative and, in many ways, may have vast effects on the economy of Saudi Arabia if properly commercialized and exploited. This understanding did not take a functional dimension; rather it is something to talk about at the case-study organisations. Since this sense of obligation is considered a motive for KT activities, the lack of action to take the scientific obligation to the next level created a hidden barrier for KT. Respondents justify this situation by the absence of scientific strategy to convert this obligation into useful action. Moreover, researchers perceive a further dimension to their scientific obligations; namely, that an individual sense of responsibility has been fading in relation to those values, which has affected KT activities as a general culture on the individual personal interests levels. A respondent supports those values but could not give a direct answer whether this is being exercised at their organisation. Demonstrated lacks of interest in these obligations implicate categories such as ethics, skills, culture and perhaps mindset.	Orange
4.3.2.12	Interest In International Recognition	Some respondents claim that it is very important to develop interest among researchers to produce internationally recognized work. Some respondents report that this interest is	"... When you are seeking to have support for work that is being recognized internationally, then I think you have to collaborate with outsiders, especially who are way advanced."	The appetite for international recognition is variable according to respondents. Some respondents assign a high level of importance to developing interest, which is absent now at the case-study organisations. Respondents describe such lack of interest as the product of a generalized lack of confidence in working with international experts. Lack of interest in collaboration is tantamount to the failure to compete on the global level. All KT related matters would drag on this philosophy and become serious barriers. This matter needs to be addressed	Orange

4.3.2 INDIVIDUAL LEVEL OF ANALYSIS / MOTIVATION / PERSONAL INTEREST					
Code	Knowledge blockage	Analysis summary	Sample coded reference	Analysis	Rating
		sometimes not present. Lack of interest in this area is a barrier to KT.			
4.3.2.13	Interest In KT	Loosing interest in KT responsibilities and in KT brokers because of presumed conceptions and mental frames that have been developed over the years from within the organisational culture could have hindering effects to developing the KT activity in the organisation. This needs to be addressed.	"...if you have a KT specialist to coordinate knowledge, he might not coordinate knowledge, he might cut knowledge when its going outside [or inside]. If I understand the work of the specialist correctly, those specialists will be some sort of guards at the end, that will be like, ok, say this, don't say this, which is obviously not acceptable...".	Some respondents express reservations at having KT agents at the case study organisations, fearing that this would limit KT to the extent that such agents might serve a filtering function as regards incoming knowledge. . Therefore, some respondents express disinterest in the establishment of KT agents in the workplace, or even in dealing with such an individual in any capacity. Lack of interest in KT responsibilities and in KT brokers merely because of such pre-conceptions may obstruct KT activity in the organisation.	Red

<b>4.3.3.1 INDIVIDUAL LEVEL OF ANALYSIS / MOTIVATION / CALCULATIVE APPROVAL</b>					
<b>Code</b>	<b>Knowledge blockage</b>	<b>Analysis summary</b>	<b>Sample coded reference quote/s</b>	<b>Analysis</b>	<b>Rating</b>
<b>4.3.3.1</b>	Discriminatory Recognition In Research Outcomes	Daunting for many researchers is the prospect of working hard with little or no recognition from their organisation.	"... research credit is not recognized in ranking and promotions.... unless you follow the academic system.... but I was placed on the civil services payroll system for 5 years before being transferred to the academic system. By then, I already did several projects without benefits...".	Daunting for many researchers is the prospect of working hard with little or no recognition from their organisation. The recognition of good work is necessary to increase motivation and hence improve performance. Some respondents show how lack of recognition is intrinsic in their organisation. Researchers report a tendency to slow down, to avoid working hard, or simply to let time pass, all due to belief they have that their good work pass by without recognition. There is no recognition system focused towards building reputation and recognition to individuals. This issue needs to be addressed.	Red
<b>4.3.3.2</b>	Researchers' Legitimacy As Decision Makers	Lack of recognition in decision-making has serious barrier effects on KT.	" if you deserved to be involved in a project, then you must have been qualified, trained and everything, so you should be involved in such decisions as well."	Researchers report the need to be recognized as stakeholders in decision making if they are to have a feeling of belonging and an interest in KT. Lack of recognition in decision-making can have serious negative effects on KT. A respondent explains.	Red
<b>4.3.3.3</b>	Effects Of Organisational Recognition On Individuals	Research institutions in Saudi Arabia do not enjoy a high level of international recognition.	"if we said it [Saudi research institutions] is internationally competitive we deceive ourselves".	Research institutions in Saudi Arabia do not enjoy a high level of international recognition. Therefore, it is difficult for many outstanding researchers to receive such recognition due to the standing of their institutions. This matter is seen by some researchers as barriers to be motivated and hence to dedication to KT. A lack of recognition may lead to some individuals to overestimate the accomplishments of their institutions in order to gain individual recognition. This needs to be addressed as explained by one respondent:	Orange
<b>4.3.3.4</b>	Lack Of Middle-Management Authority	Lack of authority among middle managers represents a KT barrier	" It doesn't really make a difference if I am a centre director or not. Centre director position here is another side job, it is not my main job. My main job at the university is a faculty	Center Directors who fall in the middle management category report lack of authority and do not have the capacity to make decisions necessary to the functioning of their research centers. They articulate a perception that their positions are temporary and not strategic to the organization and hence experience greater attachment to their academic positions:	Red



4.3.3 1 INDIVIDUAL LEVEL OF ANALYSIS / MOTIVATION / CALCULATIVE APPROVAL					
Code	Knowledge blockage	Analysis summary	Sample coded reference	Analysis	Rating
			member."		
4.3.3.5	Under-Recognizing Expatriates Potential	Many expatriates express alienation and a feeling of detachment from the organization.	<i>Finding based on observation</i>	Many expatriates express alienation and a feeling of detachment from the organization. Many factors work to their exclusion disempowerment as sincere members who have the same weight as their local counterparts. This feeling develops bitter reactions towards KT and internally disseminating the knowledge that they spent many years to acquire. It also triggers feeling of no belonging and threat of being replaced by locals. This issue is a barrier to KT and needs to be addressed.	Red

<b>4.3.4.1 INDIVIDUAL LEVEL OF ANALYSIS / MOTIVATION / CALCULATIVE APPROVAL</b>					
<b>Code</b>	<b>Knowledge blockage</b>	<b>Analysis summary</b>	<b>Sample coded reference quote/s</b>	<b>Analysis</b>	<b>Rating</b>
<b>4.3.4.1</b>	Time Factor In Developing recognition	The reputation issue has direct effect on the willingness of people to approach each other and engage.	" Still I'm not sure, I don't know all of them. It is a new university and we have to wait another two or three or may be five years to know who is really serious and who is productive and who is not".	It is necessary for people to have sufficient time in order to develop capabilities and to build a suitable reputation. The organisation would have to wait and see the results obtained from an individual before ranking his or her reputation. This reputation issue has direct effect on the willingness of people to approach each other and engage. People need to know how to perceive someone before considering KT with him or her. The guidance on this issue from the university is essential. The organisations are not providing catalyst or allow people to understand that the organization understands this matter.	Red
<b>4.3.4.2</b>	Difficulty In Developing Mutual Respect And Sharing Knowledge With Individuals Of Repute	Academic, cultural, social and personal power reputation represents different angles to the KT barrier.	"From a scholar point of view, from a scientist point of view, you have a reputation and you want to be sure that when you're committed you are dealing with the right person".	Researchers in the case-study organisations face many barriers due to reputation issues. The researchers need to remove the reputation barrier to be able to communicate freely with international experts. The reputation topic is linked with several lenses. This includes academic, cultural, social and personal power reputation. The respondent speaks of one example where reputed experts do not offer priority to KT with less reputed individuals. This issue needs to be considered. Researchers also report a lack of respect due to diminished reputation. This is a barrier to KT activities as many researchers may avoid engagement activities due to the feeling that they are not respected. The more researchers feel that they are respected; the more confidence they have to enable them to engage with others and interact. On the other hand, when researchers receive the opportunity to engage with reputable experts, they need to have the ability and the initiative to engage the expert, absorb knowledge and dispense with the presence of equality in terms of ability.	Orange
<b>4.3.4.3</b>	Loss Of recognition As A Result Of	The reputation of the group and the organisation as a	"yes we have experience, but we lost now some of our glory, because many of our researchers retired, we are left with a couple	The recognition of individuals builds on the collective reputation of the group and the organisation as a whole. This collective reputation forms the basis of the individual	Red

4.3.4 1 INDIVIDUAL LEVEL OF ANALYSIS / MOTIVATION / CALCULATIVE APPROVAL					
Code	Knowledge blockage	Analysis summary	Sample coded reference quote/s	Analysis	Rating
	Attrition	whole represents another KT barrier	<p>of them, so this is another problem".</p> <p>"yes, the trust. For example, if you have someone who is your colleague in the university, you have all the massed multiple folds with him because he already knows you and he knows you very well, he trusts you, he knows your achievements and it is quite inevitable that you guys would have to collaborate with each other... When it is with an outsider, he doesn't know you, how is he going to trust you that you are not going to take his knowledge, for example? Let me give you a basic example, you can have both guys collaborate in a project and then you can publish the work without mentioning his name. Someone can do that. That's why some people will be reluctant to give you information to solve your problems, to give you consultations, if he doesn't know you. That's why sometimes its tiring to establish good collaborations with reputable people, especially when you are talking about people who working in top 10 institutions. They are very careful when it comes to working in collaborations. They do not collaborate with anyone because every collaboration is counted on him. He doesn't want to associate himself with someone having bad education in the field maybe or someone..".</p>	<p>reputation, which is affected when individuals of renown leave the organisation. This in turn may result in a concomitant decline in the reputation of others in their individual capacities. This situation may be a barrier to KT. Trust also intersects with reputation in that a researcher of repute must value and trust the potential collaborator.</p>	

<b>4.3.5 1 INDIVIDUAL LEVEL OF ANALYSIS / MOTIVATION / REWARDS</b>					
<b>Code</b>	<b>Knowledge blockage</b>	<b>Analysis summary</b>	<b>Sample coded reference quote/s</b>	<b>Analysis</b>	<b>Rating</b>
<b>4.3.5.1</b>	Penalties As Negative Incentives	There are very weak penalty elements that address low accountability and performance matters that send the wrong message that it is ok not to perform optimally.	"We have a problem with the system, the system doesn't really reward, it does sometimes only reward, but it doesn't punish enough so that people perform at their most "	Penalties, defined broadly as negative incentives, may be as effective as rewards. One respondent points out that there are essential elements for successful systems, which include reward and penalty elements. These two are presently underdeveloped.	Orange
<b>4.3.5.2</b>	Absence Of Categorized Situational Incentives	In situations where a senior researcher finds himself in demand to train many new researchers, there are little incentives designed for this senior category of researchers.	<p>"So basically, a researcher here instead of having a professional team, he usually ends up with a team who needs to be raised in terms of skills. Most researchers here are becoming discouraged because of the time, because they noticed that the time they spend on developing skilful people, most of it goes away, because those skilled people move..."</p> <p>"Of course the rewards or the money or the financial support needs to be regulated...The current regulations are considered a barrier to KT ..."</p>	A system of penalties and rewards touches upon the generation of new knowledge and ideas to the extent that it fosters the sharing of knowledge. If KT within the organisation is weak, how could KT be better when people are separated apart as for the case between the internal and the external individuals? Effective senior staff require incentives to help the junior researchers grasp communication skills and enough knowledge to engage with external researchers. This needs first a strong KT activity internally. The task above requires regulative systems. It is not possible to have high performance with the money regulations that are being employed, hence, this issue needs to be addressed.	Orange
<b>4.3.5.3</b>	Reliability Of Research Management	Research projects require steady support in order to produce tangible results. The changes in policy and support throughout the lifecycle of research projects interrupts KT and other research	"Let's focus on the problem. What I have is not common. I am lucky here to have 3 projects at the same time...The project also may stop at any time ... The funding may stop, like 2 years ago when the initiated one mega projects and most of the other projects we were stopped and funding went to the mega project but we still worked".	There are many research projects that researchers wish to join but are not allowed for various reasons. Also many projects are altered in terms of their spending, budget, priority and staffing.	Red

4.3.5 1 INDIVIDUAL LEVEL OF ANALYSIS / MOTIVATION / REWARDS					
Code	Knowledge blockage	Analysis summary	Sample coded reference quote/s	Analysis	Rating
		related elements. It is essential to reward researchers for their work rather than interrupting their work flow.	"they did not pay us because the budget was cut. I was motivated because I wanted to learn not for the money"		
4.3.5.4	Authority Of Frontline Managers To Reward	When research centre directors see some researchers performing in an outstanding fashion, the actually have very little space to reward them which causes frustration among center directors and research alike. This limits the center director's capability to encourage KT in their teams.	"we don't have the tool for money rewards. We can give them something else like travelling ...".	The frontline and middle management have very little authority over incentives for staff. This is a typical governmental attribute, however, center directors engage on a daily basis with researchers and in order to perform effectively do need authority to provide individual motivational rewards. Not having the authority as such may cause KT to lack while center directors are helpless to intervene.	Orange

<b>4.4.1 INDIVIDUAL LEVEL OF ANALYSIS / PSYCHOLOGICAL CONTRACT / EMPLOYEE COMMITMENT</b>					
<b>Code</b>	<b>Knowledge blockage</b>	<b>Analysis summary</b>	<b>Sample coded reference quote/s</b>	<b>Analysis</b>	<b>Rating</b>
<b>4.4.1.1</b>	Commitment To Learning	Many researchers fail to commit to or persist in learning from KT.	"in most of these cases, I just skip this knowledge and look for other resources..."	Researchers demonstrate an understanding of the costs and benefits of acquiring knowledge and view the calculus as a net benefit. However, many fail to commit to or persist in learning from KT, especially when they encounter interpersonal difficulties. When a researcher attempts to seek specific knowledge and finds resistance from the provider, then this may halt the KT process and create a barrier within the knowledge seeking individual for future attempts. The strategy of getting the 'easy' knowledge may prove to be wrong and harmful for researchers. This challenge requires a commitment from the research to continue to try using all possible and ethical techniques. The organisation needs to decrease the resistance of the providers and increase the persistence of the seekers. It needs to simultaneously address this issue as researchers may begin to surrender when time passes without success, which implicates learning practices	Orange
<b>4.4.1.2</b>	Committing To Best Learning Practices	In order for knowledge seekers to learn correctly they need to learn by doing, testing, investigating, going back to experts and so on. This is a tedious but proved to be the best practice to learn. Some researchers do not commit to this method and prefer spoon-feeding ways.	"Some people just gave up, they just stopped. I cannot do this in that way so I will stop. "	Many researchers actually do not know what it takes to learn from groups and colleagues, especially when this involves international interactions. Process-specific obligations of learning are highly dynamic and require some basics to produce a favourable result. A respondent expressed his views on this in his organisation as failing. However, the problem here lies in two main issues: AC of learners, and behavioural skills of learners. From the perspective of the knowledge provider side, some initial training on teaching methods are required for the Saudi learners to adapt to the prerequisites of international learning.	Orange
<b>4.4.1.3</b>	Learning Accountability	Keep researchers accountable for their learning and KT processes could help produce measurable	"... or may be I am not interested to do this...".  "... I am academic, I came from academia. When my term is	Researchers should keep an eye to results from their learning. Keeping a commitment to accountability in the learning process is essential to ensure results. KT requires supervisors and senior staff to take their share in accountability to push towards synergetic engagements. The barrier, on the other hand, would be when supervisory staff are not	Red

		<p>results. When supervisors do not take part in ensuring this, KT tends to fade and outcomes are unnoticeable. This could commitment problem could be a serious barrier to effective KT.</p>	<p>finished here, I have to return to my department faculty..."</p>	<p>committed to this responsibility. This issue needs to be addressed. Without the commitment of supervisory staff to KT activities it is almost impossible for staff to plan and execute KT processes. Also, the commitment needs to strongly exist to the position of being a supervisor. Many researchers when being assigned supervisory positions such as Research Center Directors feel not much committed to their positions.</p>	
4.4.1.4	Commitment Of Knowledge Providers And Industry Users	<p>Most entities from the provider and user perspectives tend to have less interest in KT than the case study organizations. This builds up extra pressure on the internal researchers to try to involve those entities who show little commitment to KT. This is a barrier to KT.</p>	<p>"... I did some work with some entities during summer, and what I found was that there is a lot of research subjects taking place in the facilities, but when you go to the labs you don't see something running, why? the answer comes from the researcher, I am not willing to repeat my Ph.D. and sit in the lab and do the experiments, I need more labor to work with me. So, this is the sort of things they have inside. So I think some of them are shuffling papers..."</p>	<p>In order for KT to take place across the borders of the research institutions both from overseas experts and to the local industry, researchers in local industry must engage in relevant research topics to the hands-on level. Learning across the borders -- whether seeking or giving experience -- requires a commitment from the providers and users alike. The difficulties in the processing of passing knowledge across the borders are a real test to the commitment of those involved in the process. When the local industry tends to avoid engaging in actual research and prefer to receive ready-made solutions developed by research organisations whether domestic or international, then this will lead to a culture of research consumption rather than a culture of innovation and creativity. The tendency to work on turn-key basis with research institutions develops a barrier to KT as seeking knowledge becomes absent from their actual intentions and instead they tend to look for the 'finished' solution. This needs to be addressed. Nonetheless, researchers abroad are not willing to invest time and energy to help the case study organisations learn especially when they realize the bureaucracies involved and the tedious way of management.</p>	Red

4.4.2 INDIVIDUAL LEVEL OF ANALYSIS / PSYCHOLOGICAL CONTRACT / EMPLOYEE LONGEVITY					
Code	Knowledge blockage	Analysis summary	Sample coded reference quote/s	Analysis	Rating
4.4.2.1	Turnover	Case study organisations loose their best researchers to the industry. The reasons vary but it is mostly because of financial and career development incentives. The turnover trend at the case study organisations hinders the KT cycles and causes barriers to learning sustainability.	"... those skilled people move to other institutions, move outside of [Organisation X]... its almost the whole cycle is sometimes 2 to 3 years. So basically, once you get him trained, he's out."	Many researchers leave their research institutions for better jobs at the industry. This lack of commitment is said to be due to better pay at the industry and more advanced development plans:	Red



4.4.3 INDIVIDUAL LEVEL OF ANALYSIS / PSYCHOLOGICAL CONTRACT / EMPLOYEE LOYALTY					
Code	Knowledge blockage	Analysis summary	Sample coded reference quote/s	Analysis	Rating
4.4.3.1	Loyalty To Organisational Success		<p>"... basically, once you get him trained, he's out..."</p> <p>"... I think it's [KT activities] not effective in [Organisation X] because many people don't want to work hard for [helping the organisation succeed]..."</p>	Loyalty can play a vital role to remedy the many barriers KT faces in the case study organisations. This arises from the reality that there are too many obstacles that require much commitment and loyalty to stand to. Among the many loyalty indicators being able to resist the lucrative offers provided by the local industry to attract eminent researchers from research institutions. Many of the young researchers get attracted and leave their organisations before they develop the necessary loyalty to their organisations. Other indicators of weak loyalty include low productivity. These issues strike KT activities as it halts its progress in the middle of the process, leaving the activity of KT questionable as the right thing to do. Research institutions need to apply branding strategies to foster loyalty and sustain KT as a result.	Orange
4.4.3.2	Loyalty To Research Posts		"I will not by any means be sacrificing my career. I am an academic and not an administrator. So I'm doing this as part of some of the job. You see, you are a mixture of so many things, so, no, we are doing teaching, we are doing .. I am very active in the department by the way in the Mechanical Engineering department because this is my field and my position is there. And in a minute, I can be gone from here. I mean this is can be a temporary assignment."	Many senior researchers express detachment and lack of loyalty to their research responsibilities. For yet unknown reasons, most research directors are not loyal to their administrative positions and insist that they are more loyal and attached to their academic departments and to classical teaching. Respondents did mention that they are temporary and that they would have to eventually go back to their faculties, which gives a sense of insecurity.	Orange

<b>4.4.4 INDIVIDUAL LEVEL OF ANALYSIS / PSYCHOLOGICAL CONTRACT / EMPLOYEE SATISFACTION</b>					
<b>Code</b>	<b>Knowledge blockage</b>	<b>Analysis summary</b>	<b>Sample coded reference quote/s</b>	<b>Analysis</b>	<b>Rating</b>
<b>4.4.4.1</b>	Equality	Researchers are very sensitive to equality in employment and career privileges. The case study organisations have policies, systems and processes that discriminate in an unjust manner between researchers. This dissatisfaction is affecting individuals to share their knowledge.	<p>"Sometimes, you find two persons doing the same work, and one of them getting higher salary and more raises while the other gets less."</p> <p>"... Internally, the work culture depends on two separate employment structures, with two different payrolls..."</p> <p>"... I was placed on the civil services payroll system for 5 years before being transferred to the academic system. By then, I already did several projects without benefits..."</p> <p>"...If you are academic, you could get more incentives for your publications, but if you are a non-academic researcher then no body cares how many papers you publish..."</p>	Researchers feel unsatisfied when being treated differently. Reasons for such discrimination in remuneration was sourced from unfair systems. Therefore, many researchers had to fight and live unsatisfied for years before they may or may not get what they feel they deserve. An example of the consequences of such rules and associated dissatisfaction is poor research, poor publications and low productivity.	Red
<b>4.4.4.2</b>	Sense Of Achievement	Researchers need a sustained drive to continue doing a hard to do job like engineering research in a difficult environment like the case study organisations. The sense of achievement could be a big source of satisfaction if it is acknowledged by the organization. This is not the case at present	"... There is no spin of accomplishment yet..."	Researchers may become loyal, hard working and may ignore better paying jobs only if they found that there is something appealing to them that proves some sort of unique sense of achievement. If they feel that their organization really does not produce remarkable achievements that could make them feel proud of what they do then they would see no valid reason to continue hard work, be loyal or even to stay in the organization.	Red

<b>4.4.4 INDIVIDUAL LEVEL OF ANALYSIS / PSYCHOLOGICAL CONTRACT / EMPLOYEE SATISFACTION</b>					
<b>Code</b>	<b>Knowledge blockage</b>	<b>Analysis summary</b>	<b>Sample coded reference quote/s</b>	<b>Analysis</b>	<b>Rating</b>
		and is considered another barrier to KT.			
<b>4.4.4.3</b>	Status	Some respondents clearly state that they would not accept being treated without equal respect when engaging in KT.	"... personally, I don't feel happy if I feel I am working with someone who is dictator in his position or his ideas or his opinion. Things are debatable and nothing is for granted and so that's very important because that's going to influence the flow..."	A respondent clearly states that he would not accept being treated without equal respect when engaging in KT.	Red
<b>4.4.4.4</b>	Foreign Experts	Knowledge providers do not feel absorbed or part of the organizational family	"... many of the expats, let me say it clearly, and it's not me, they say out loud that we are not happy about that policy [visas and government matters]..."	Many experts are non-citizens and stand as knowledge providers at the case study research organizations. These knowledge providers do not feel absorbed or part of the organizational family, hence; extremely unhappy with the issues like visa exits, being not allowed to take leadership positions, are always on annual renewals (no tenure) and even when they need to process any governmental issue, they need to address their organization for personal matters like brining their family or issuing a driver license. They are treated the same way as low wage labourers.	Red
<b>4.4.4.5</b>	Specialization Rigidness	Researchers do not feel satisfied to work following organizational strategic paths	"... I have people here working with us and are experts for lets say around 30 years but he is an expert in one particular subject. If you want him to open a new dimension you will always feel he is hesitant and he doesn't want to really go in this direction..."	Many researchers feel more comfortable to continue what they are doing regardless if the organization can benefit from changing research focus based on contemporary breakthroughs and new national needs. They do not feel satisfied to work following organizational strategic paths. This attitude from some researchers needs to be addressed and enhanced to persuade them to think strategically and proactively	Orange

4.4.5 INDIVIDUAL LEVEL OF ANALYSIS / PSYCHOLOGICAL CONTRACT / TRUST LEADERSHIP					
Code	Knowledge blockage	Analysis summary	Sample coded reference quote/s	Analysis	Rating
4.4.5.1	Avoiding To Approach The Leadership	Researchers do not feel comfortable to approach the management regarding KT activities	<p>"... we never experienced a request like that. They [researchers] might fall in traps but would not inform us..."</p> <p>"I think as per the culture of the university and being an expat, I will be more of a loser if I feel like that I should take an action... Here the culture does not permit that. You will be more losing..."</p>	Many researchers do not feel comfortable to approach the management regarding KT activities that require leadership involvement to get it approved. It seems that they put such activities on hold when it reaches to a point that they would have to approach the management. The barrier between researchers and management is therefore also a barrier to better KT. Researchers would do what they can to move with their work without visiting the management for guidance. When they fall in problems they keep quite.	Red
4.4.5.2	Qualification Relevance Of Leadership To KT Needs	Management shows lack of understanding to KT	<p>"... I believe that we should develop leaders in research ... the directors of the research centers, and the executives are researchers who haven't been exposed to academic training on management... "</p> <p>"... An administrator [for Organisation Y] may be necessarily who should be much experienced on how to handle the external world. So in this case [the case of managing KT] if we have a specialist [an management expert], a trustworthy one, then he can guide us better."</p>	When management shows lack of understanding to KT and research management from a contemporary point of view, researchers tend to loose trust in their leadership especially when it comes to modern research management and KM. The current leadership in all research organizations in Saudi Arabia are scientific leaders lack many management concepts including the KM field. Researchers feel that it is not acceptable that scientific researchers are assigned to manage their organisations with this background. Having leaders who know little about international KT practices can create great barriers	Red

4.5 INDIVIDUAL LEVEL OF ANALYSIS / PSYCHOLOGICAL CONTRACT / RELATIONSHIPS BARRIERS					
Code	Knowledge blockage	Analysis summary	Sample coded reference quote/s	Analysis	Rating
4.5.1	Bad Historical Experiences	Researchers feel not interested to enter into KT experiences due to negative historical events	"... some people have bad experiences with international work..."	When researchers are exposed to bad experiences that relate to KT and engaging with external experts, it lays its shade on their future plans in this same regard. Leaving the processes unguided for KT can result in such scenarios to happen. This is why some researchers might feel not interested to enter into KT experiences. This matter needs to be addressed to make the experience of researchers a pleasant one when they engage in KT activities. The organisation must look at this a KT barrier and act to limit such thinking as possible internally.	Green
4.5.2	Personal Relationships Between Domestic Research Leaders	Weak relationship between research leaders create a KT barrier	"At the moment there is no cooperation between research institutes in Saudi Arabia... For example ... almost all ministries participated with us except the ministry of higher education which houses most research institutions in Saudi Arabia... they wouldn't even attend our workshop. Dr ... sent us his apology that he would not attend 2 months after the workshop was conducted. We sent him the content of the workshop to prepare his feedback. He did not reply to our letters. The ministry of higher education was potentially the most important participant..."  "... unfortunately, the link between Organisation X internal institutes is not strong..."	It is very difficult for a single research institute to establish a national revolution in KT and KM best practices due to the scale and scope of the complexity of the KM problem. The synergy that can emerge from domestic administrative cooperation can produce necessary momentum. The barrier currently facing this vision is the weak relationship between research leaders in different research organisations on the national level and its effects on potential KT activities. The relationship that research leaders have between them seem to be cold and any initiative from one of them would be dealt with in a cold fashion:	Orange
4.5.3	Gender Issue Relationships	Some researchers and external experts feel that gender segregation	"I believe our culture will have or can have an impact on cooperation with experts from outside especially when it comes to ladies, that's an important issue."	In Saudi Arabia, as a unique attribute, some institutions have gender segregated organisational structure, which does not	Orange

<b>4.5 INDIVIDUAL LEVEL OF ANALYSIS / PSYCHOLOGICAL CONTRACT / RELATIONSHIPS BARRIERS</b>					
<b>Code</b>	<b>Knowledge blockage</b>	<b>Analysis summary</b>	<b>Sample coded reference quote/s</b>	<b>Analysis</b>	<b>Rating</b>
		is a barrier to KT.		allow for research work to take place jointly between both genders. This is somewhat different in 1 of the 3 case study organisations where the environment is gender shared. For the first two, it is issue to be creatively resolved to allow KT between the two genders and with external experts. The relationship between men and women researchers need to be clearly defined to allow for possible improvement in this regard.	
<b>4.5.4</b>	Rank Issue Relationships	Establishing rank in the case-study organisations is difficult	"From a personal perspective, I think there is a gap in [Organization X]. The gap is between researchers or highly educated researchers, and... Researchers who have PhD's mostly from out of the kingdom and lot's of them are from leading schools; and the employee and researcher pool that is available."	Rank is very important to many senior researchers. New researchers or ones who need many years to establish themselves in research find it difficult to establish a relationship with the senior ones to allow KT to take place. The organisations are not recognizing this issue as major to KT and the result was a culture of rank. This needs to be addressed.	Orange
<b>4.5.5</b>	Proximity Issues Relationships	KT can face serious implications when looking at the relationship between domestic and overseas researchers.	"...It was not only the IP, but how the relationship between us and him would work. So, I think [Organisation X] transferred this agreement to an attorney in the USA, to improve the agreement. It took around 4 months to finalize in discussion, emails, meetings and like this..."	KT can face serious implications when looking at the relationship between domestic and overseas researchers. Having little or no relationship can prove to be a real barrier for KT to take full momentum resulting in very slow movement of knowledge or even a full stop. Many questions arise when a relationship is weak or absent. This results in lengthy agreements to cover all probabilities.	Red
<b>4.5.6</b>	Business Issues Relationships		"As you know, some guys with knowledge who may feel that they will not have future projects may try to retain some	The fact that the case study organisations rely on transactional KT, it allows the	Orange

<b>4.5 INDIVIDUAL LEVEL OF ANALYSIS / PSYCHOLOGICAL CONTRACT / RELATIONSHIPS BARRIERS</b>					
<b>Code</b>	<b>Knowledge blockage</b>	<b>Analysis summary</b>	<b>Sample coded reference quote/s</b>	<b>Analysis</b>	<b>Rating</b>
			knowledge that will make you come back to him. This is a business activity you can say."	knowledge providers to think strategically to the relationship as a business. This means KT could be a threat to future business. It also means that sharing knowledge freely could result in less transactions in return of this same shared knowledge. The concept that knowledge is worth money makes KT rely on business factors rather than relationships.	
<b>4.5.7</b>	Technology Applications To Support Relationship Building	Communication is sometimes blocked and this slows down or stops KT.	"This is already applied in some centers, but I can't access this. From center to center and institute to institute is not available. May be in the future, but I am not sure about that."	Relationships result in KT when there is a minimum strength of communication traffic to allow knowledge flow. When this flow and communication is blocked or not provided sufficient channels it slows down or stops. At the case study organisations there are limited channels for knowledge flow.	Orange
<b>4.5.8</b>	Incentives To Build Relationships	Absence of 'push' relationships creates KT barriers	"There is no clear rules to encourage people to work jointly. There is no incentives. "	Although relationships usually are established in a natural way, however, in intensive knowledge workplaces these needs to be some sort of 'push' mechanism to encourage relationships. This is due to the value that people find in their knowledge and the culture that encourages holding knowledge from others. Researchers would not normally at the case study organisations seek relationships for the purpose of sharing their knowledge. The organisation needs to show interest in their knowledge and institute means of how these relationships are built and then invested.	Red
<b>4.5.9</b>	Searching For	Abandoning the	"The new generation should work and benefit from the	In many cases, it has been reported that	Green

<b>4.5 INDIVIDUAL LEVEL OF ANALYSIS / PSYCHOLOGICAL CONTRACT / RELATIONSHIPS BARRIERS</b>					
<b>Code</b>	<b>Knowledge blockage</b>	<b>Analysis summary</b>	<b>Sample coded reference quote/s</b>	<b>Analysis</b>	<b>Rating</b>
	Relationships Externally Before Exhausting Internal Option	existing knowledge at case-study organisations may represent a KT barrier.	previous generation before they try to find knowledge from external resources."	external knowledge is sought while there are internal individuals who are capable of providing competitive knowledge to other internal staff.	
<b>4.5.10</b>	Building Relationships With The Local Industry	The local industry is not open to case-study organisations which represents a KT barrier	"we are working on oil and gas exploration. So we are trying to open the contact channel with them and visit them and make workshops."	The local industry is not open to case-study organisations which represents a KT barrier. In such case, the case-study organisations need to find ways to establish relationships that help produce research collaborations.	Red
<b>4.5.11</b>	Building Relationships With Internal Expatriates	Saudi and expatriate researchers have weak relationships	"Because I'm not solid here, I am coming here just for 2 years, I think many things I don't understand about [Organisation X]."  "I work here and sometimes I talk with them but less than 1 hour in a day."	KT with internal expatriates can be very rewarding. This is due to them being under the same roof. However, their feeling that the relationship is temporary makes KT in question. Not providing the time is also an issue.	Orange
<b>4.5.12</b>	Politics In Relationships	Internal staff have rivalry issues that are far from being productive to KT.	"Politics plays a significant role... Yes. This is what is happening. Even for the car parking. Even for this small thing they are fighting who is taking this piece... It is under the table. This is the main problem of [Organisation X]... Lets go back to the trust. I think some researchers here trust researchers from outside more than the local."	The existing politics in the relationships of internal staff is causing negative implications to KT activities. Cooperation is affected by the politics at case-study organisations.	Orange
<b>4.5.13</b>	Reliability Of Relationships	The ethics of business is causing KT barriers	"It was a proposal, a new idea being submitted to a client on the promise that we will talk back about it and get it further. After a year, we discovered that this project exactly was being done somewhere else... he was just seeking an idea or knowledge or something so when we gave him, he ran"	The case-study organisations face ethics issues related to the research projects that contain KT between researchers and the local industry. Researchers tend to become more protective therefore to reduce KT.	Green
<b>4.5.14</b>	Making Advantage Of Strong Internal Relationships	Lack of realising the potential internal relationships is causing a KT barrier	"yes, the trust. For example, if you have someone who is your colleague in the university, you have all the massed multiple folds with him because he already knows you and he knows you very well, he trusts you, he knows your achievements and it is quite inevitable that you guys would	The internal staff may experience extremely rewarding relationships and enjoy KT activities. KT becomes second nature when people have good relationships and have something to share. However, they need to	Orange



4.5 INDIVIDUAL LEVEL OF ANALYSIS / PSYCHOLOGICAL CONTRACT / RELATIONSHIPS BARRIERS					
Code	Knowledge blockage	Analysis summary	Sample coded reference quote/s	Analysis	Rating
			have to collaborate with each other. Sometimes, there is some sort of a demand because both of you are working in the same institution..."	know what are the goals and milestones to align their relationships time to serve a purpose:	
4.5.15	Knowing How To Establish External Relationships	The incapability of establishing the platform in relationships to build research collaborations is causing a KT barrier	"When it is with an outsider, he doesn't know you, how is he going to trust you that you are not going to take his knowledge, for example? Let me give you a basic example, you can have both guys collaborate in a project and then you can publish the work without mentioning his name. Someone can do that. That's why some people will be reluctant to give you information to solve your problems, to give you consultations, if he doesn't know you. That's why sometimes its tiring to establish good collaborations. Sometimes even you establish a collaboration, in the first year you will be tired in the first stage, then once you establish it in the right way then I think it will be very fruitful. The idea here is that in front of you should be able to trust you, to trust that you are someone with whom he can collaborate, especially when you are talking about people who working in top 10 institutions. They are very careful when it comes to working in collaborations. They do not collaborate with anyone because every collaboration is counted on him. He doesn't want to associate himself with someone having bad education in the field maybe or someone..."	Many internal staff have little skills in how to earn the trust of external researchers. This situation is building up into a level where it is affecting the core capability of case-study organisations in executing KT activities.	Orange

## 1. ORGANISATIONAL LEVEL OF ANALYSIS

5.2 FINDINGS ON ORGANISATIONAL CULTURE					
Code	Knowledge blockage	Analysis summary	Sample coded reference quote/s	Analysis	Rating
5.2.1	Understanding Existing Perception	Lack of staff perceptions on KT is a barrier in itself to KT.	"... we as department heads know that the leaders in [Organisation X] do advocate this culture of international cooperation. However, the researchers opinion must be surveyed to know what they think. For example, if we pitch this question to researchers like this "if you are offered a grant, would you choose to spend it on your individual work, between you and colleagues or on an international collaboration?" You know, some people might have had bad experiences with international work, or they might have found that our geographical distance is a real barrier, or may be visa issues being a true obstacle and so on..."	Participants report that their organisations have not conducted cultural assessment studies to uncover the reality of how staff perceives their work culture nor the role of KT, within or across the borders of their organisations.	Orange
5.2.2	Ego Attitude	The focus on positive achievements while ignoring clear pitfalls is causing a barrier to improving KT activities.	"We have of course made many achievements in this regard. We have had cooperation with Beijing University, for example, and we can give you the report we published on the	In many successful organisations, leaders and members feel the challenge to perform, the pressure to compete, and the need to fill workplace gaps. Other organisations talk about past achievements rather than focusing on the challenges of the future:	Orange

5.2 FINDINGS ON ORGANISATIONAL CULTURE					
Code	Knowledge blockage	Analysis summary	Sample coded reference quote/s	Analysis	Rating
			achievements of Organisation X in this regard."		
5.2.3	Lack Of Trust	When low, trust is seen as a barrier to increase the flow of knowledge.	"Lets go back to the trust [issue]. I think some researchers here trust researchers from outside more than the local."  "... They [internal staff] might fall in traps [related to international research issues] but would not inform us [support departments]"	It is clear that there are many cultural issues related to trust. People in all three organisations tend to have low trust. Confidentiality is not perceived as being guaranteed and as such internal members seeking help feel their confidential problems may be passed onto their superiors.	Red
5.2.4	Control Over The Workplace	Active researchers feel there are no clear incentives to increase performance.	"I tend to believe that the system is not very effective in pressuring researchers and employees to perform at their most capacity."	Active researchers feel there are no clear incentives to increase performance, and lower performing researchers have not noticed potential penalties for their low performance. Problems related to performance and KT is avoided to gain a temporal stability. Such causes long term and strategic problems. The respondents have a strong consensus that they are not working in a well-designed system to be able to look into KT seriously:	Red
5.2.5	Gender Issues	Gender segregation is seen by some staff and external collaborators as a KT barrier	"I believe our culture will have or can have an impact on cooperation with experts from outside especially when it comes to ladies, that's an important issue".	Saudi Arabia has a national policy of gender segregation. The issue here is how an organisation deals with this matter and how it affects its KT practices. The case study organisations have approached this issue differently. Organisation Z allows a mixed environment more akin to a western style. However, some local experts, both men and women, may avoid such environments for cultural reasons, and this in turn will affect KT. Organisation X adopts a middle ground where workstations are segregated but meetings and workshops are mixed. At Organisation Y, the whole university as well as its research institutes is males only. Sensitivity to national culture affects KT within local organisations as well as affecting interaction at an international level.	Green
5.2.6	Profitability And Competitiveness	Lack of strategic competitiveness is causing KT	"The problem was related to time but we can extend the project deadlines because the target is	The driving force for organisations is competitiveness. It is the competitive environment that makes organisations optimize their performance and think strategically to compete. KT is about building	Red

<b>5.2 FINDINGS ON ORGANISATIONAL CULTURE</b>					
<b>Code</b>	<b>Knowledge blockage</b>	<b>Analysis summary</b>	<b>Sample coded reference quote/s</b>	<b>Analysis</b>	<b>Rating</b>
		inefficiencies.	not time meeting but to get the product we want."	internal capability with a competitive edge in set time frames. The local organisational culture at the case study organisations views time as an unlimited resource and is not linked to performance. The challenge for KT is not that it needs to exist but that it functions with a competitive edge locally and internationally. To achieve this, issues related to time need to be addressed. An ultimate goal would be to lead the way in specific knowledge areas.	
<b>5.2.7</b>	Lack Of Win-Win Thinking	The mental models of management encourages trying to take advantage of others in a selfish fashion rather than a cooperative approach	"So I think we will sell more than him. We think we are winning."	The organisational culture needs to maintain a win-win scenario for all individuals and organisations engaged in KT. It is essential to think positively and honestly to ensure everyone wins from a KT activity. This is not what respondents are observing:	Red
<b>5.2.8</b>	The Culture Of Departments	Lack of cooperation between department heads is affecting researchers and therefore internal KT.	"[cooperation] between institutes in practice is not strong ... for example, this is already applied in some centers, but I can't access this. [Cooperation] from center to center and institute to institute is not available. May be in the future, but I am not sure about that."	The case study organisations are large to very large organisations. They are divided into department and research institutes and have many correlations between them. However, the way these interlinks are dealt with show that there is no sense of unity between departments and no driving force to cooperate. In many cases, an isolated benefit for one department contradicts with the overall purpose of the organisation and KT between departments is affected:	Red
<b>5.2.9</b>	Organisational Informal Attitude	The general attitude at case-study organisations is protective, which represents a barrier to KT	"This doesn't exist here and is not recommended. A friend of mine did this and he was told to provide awareness to uncooperative people. Still, if I don't want to cooperate, no one can force me. I may even be given information in the wrong way".	Many organisational members feel it is unsafe to expose their experiences with other members to their leadership. They fear that the leadership may interpret this in a wrong way. When KT takes place between two individuals or departments and it becomes obvious that the provider is not willing to cooperate usually the seeker withdraws silently, knowing that this is the safest way forward:	Orange
<b>5.2.10</b>	Expatriates	Expatriates feel that	"[B]ecause I'm not solid here, I	Expatriate researchers possess most of the knowledge in the case study	Orange

<b>5.2 FINDINGS ON ORGANISATIONAL CULTURE</b>					
<b>Code</b>	<b>Knowledge blockage</b>	<b>Analysis summary</b>	<b>Sample coded reference quote/s</b>	<b>Analysis</b>	<b>Rating</b>
	Setting	they are temporary at case-study organisation and therefore set for short term thinking	am coming here just for 2 years, I think many things I don't understand about Organisation X."	organisations and this fact should be included into organisational practices. However, due to power and authority, the culture of expatriates is suppressed to a minimum where they feel they are temporary, isolated and external. In many situations, internal KT between an expatriate and a national is considered as external rather than internal and given suppressed weight.	
<b>5.2.11</b>	Aligning Culture With Systems	KT faces the barriers of incompatibility between culture and internal systems	"There is a clear policy for cooperation but I don't know for some reason they are still not following this"	The role of culture is a major influence in formulating how these case study organisations function. The cultural influence will over-ride conflicting needs on a day to day level, despite a clear intention to improve:	Orange
<b>5.2.12</b>	Setting The Example	Role model lacks and creates therefore a barrier to KT best practices	"... Even for the car parking. Even for this small thing they are fighting who is taking this piece. It is under the table. This is the main problem of Organisation X."	In every high performing organisation a successful example is set to follow. Well known organisations usually experience remarkable examples of individuals who offer a patriotic, charismatic and/or cooperative example for organisational prosperity. The case study organisations respondents failed to identify real examples for others to follow in their organisations. Some frontline supervisors and middle managers are not taking the wider perspective but are influenced by internal politics or personal gains, thus affecting KT and growth.	Orange
<b>5.2.13</b>	Individualistic Attitude	Lack of clear organisational policies created individualistic attitudes that combined with authority creates problems for KT between staff.	"I have [on my own] all the expertise."	Many of the experts in the case study organisations feel that other internal members cannot add much to their knowledge and because they lead their colleagues in their area of expertise, they are not interested to enter into KT settings. Experts hold onto their knowledge rather than passing it on to junior researchers. Although they claim they would answer any question they receive, it is evident that many of them are not really interested to serve the purpose of KT due to reasons like age, lack of incentive, too busy, low AC of researchers, etc.	Green
<b>5.2.14</b>	Creativity And Innovation	Existing traditional work styles and routines limit the effectiveness of KT.	"In some cases and some areas yes... I have people here working with us and are experts for lets say around 30 years but he is an expert in one particular subject. If you want him to open a new dimension you will always	Engineering research without creativity and innovation is not valuable. Research institutions that follow traditional work styles and set routines limit the effectiveness of KT. The gap between the current organisational culture at the case study organisations and international organisations is large.	Orange

5.2 FINDINGS ON ORGANISATIONAL CULTURE					
Code	Knowledge blockage	Analysis summary	Sample coded reference quote/s	Analysis	Rating
			<p>feel he is hesitant and he doesn't want to really go their ..."</p> <p>"I think that the culture that prevails at a world class level, if I compare our culture with that, then we have an enormous room for improvement."</p>		
5.2.15	Tendency To Keep Things Unofficial	The dependence on subjective unofficial practices is creating a KT barrier	"when you have this as an obligation as part of the job, then that's going to find resistance from individuals."	Informal procedures and routines are the norm in the case study organisations. Standards and detailed procedures are less than most advanced international research institutions. This is especially the case with documenting research practices, research methods, research findings, and research applications, as well as set procedures for KT. However, most respondents feel uncomfortable to add this task to their job description, preferring to follow their own judgments with KT. Resisting the formulation of rules and clear job descriptions are barriers to KT.	Orange
5.2.16	Persistence To Change	Over time, change fades and causes a barrier to KT	"I'm talking as an individual not as a director, you give up, you give up and you don't want to do that again."	Many directors, middle managers and researchers started their career actively but in time the internal culture damages their morale and encouraged a push towards silence rather than change and growth.	Red
5.2.17	Organisational Mental Frame	Staff do not trust the mental models of management	"The moment I know that [Organisation Y] might play nasty games with me, that this service (KT) will be used against me. That as soon as these people are trained, the university will consider that you are now old, we have to run the University with new blood, I think this is a very dangerous path. No society can stand"	Researchers in successful research institutions worldwide cannot imagine themselves without their research. They feel they are part of a family that is warm, caring and nurturing to their ambitions. When researchers feel that their work is just to get paid and when they feel insecure or unacknowledged then this will definitely create a big barrier for their KT practices. Dissatisfied researchers will not be enthusiastic about KT.	Red

<b>5.2 FINDINGS ON ORGANISATIONAL CULTURE</b>					
<b>Code</b>	<b>Knowledge blockage</b>	<b>Analysis summary</b>	<b>Sample coded reference quote/s</b>	<b>Analysis</b>	<b>Rating</b>
			"The opposite of job satisfaction is frustration. Now if any employee works under frustration, then he does not deliver the maximum to the organisation."		
<b>5.2.18</b>	Effects Of Work Practices On Cultural Matters	The culture disorganised practices is causing a barrier to KT	"I have seen, you know, knowledge gaps and not explaining properly what to be done is a source of failure for a project, and it is also a source of misunderstanding, ill feeling, and worst relationships"	It is always understood that culture influences work and workers. However, there is evidence from respondents that work practices do influence some aspects of the culture. The culture undergoes some change when work is redesigned. This is an important finding where work procedures could help solve some cultural issues. These work procedures need to be carefully drawn to encourage positive cultural practices and enhance KT. This includes well-managed meetings, respect to senior researchers through special incentives, making sure no threats in the policies are present, etc.	Red

<b>5.3 FINDINGS ON ORGANISATIONAL POLICIES</b>				
<b>Code</b>	<b>Knowledge blockage</b>	<b>Sample coded reference quote/s</b>	<b>Analysis</b>	<b>Rating</b>
<b>5.3.1</b>	Unjustified Discriminative Rankings	<p>"We are positioned as administrative scientific researchers ... they apply the civil services governmental salary plan... The academic staff here do not have that applied to them, instead they follow the universities path."</p> <p>"... but I was placed on the civil services payroll system for 5 years before being transferred to the academic system. By then, I already did several projects without benefits..."</p> <p>"Internally, the work culture depends on two separate employment structures, with two different payrolls".</p> <p>"If you are academic, you could get more incentives for your publications, but if you are a non-academic researcher then nobody cares how many papers you publish... if you get a masters degree by yourself, then the situation will be difficult to join the academic employment structure. If you get a scholarship from [Organisation X] then you will be automatically academic. It takes a long time to convert, perhaps a year or two".</p>	<p>Researchers acknowledge difference in rank and salary based on expertise and experience. A non-expertise based segregation between researchers affects cooperation between them and impacts on KT practices. The issue becomes publicly problematic when equal researchers receive different pay. The researchers often discuss this issue with a high level of dissatisfaction. A feeling of equal-opportunity and fairness is absent which needs to be corrected by policy amendments.</p>	Red
<b>5.3.2</b>	Policies On KT Legitimacy	<p>"I find IP issues to be the main issue. We are required to look after many IP issues that could prevent KT due to non-ownership of knowledge".</p>	<p>It is known that KT requires the sender and the receiver to accomplish some sort of mutual benefit. It is unrealistic to expect experts to share knowledge with no return. Researchers need to prove that collaborative work would add advantage to external researchers. Otherwise, the KT will become transactional and the case study organizations will have to enter into IP acquisition issues. The fact that the researchers do not offer much value to external researchers creates a barrier to KT.</p>	Orange
<b>5.3.3</b>	Filtering Policy For Sourcing External	<p>"... if you wanted to sign an agreement with a research center affiliated with a university then you would not sign</p>	<p>When the case study organizations seek to source external research organisations for research collaborations, the sourcing</p>	Red



5.3 FINDINGS ON ORGANISATIONAL POLICIES					
Code	Knowledge blockage		Sample coded reference quote/s	Analysis	Rating
	Research		with the center, but rather you would always sign with the university... Therefore, our strategy is not to approach universities outside Saudi Arabia ...What we target is pure research organizations ..."	and selection process should be based on expertise in the subject area. However, some case study organisations select for reasons of organisational structure rather than the degree of expertise present.	
5.3.4	Policies Accountability International Cooperation Departments	On Of	"Clause 3 in our standard agreement clearly stipulates the administrative roles that we [international cooperation department] cover throughout the life cycle of the agreement. We usually cover any administrative work required during the agreement. So we cover those administrative activities on behalf of the research center".	The three case study organisations have a department for international research collaboration to facilitate KT. Internal KT is often merged with international KT. The reality is that these departments see themselves as administrative coordinators and not accountable for making KT agreements successful from a policy point of view. Reviewing KT results, benchmarking to other practices, and generating KT indicators are not present in their activities.	Red
5.3.5	Policies On Management	Risk	"The problem is therefore, they [external organisations] will not object to start with us on anything from scratch. The problem from our side is that if we go in this risky path, then would this cooperation result in obtaining a new technology or something tangible and useful? This is the gamble. We don't know. We would have to pay a lot of money, establish the research, fund it, and then we might reach nothing, and that's the main hurdle in making these decisions. The problem is that there is high possibility that big research efforts can have no results at the end. This may cause inability to justify all the money spent and this could cause problems for the executives with the government."	Research work is extremely risky and may result in no return. For example, finding out that others have already completed the same research, drawn conclusions and registered an IP could undermine years of research. Another risk involves predicting the success of the research in terms of commercial viability. The case study organisations only pursue those projects that will result in patenting and commercial benefit. All other benefits such as building internal capabilities and basic knowledge on the subject are treated as by-products and not important if the risks are considered too high. The methodology needed to manage risk requires comprehensive understanding of the current status-quo in the respective organisations and to select projects with high potential. A problem arises when internal capability is moderate making it difficult to assess the degree of risk and predict success for the project. In the case study organisations almost 100% of external research organisations being invited for research collaboration engage in transactional KT. Usually they target external organisations that are already close to achieving success with their research. They do not want to spend time and energy trying to develop this knowledge on their own, preferring to buy the knowledge from external sources. A barrier to KT	Orange

<b>5.3 FINDINGS ON ORGANISATIONAL POLICIES</b>				
<b>Code</b>	<b>Knowledge blockage</b>	<b>Sample coded reference quote/s</b>	<b>Analysis</b>	<b>Rating</b>
			begins from this stage where the case study organisations remain the learner and the external organisation remains the provider. Clearly there is a large gap in knowledge between the provider and the receiver. The case study organisations are interested in practical results, not the success of KT. By taking this path the case study researchers are not developing internal capabilities, such as developing projects from scratch, gaining risk management experience nor beginning projects with external organisations from scratch. The understanding of how to manage research progress and planning for results while maintaining a benchmark for KT needs to be revisited.	
<b>5.3.6</b>	Auditing Policies	"however, we are measuring the advancement in terms of knowledge use and KT by the number of papers that we published, by the number of people who are doing research, or capable of doing research and by the services that we perform for, for example, for companies.".	The case study organisations are knowledge intensive; however there is no clear policy on what to audit and benchmark, and no clear indication of how they audit their knowledge base. The absence of policy is a barrier to KT.	Red
<b>5.3.7</b>	Policies On Disciplinary Practices	"I tend to believe that the system is not very effective in pressuring researchers and employees to perform at their most capacity... I think that what I should do... there is a lot of things that I should do, I should first of all redesign the reward and punishment ..."	All case study organisations are governmental. The productivity of research staff follows almost the same productivity curve as government employees. The private sectors are more productive in Saudi Arabia due to the importance of financial profit and loss factors. When productivity falls, the financial indicators also fall, and decision makers take steps to make necessary adjustments. In government organisations, on the other hand, finances are not linked with performance and productivity. With the absence of disciplinary policies to ensure both the flow of KT and improving performance, such becomes a double barrier to effective and active KT. In the case study organisations little attention is given over to discipline with respects to performance and productivity.	Red
<b>5.3.8</b>	Discrimination Barriers	"One of the problems that we have is that employment is reserved only for Saudis which is good, wonderful but the pool of the available human resources doesn't have the skill needed."	A policy of maintaining a high percentage of nationals in research organisations, and in some cases a 100% are to be nationals is considered a barrier to KT by the respondents. They feel that this intrusive measure inhibits engagements with external researchers, and only leaves international research	Red

5.3 FINDINGS ON ORGANISATIONAL POLICIES				
Code	Knowledge blockage	Sample coded reference quote/s	Analysis	Rating
			agreements as means for KT.	
5.3.9	KT Related Policies	"so basically teaching others is not at their priorities...". " there is no clear rules to encourage people to work jointly".	There are no policies relating to KT in the case study organisations. The absence of policies sends the wrong message to researchers about the role and importance of KT.	Orange
5.3.10	Research Pace Policies	"... what we are trying to do is to select carefully the projects that we are doing, knowing the difficulties that we have and not to avoid doing as many projects as if we were in another place. So basically, slow down in terms of research activities..."	Deadlines in the research industry are vital. This is due to competition and the race to secure patents before rivals. The research pace at the case study organisations is not controlled by any policies. The idea of meeting deadlines is neither well understood nor taken seriously and the consequences for not meeting deadlines are minimal. The issue of pace is considered a barrier to KT.	Orange
5.3.11	Financial Policies	"The regulations hinders the money ... so you cannot have it [the money] to do things [research activities] ..."	There are numerous cases where researchers complain from lack of policies to ease the flow of funding to research activities. The policies that are in place are perceived as too rigid and ill conceived. When research stops for funding reasons then so does KT.	Green
5.3.12	Policies Related To Expansion	"... recently [Organisation X] extended their employment numbers, buildings, faculties, and quickly..."	There are no policies that control how expansion of takes place. It all depends on funding. The planning side for KT activities is not embedded in the expansion activities. Equipment, facilities and staff are often added to the organisations without proper planning. The issue of properly embedding KT into expansion plans needs to be addressed.	Orange
5.3.13	Internal Cooperation Policies	"I think the most important thing.. Orgnisation X has like more than 15 institutes and unfortunately each institute is working separately. There is no clear policy or clear.. There is a clear policy for cooperation but I don't know for some reason they are still not following this."	The case study organisations are large and contain 15 to 20 research centers per organisation. This makes internal cooperation vital for KT. Lack of cooperation in this regard means less KT. Lack of internal cooperation policies becomes a barrier to KT as a result. The intention to improve exists but there is a flaw in the process, the system or both.	Orange
5.3.14	Policies On Position Authority At Research Centers	"Centre director position here is another side job, it is not my main job. My main job at the university is a faculty member. The centre director is only managing this place, managing the whole thing, for two years then I'll go back to my department."	Research center directors tend to take their responsibility as center directors as secondary to their research work. There is consensus between center directors that their positions as center directors is temporary and therefore not very important. The respondents mention that they have little authority and that	Orange

5.3 FINDINGS ON ORGANISATIONAL POLICIES				
Code	Knowledge blockage	Sample coded reference quote/s	Analysis	Rating
			internal policies don't really empower them as leaders in their organisation.	
5.3.15	Policy On Individual Consulting	"No, according to the university policies, we cannot personally consult."	Researchers are prohibited from providing consulting services outside of their organisations. The engagement of researchers with local industry needs to be encouraged as KT would benefit from this kind of flexibility. Many local industries cannot afford to go through large research organisations but would benefit from individual consulting.	Orange
5.3.16.	Organisational Affiliation In Terms Of Policies	<p>"yes it is governmental policy, it's a unified policy from the Ministry of higher education. The university has no say on that at all."</p> <p>"... because as I told you a while ago, financial is not an issue but sometimes you find yourself, ah, facing, I mean, a governmental bureaucrat who is sitting in his office, he has never seen the case that you are talking about before... it takes a long time. Many times, I'm talking as an individual not as a director, you give up, you give up and you don't want to do that again ... because always we here have problems that come from these regulations which comes from the financial, as long as you are getting the money from the government, you are obligated to follow the rules of the government".</p>	The case study organisations are not independently operated. Being part of the government, they follow the same procedures as other governmental bodies with regards to finance, civil services, higher education, etc. Policies are not developed separately to meet the needs of different government departments. Imposing external management practices affects performance and creativity, as well as KT.	Red
5.3.17	Research Compensation Policies	"I don't know if you consider the compensation and these issues as relevant. These are things that has been decided on and we try to convince our colleagues here. This was an issue here, you need to understand."	Researchers' payroll schemes is not connected to their performance in research. In time they are convinced that there is no clear personal benefit for them from the organisation and no incentive to perform at a higher level. When this issue becomes so common and there is no negotiation then this becomes an organisational policy problem. When this problem spreads to the idea that researchers see no benefit for them to share their knowledge then this becomes an organisational KT barrier.	Red
5.3.18	Policies On Recruitment	"Because they don't have enough manpower and if there is manpower then all of them should be recruited in the subject they already chose for themselves to go through."	The recruitment policies at the case study organisations are subjective and do not follow clear guidelines. This is due to many factors including, but not limited to, changing strategies	Green

5.3 FINDINGS ON ORGANISATIONAL POLICIES				
Code	Knowledge blockage	Sample coded reference quote/s	Analysis	Rating
		Otherwise, this is becoming a headache for everybody."	and visions for the research centers, lack of clarity in funding schemes, and broad research targets that nullify the efforts to align recruitment with research needs. Inappropriate selection and use hinders research activities and KT. People share knowledge when they share interest in the knowledge subject. When people have different knowledge interests then KT weakens and this becomes a barrier to KT as a whole.	
5.3.19	Policy On Customer Funded Projects	"The other issue is that, I call them crazy people, they will ask other entities to put money ... this is not right ... You have to pay until you reach them ... for the sake of what they are giving you money? ... what is the issue behind collaborations with other universities? It's to get experience, right? So, it is to build the nucleus with that university or entity which is already ahead of you ... the orientation for centre of research is commercial oriented, they call it client funded projects ... As a government or as the top management, they are setting different objectives for us. This is bringing us back to square one, because no one will come to you to do client funded projects unless you have something ahead of him, knowledge. As you mentioned, you need to gain this knowledge. There are many ways, one is participate or contact others in certain bases. So we call it long-term investment or ahead of investment. This does not exist here..."	Research can be focused on basic knowledge generation or the needs of specific customers. The case study organisations are supposed to work on both, building internal capability through joint research work with the local industry or with external partners. When the case study organisations shift their strategy towards gaining financial profits at the cost of building long term capability then KT is also at risk longer term. The strategy to achieve quick financial gains can be a barrier to KT since it does not seek strategic topics for knowledge capability building:	Orange
5.3.20	Policies Infrastructure On	"... here our situation is, which comes first? The egg or the chicken. Actually I get sick of this example. Now, in my basic understanding, I came from a family doing trading by selling. If you would like a customer to come to you, you should prepare yourself for him, in terms of what? You have [the product], I have all the sizes for example for [product X], if not all sizes are available then the customer will not wait for me to get it from another shop. At the same time, I should be modern, I should update myself. So, this is the problem here in the research	Organisations in engineering research require modern infrastructure to be able to conduct cutting-edge research. The policies that govern such infrastructure planning and implementation must include cost-benefit analysis and feasibility studies. The case study organisations, although being aware of the potential gained from infrastructure building and providing sufficient funding, have problems devising clear policies for infrastructure planning. The barriers to KT are those of missed opportunities for KT when potential clients are lost for the lack of a solid infrastructure.	Orange

5.3 FINDINGS ON ORGANISATIONAL POLICIES				
Code	Knowledge blockage	Sample coded reference quote/s	Analysis	Rating
		entities, it is a long term investment that decision makers don't want to enter. Second, it is a little bit risky [and our policies do not support that]... No support from the administration, because they are thinking of SABIC and ARAMCO like a milking cow. Bring the money, bring the money, bring money. I don't call it 50-50, you put some share and I put some share. This is our problem."		
5.3.21	Policies On Staff Distribution	"There is a problem in RI also, that we have good people who are teaching but they are not allowed to do research because his department has its own people and everybody wants to keep their soldiers around them."	The case study organisations are large and work policies are used by departments and sections in a way that shows internal rivalry for resources. This includes human resources. Such policies that prevent good researchers from conducting research only because they fall under an academic department and not a research center is a great barrier to KT for the research centers.	Orange
5.3.22	Policies On Saudization	"Once there is a substitute for one person, then there's no need for this guy to stay. So this is another critical issue."	When local researchers are hired by the case study organisations, the internal policies dictate that they should replace the foreign researchers especially if both have similar experiences and skills. KT is affected by these policies.	Red
5.3.23	Aborting Active Policies Midway	"Imagine if we continue with the previous policies, I think we would have really achieved more. By the way we aborted many projects that could have been an industry by itself here in this research Institute because of short vision."	New policies and different visions are introduced when leadership changes often causing projects to be aborted midway. KT needs time, continuation and planned change to be successful	Red
5.3.24	Second Line Leadership Authorities	"with the existing policies, I think it [becoming a Vice-Rector] is a bad decision. Because I feel myself at this position [Center Director], I would do much better than in that position... No, I will not have the authority in this university."	Top down leadership and control policies prevent vice-directors applying new ideas and changes. KT benefits from leadership policies where middle management has more authority to act. Such distributes the workload and gives more importance to KT activities:	Orange
5.3.25	Policies On International Collaboration Agreement	"... but this relationship tries to become formal between two institutions, then the whole process substantially slows down at the university here. I am happy that the university is careful, but our university is VERY careful. Too careful. Sometimes they should keep it working in parallel to speed up the process, and keep the carefulness."	Organisation Y has a strict bureaucratic process regarding international collaboration that slows down the KT process between the internal and external research staff.	Green

<b>5.5 FINDINGS ON ORGANISATIONAL RESOURCES</b>				
<b>Code</b>	<b>Knowledge blockage</b>	<b>Sample coded reference quote/s</b>	<b>Analysis</b>	<b>Rating</b>
<b>5.5.1</b>	Using Resources For ROI	<p>"at times we are not able nor willing to fund that. It is sometimes questioned that some knowledge does not have an attractive ROI. So, do we buy it or not?"</p> <p>"[Organisation X] for example, is focusing on the human resources to be Saudis and the services to be professional so that they can compete".</p> <p>"Money problems for my centre, yes. As the centre of engineering research as a client funded project delivery because they say this is your main mission".</p>	Research, organisations need to decide on whether they wish to proceed with development of commercial research or to focus on building internal research capabilities. If the level of expertise is low then it would be more appropriate to invest in building capability rather than on delivering business outcomes. The barrier for the case study organisations currently is that there is confusion and indecision at the leadership level on how to use resources (i.e. for commercial returns or for building internal capabilities). The competitiveness dimension places itself under ROI since it is the guarantee of ensuring the return is based on a competitive advantage. Other issues are related to money returns from research on transactional customer funded research:	Orange
<b>5.5.2</b>	Lack of administrative human resources	<p>"We also don't have professional secretaries to contact international organizations in a professional manner. So we just have personal initiatives to cover some tasks between the current staff".</p> <p>"We need a support unit, for example, we are a scientific research team, but we need some administrators to support our team, to take care about paper work, to take care of legal issues, to promote our understanding on how to achieve the most efficient way to achieve our goals".</p> <p>"currently, we don't have any indicators that are based on clear surveys for example".</p>	Research requires a large amount of human resources and support services. These services are usually provided by skilled administrators, managers and consultants at every stage of the research life cycle. The barrier that case study organisations face is that researchers have to make up for shortages in human resources by doing administrative work themselves, taking them away from their research and requiring administrative skills they may not have. This issue has been raised across the	Red

5.5 FINDINGS ON ORGANISATIONAL RESOURCES				
Code	Knowledge blockage	Sample coded reference quote/s	Analysis	Rating
		<p>"... the US consultant just provided some suggestions and to check the patent laws in the US to be covered in the agreement, and some instructions and guidelines. Now the agreement has many pages and details and it is very clear... I think because we didn't have professional guys for some tasks".</p> <p>"I spend at least on a daily basis between 2-3 hours minimum to do secretary jobs because the way I want the job to be done, even writing certain memos, I don't feel confident to assign to my secretary... Here, this is not the case because even a secretary here is doing more than a single job. I mean not a single job but I mean a secretary is expected to even, a secretary working here is not just helping me in this office, he is helping all researchers. You could imagine I mean, how the load comes to him, so..."</p>	case study organisations. Researchers suffer from lack of progress indicators, benchmarking services and consulting services to support their KT activities. The consulting services at the case study organisations are often transactional with almost no involvement from the local administrative side. A lack of administrative skills leaves little hope for future internalization. All case study organisations share this barrier:	
5.5.3	Lack Environmental Resources	In <p>"... there is scarcity in human resources and professionals as they are not usually attracted to research environments in here, they prefer to work for companies."</p>	KT activities require an encouraging environment to prosper and create synergy between researchers. Many researchers feel that their environment is too 'rigid', i.e. not alive and active. It is similar to a typical governmental department with workers just doing their job. Creativity and innovation requires unique environments.	Orange
5.5.4	Lack Of Scientific Human Resources	<p>"... it's obvious that we have young researchers who are starting their research careers and if the technology is difficult or complex then it will require a long time to be acquired and be applied".</p> <p>"... You know we have many smart people here, if they don't have interest then it's a problem for the KT".</p> <p>"Because still we have shortage. We don't have the capability for example, in one department, I'm not talking about, they have 180 graduate students and large number of faculty members and here we are fighting to get 11 to 15 graduate students. So, satisfaction, improvement, it's not just we hire people and even graduate students is one of the issues we are having with visas. Most of, you are here because of what? Because you are doing your thesis, I mean dissertation and the research coming from</p>	Most new researchers coming in from university study have little or no experience in research work. To complicate the matter even further, these new researchers lack an active interest in the research work. They are slow in their work, disinterested, and time and resources are needed to bring them up to speed. Even if the case study organisations accepted fresh graduates there remains the problem of too few researchers. The effects of these problems to KT are dramatic. On the other hand, some other respondents feel that	Red



5.5 FINDINGS ON ORGANISATIONAL RESOURCES				
Code	Knowledge blockage	Sample coded reference quote/s	Analysis	Rating
		<p>that is gonna be published, it gonna have reputation. Who did it? You did it with your supervisor. Most of the, I mean, the one behind development especially in academia is graduate students. If you have in one department 5 or 6 students and you have the constraints from the ministry of labour or .. you don't have Saudis because they are not interested in graduate studies ... If we are opening the way to collaborate with everyone, we don't have that manpower. Manpower is limited here because this is an area..."</p> <p>"in [Organisation X] in my field there are not many people who know ... I had to try to connect with people outside [Organisation X]".</p> <p>"the first issue about research excellence they started with utilising our existing people in terms of faculty. Faculty already busy with teaching, with his own project and after 2 years, the mission change, after becoming very clear for everybody that this is not achievable, and they start ...ok ... now, you have to recruit your own people".</p>	teaching staff and research staff should be separate.	
5.5.5	Lack Of Planning The Human Resources Within The Organisation	"... we made a search inside [Organisation X] to source some engineers. We made some meetings with them and we got good engineers who could help us do this job, but unfortunately, the link between [Organisation X] internal institutes is not strong, and also these engineers are busy with other projects, so they couldn't stop their work and join us".	In many cases, human resources may be available within the organisation but distributed over a number of departments and research centers. This means that if a project requires different research from multiple departments then it will require high level coordination to process this administratively.	Orange
5.5.6	Redistribution Of Resources	"They would give no reason except that the budget is not enough to support your project, that's it, and you have to continue your project".	It is very confusing for researchers to engage in research work and then be redirected without proper notice or given an acceptable reason to continue work without providing the required resources.	Red
5.5.7	Lack Of Coordination On Existing Resources	"I'll give you an example, they have brought a system, they have implemented a machine cluster, a big cluster with a very high capacity of information and they asked, they wanted it to be used by some institutes. Each institute does want to communicate with the others. They were using the machine individually so they load	There is strong funding support for the case study organisations. However, the resources within organisations are not used efficiently. Efficient use of resources	Red

<b>5.5 FINDINGS ON ORGANISATIONAL RESOURCES</b>				
<b>Code</b>	<b>Knowledge blockage</b>	<b>Sample coded reference quote/s</b>	<b>Analysis</b>	<b>Rating</b>
		a huge amount of data on the machine and they just overloaded it. It was easy to communicate then everyone knows what is exactly done, and things would be easy for everyone."	needs good communication and cooperation within research organisations. In the case study organisations proper communication is either poor or simply absent.	
<b>5.5.8</b>	Linking Resources To Politics	"I think the budget is connected to the politics."	The case-study organisations are governmental, which implies that it may be influenced by the governmental political stances. This is realised by staff and as scientific researchers feel uncomfortable that their research institutes are influenced by politics.	Green
<b>5.5.9</b>	Put The Resources All Together	<p>"but as the beginning we are still establishing the labs, equipment, doing the labs and starting the research programmes and we have to understand that research is not turning the light on or off, there is an infrastructure, there is accumulation of knowledge and expertise and also management structure of research management... It would be better but there's a reason for that we are establishing a university from zero so there is a lot of admin work to be done even you will see the buildings and the lab construction being built at the same time so we have other duties to focus on. I think when we reach the goal of our organisation we should be and could be very satisfactory".</p> <p>"It is very long way to go. Very long way to go here. We just started and you know it's like you know faculty are doing the research, the labs have just been completed, and you know, still a lot of labs are still to be completed..."</p>	There is consensus at Organisation Z that many resources are missing. Many researchers feel that KT cannot take place with the existing infrastructure. This situation is different at organisations X and Y but still, many resources need to be upgraded to enhance KT activities.	Orange
<b>5.5.10</b>	Disappointment of external experts from the resources management	"We need to interact with world-class leaders but at the same time how did these people become world-class? The ingredients which they had are not present in the infrastructure here. So, how do we interact? Even if they liked to give us [knowledge], they will not be able to... They want things to be done in two days, here I don't think it can be done in two months, then this will be a source of demotivation for them."	The internal staff have sensed dissatisfaction not only from their fellow staff but also external researchers visiting case-study organisations because resources management is weak and causes many inefficiencies in KT processes.	Red
<b>5.5.11</b>	Competitive advantage	"We are not competing with Australia, but we are having the basic things..."	Benchmarks for what is competitive and what is not is needed. Subjective	Orange

<b>5.5 FINDINGS ON ORGANISATIONAL RESOURCES</b>				
<b>Code</b>	<b>Knowledge blockage</b>	<b>Sample coded reference quote/s</b>	<b>Analysis</b>	<b>Rating</b>
			approaches are damaging the credibility of policies.	
<b>5.5.12</b>	Matching the resources of the collaborators	"when you talk to collaboration usually, you have to sit at the same level of stage in terms of the capacity, in terms of the manpower, only the missing things from your side maybe, some experience in this subject, but if you are missing a couple of things, missing researchers, missing time given to the researchers, okay, so you will be two steps behind than the other entities. You can't catch up".	It is essential that external collaborators see value in collaborating with the case study organisations. Otherwise, the only way for joint work would be transactional and such would offer minimal KT returns. Shortage of manpower further complicates efforts to collaborate with external researchers. Researchers now have quality and quantity issues to deal with. More pressure is placed on the few high quality individuals causing possible exhaustion, burnout and low morale, resulting in further trust issues with management.	Red
<b>5.5.13</b>	Knowledge resources decay	"So I think, yes we have experience, but we lost now some of our glory, because many of our researchers retired, we are left with a couple of them, so this is another problem with management here, that they don't have the vision for the future... yah, usually, middle management have a plan to replace but do they agree? this is the big question. Because again they will tell, are we going to put money? In the sake of what? Do you have projects?... Yah, this is what you need, to find other researchers ... ah, as I mentioned now, a lot of people are reaching 55 and 56 years old, they came young, they gained experience, they built their career and there is no one after them to carry the flag"	The building of manpower and internal capability is already facing many barriers as discussed in the previous case issues. However, when some of these issues are overcome by building the capability of some researchers through years of development, the problem of retirement and leaving the organisation arises as a serious threat.	Orange
<b>5.5.14</b>	Lack of willingness to spend for resources	"It is a must to change. This is dynamics. In education it takes 10 to 20 years to see a change, it does not happen in one or two years. This is the culture, but if we are creating the vision, trusting people and being generous, then this will take you to the lead but I have big ambitions and big vision and still I am greedy from one side, it doesn't work this way."	Governmental spending tends to be conservative, especially when returns are not guaranteed. Risk management is blocked from being practiced and legitimate spending is rejected. This inhibits KT as well as other useful research related activities.	Red
<b>5.5.15</b>	Lack of confidence of local industry in	"... we are negotiating with them and we tried to convince them. For example when they come over here this is an old problem, we say we can do this research. They ask	The local industry feels that the case-study organisations do not provide a level of	Red

<b>5.5 FINDINGS ON ORGANISATIONAL RESOURCES</b>				
<b>Code</b>	<b>Knowledge blockage</b>	<b>Sample coded reference quote/s</b>	<b>Analysis</b>	<b>Rating</b>
	case study organisations' resources	us do you have enough manpower? Do you have the equipment? we say yes and no. Then from our side, we ask them are you really serious so if we recruit, you are going to give us this type of projects? You see the type of talking, everybody tries to put the blame on the other".	competitiveness in terms of its resources as compared to overseas rivals. This is causing a barrier on the internal-to-external KT system level	

5.6 FINDINGS ON ORGANISATIONAL SYSTEMS				
Code	Knowledge blockage	Sample coded reference quote/s	Analysis	Rating
5.6.1	KM IT Systems	<i>Finding based on observation</i>	KT could be facilitated using the KM systems. The case study organisations have not implemented any IT system that serves this purpose. It has not provided any attention to IT applications for KT purposes.	Green
5.6.2	IT For Communication And Planning	<i>Finding based on observation</i>		Green
5.6.3	Legal System	<p>"We sent one person to them, and they brought 15 lawyer to speak with him. This was a big error from our side to send a single person... This legal department is also over loaded with many project documents and agreements".</p> <p>"It was not only the IP, but how the relationship between us and him would work. So, I think [Organisation X] transferred this agreement to an attorney in the USA, to improve the agreement. It took around 4 months to finalize in discussion, emails, meetings and like this".</p>	The legal advisors for IP and other related research activities lack formal academic standing in the field of IP, international cooperation and patenting. In addition, the number of advisers is minimal. The dependency on external expertise for readymade solutions is a barrier.	Orange
5.6.4	Pay Scale Systems	<p>"Usually for non academic it [pay rise] is 5% per year if you get excellent. [for non-academic researchers, pay rise ]it will be 3%. [Pay rise] it is fixed but if you are a masters and you don't complete your PhD then your salary will freeze at some point".</p> <p>"... like if you have a project then you will get an award of SR3000 per month for bachelor and masters and SR6000 per month for a PhD... but the number of projects is limited and does not cover all employees... this year I got 3 projects which means SR9000 per month added to the basic... What I have is not common. I am lucky here to have 3 projects at the same time. Anyone who considers a position for working here will not consider this as an incentive because he might not get projects... The project also may stop at any time... The funding may stop, like 2 years ago when the initiated one mega projects and most of the other projects we were stopped and funding went to the mega project".</p>	In the case study organisations, new employees are put on a pay scale that has little flexibility to cater for creativity and better performance. Standardizing pay increases disregards the possibility of having extremely active and innovative researchers with a Masters degree. Regardless of their performance, they will reach a point where pay rises are frozen until they complete their PhD. Such will affect their morale, the extent of their performance, as well as their KT activities. Only a few may find the opportunity to complete their PhD and reinstate their salary increase. Also, pay rates are not linked to performance, but are dependent on being given a project assignment and academic level. Policy is not clear as to how projects are assigned or whether they are given on a consistent basis. External experts considering employment would find this vague. In addition, pay scales for some skilled support staff are not sufficient.	Red

5.6 FINDINGS ON ORGANISATIONAL SYSTEMS				
Code	Knowledge blockage	Sample coded reference quote/s	Analysis	Rating
		"We are even not able to hire good translators because this position pay scale here is quite on a low pay scale. What can we do in this case? Good translators want good salaries which we don't have".		
5.6.5	Measurement, Quality Control And Support Systems	<p>"if they want to benefit then they can come to us and request information. We would be ready to help".</p> <p>"Generally, I can say that this is a successful project. Why? Because you provided a new thing and you got a patent. So I think this is success. I don't want to say that this is enough, no. The goal is to get the knowledge, the IP for this product, this is the main aim for [Organisation X] also".</p> <p>"... we have a centre called research support within this building. This centre here manages all the financial or contractual agreements for the research institutes and through them they also manage the questionnaires. For every project when we reached the completion they immediately contact the client and get the questionnaire sent to get that feedback to the IP at the centres of concern and proposal investigators and that is a dynamic process because it is good feedback to the system".</p> <p>"Because I did some work with some entities during summer, and what I found that there is a lot of subjects taking place in the facilities, but when you go to the labs you don't see something running, why? the answer comes from the researcher, I am not willing to repeat my Ph.D. and sit in the lab and do the experiments, I need more labour to work with me. So, this is the sort of thing they have inside. So I think some of them are shuffling papers".</p>	Respondents from international cooperation departments seem to believe that they are departments on standby mode, where they take action when asked to, and not taking the initiative in designing, implementing and monitoring KT activities. The way progress is measured is not standardized. Each section or research centre has its own way of looking at their progress. Overall, these activities are not standardized and also vary from section to section and centre to centre. Audit systems are also related to quality and require standardization and base lines for researchers and centres to follow. Local industries are concerned with this issue and demand evidence of high quality as they engage with the case study organisations. Although respondents feel that local industries lack such qualities.	Red
5.6.6	Employment System	<p>"the idea is that we are having many flaws with the current employment system".</p> <p>" I had been trying to recruit and I sent e-mails and established a</p>	The main objective for the employment system of the organisation is to gain the needed expertise that can help the organisation increase its internal capabilities and scientific expertise. The current employment system does not offer system	Orange

5.6 FINDINGS ON ORGANISATIONAL SYSTEMS				
Code	Knowledge blockage	Sample coded reference quote/s	Analysis	Rating
		<p>database to more than 126 individual worldwide and most of those contacts are from the US. I have received so far I mean a good number of applicants. 90% of them, of the applicants, are from the Arab world originally or from the subcontinent. They are in the West that means the same message was received by Arabs or Indians. Why? We've been trying to solve this one problem. There is a cultural issue and always there is this stereotypes about the kingdom and the Middle East in general and there are factors beyond. Woman driving is it possible? Or is it allowed to drink or not to drink? I have been talking to people I mean from Europe and North America and they are willing to come and maybe they will have better offers here but always this fear in them for making a decision to come or not to come".</p> <p>"We have a problem with the system, the system doesn't really reward, it does sometimes reward, but it doesn't punish enough so that people perform at their most".</p> <p>"So basically a researcher here instead of having a professional team, he usually ends up with a team who needs to be raised in terms of skills".</p> <p>"Employees here are categorized into three systems: Academic payroll system, civil services payroll system, and contracted payroll system. The contracted employees work as assistants for the researcher, but he is actually doing the same job. The contracted person get nothing. Also, research credit is not recognized in ranking and promotions.".</p> <p>"We as a project before we made this center and before any Chinese coming to Saudi Arabia, we must do something, we should give them [the Chinese] like a checklist, something to do before coming to Saudi. We should give them like information about the country, about religion issues. We should give them a whole idea...".</p>	<p>competitiveness in sourcing and selecting external experts. Respondents have expressed dissatisfaction with the employment system. Sourcing and selecting research experts from foreign countries is not yet stable at an organisational level. Many centre directors feel helpless to support their employment needs. The way forward, as they see it, is to participate with the system to source researchers from abroad. However, the system is not structured objectively and individual practices have not been standardized nor tested. There are many examples of poor work systems. An ineffective employment system affects research and KT. The segregation between employment schemes is also a barrier. In many situations where the successful employment of external experts takes place, the experts have little idea about the work environment and life at the case study organisations. Although they might be keen to arrive at the new work laboratory and begin research, they may face difficulties in understanding what is going on and adjusting to new ways. Their personal perceptions affects KT practices. I would recommend the above suggestion to be used as a must-do sub-process that's assists in the settling-in process.</p>	

5.6 FINDINGS ON ORGANISATIONAL SYSTEMS				
Code	Knowledge blockage	Sample coded reference quote/s	Analysis	Rating
5.6.7	Financial System	<p>"The regulations hinders the money or regulate the money, so you cannot have it to do things ...".</p> <p>"I developed a proposal, without knowledge about budgeting".</p> <p>"The funding may stop, like 2 years ago when the initiated one mega projects and most of the other projects we were stopped and funding went to the mega project".</p> <p>"we don't have the tool for money rewards. We can give them something else like travelling ..."</p>	<p>Researchers have little understanding about finance and budgeting since they come from scientific fields. Leadership practices affect financial systems negatively. When financial systems are involved in almost any process throughout the case study organisations, it usually slows things down to a level that it threatens the success of the whole objective. Tools to manage finance are inefficient.</p>	Orange
5.6.8	Business Development System	<p>"The solution is sometimes to solve or to resolve their problem.. or to do a service to a company, then you have to have skilled professionals, you have to have the knowledge and of course you have to have the time. So basically, and of course the money. So if we think about it as project managers then we're talking about the time, we're talking about the resources, and of course the knowledge".</p> <p>"really we started communicating with Saudi ARAMCO, and they got interested about some sides of this project. Nowadays, we are working to provide a complete presentation that we plan to introduce to ARAMCO within 3 or 4 weeks".</p> <p>"Yes, they are not client based. Now, those centres of excellence are funded by the ministry of higher education and their mandate is to do research of excellence in specific areas. They are being hosted in the RI only but they are different than the research scheme of the RI. Now [Organisation Y] is thinking of making another building where they host all these centers of excellence. Basically their mandate is profoundly and fundamentally different than the RI".</p> <p>"This is for sure. I'm very sure about it and people who spend time in</p>	<p>Case study organisations do not apply business development strategies since they are governmental. They approach their need to receive research requests in a non-traditional way. The methodology for recruiting research projects needs to develop a more modern approach. Business development requires expansion of organisational structures. There is confusion regarding roles and responsibilities. Organisation Y, for example, has 3 schemes covering research -research groups, client funded research and centers of excellence. Such schemes are created from weak planning and in many ways, duplicate the same service. Business development in research areas requires patience to build internal infrastructure. The system that guides this process requires time and support.</p>	Orange



5.6 FINDINGS ON ORGANISATIONAL SYSTEMS				
Code	Knowledge blockage	Sample coded reference quote/s	Analysis	Rating
		the labs, can tell you about this. Especially in our culture. In the USA, Australia, you can have any parts by the phone, and they can deliver it to you. Here if you would like to get it, you need 2 to 3 months to get it from outside. This is one, second, transactions, sometimes they don't give you cash money flow, you have to pay from your credit card and even though when they reimburse you, they take what you call the shipment cost from the reimbursement amount because they said that this is not included in the bill and the government should not pay for it. So this is also another hurdle".		
5.6.9	Communication System	<p>"[Organisation X] has like more than 15 institutes and unfortunately each institute is working separately. There is no clear policy or clear .. There is a clear policy for cooperation but I don't know for some reason they are still not following this".</p> <p>"There are instructions from executive management to have strong communications but practically that's not implemented. That's, I think, the main reason".</p> <p>"Because its, the people who are communicating with the outside external organizations are very high level of education. They are all PhD and they are all from very good universities and have very good and long experience. No one of the regular researchers who are working on the projects was asked to contact some of the external organizations. It must be done through the administration and VP office which need a director".</p>	The case study organisations are traditional in terms of their communication systems. Team building, total quality concepts and knowledge communication platforms are yet to be considered. Although the need to improve is clear to management, it is still far from being a reality. This node here shows clearly that the intention to improve exists but there is somehow a flaw in the process, the system or both. It becomes more evident that this organisation is in deep need to re-design their processes to meet their goals and objectives. Also, when newly active researchers are not allowed to freely engage with external knowledge sources, it creates a sense of a controlled environment that limits innovation and creativity.	Orange
5.6.10	Strategic Planning Systems	<p>"researchers want to help their country, their society but sometimes the rules, the planning, and the management rules is a problem in his way... I think by clear planning for this center, institute".</p> <p>"One can at least elaborate on this issue, and see what is going on because by the way we have to understand that here in our system we are too much analytic. If we do something, how much I gain. If you justify it this way, gain, you can have a new department completely,</p>	The planning systems of the case study organisations rely on the long experience of senior researchers and the leadership. However, strong management proven tools for planning and system analysis is missing. The result is that most planning decisions develop systems that are based on personal perceptions without the use of validated planning tools. Decision making systems are not appealing to respondents. The idea of research excellence is a strategic choice. This requires strategic planning	Orange

5.6 FINDINGS ON ORGANISATIONAL SYSTEMS				
Code	Knowledge blockage	Sample coded reference quote/s	Analysis	Rating
		<p>no problem. If the case is not there, nobody will listen to you or talk to you".</p> <p>"there is no center can accommodate everything, otherwise they don't call it center of excellence. the mission of the center of excellence is to pick a subject and you go deep not spreading too thin, so, ah, what they are doing, this is very clear, they already have a plan even though for us as a corrosion, we have a plan what we are going to do is for example for the coming 5 years. we are just concentrating on this subject in terms of the manpower, in terms of the ideas, in terms of the equipment, so that we can achieve the excellence, otherwise, we are defeating our mission by spreading too thin .. and getting from here and there little projects, this is not really a subject and just because I'm calling myself Corrosion. Corrosion for example is a big subject. I have to be really too much specific in my subject. Otherwise, it is not research excellence".</p>	<p>systems to invest time and resources into developing the infrastructure on long term basis. The longest planning period currently at the case study organisations is 5 years. This is problematic because this is a short time span with respect to strategy.</p>	
5.6.11	KM System	<p>"There is no way to force someone internal here to give knowledge".</p> <p>"[having formal KT position] in this way we could guarantee the experienced staff to be involved in the current projects. If we are going to have a vision to extend our capabilities, so this is very important".</p> <p>"I don't have the strength from my staff to apply KT and even from the outsiders are also a barrier".</p> <p>" we measure it [KT] in different ways like joint supervisions, joint projects, but I mean the measure itself, how to measure transfer of knowledge, I would be happy to find a way to measure it in a very precise way".</p>	<p>Knowledge intensive organisations such as research institutions usually have knowledge base systems to capture and disseminate their internal knowledge. It also allows knowledge be collected efficiently and made available to all members to absorb and use. The case study organisations have reported no systems. They have been focusing on bringing in experts to help push their research activities forward as well as hiring consultants and collaborators to help internal members complete their research work. The process remains subjective, and varies from case to case. There has been no specific methodology put in place to coordinate these activities. Also, there is no formal assignment of any internal staff to manage knowledge resources within a standard system. The support that comes from bottom to top is also not present. Staff does not seem to value KT and leaders do not have a clear strategy to apply change in this regard. Techniques relating to KM are also present at the case study organisations.</p>	Red

5.6 FINDINGS ON ORGANISATIONAL SYSTEMS				
Code	Knowledge blockage	Sample coded reference quote/s	Analysis	Rating
5.6.12	Systems For Research Collaborations	<p>"Yes, we pay them [external collaborators] per project... I am not really sure but what I know is that each one of them [external researchers] have salaries, each one of the Chinese have monthly salaries..."</p> <p>"it is personal contacts but always it is recognised in the system. Normally it works by personal contacts".</p> <p>"there is no liaising office".</p> <p>"for some of the projects, we designated someone for managing to avoid management follow-up. That's why I don't want to put myself in the forefront".</p> <p>"... but when this relationship tries to become formal between two institutions, then the whole process substantially slows down at the university here. I am happy that the university is careful, but our university is VERY careful. Too careful. Sometimes they should keep it working in parallel to speed up the process, and keep the carefulness".</p>	<p>There are many agreements signed with external experts. However, the agreements concentrate on generating knowledge without much emphasis on the processes in which this knowledge will be generated, nor what engagement strategies are to be included. Measurements, liaising services and benchmark systems are currently not enforced during the life cycle of research collaboration agreement. There is no enforcement of KM practices within the system. This is a barrier that needs to be addressed. Also, the efforts made by individuals to help optimize the research collaboration efforts are not recognized by the system. Individuals do not have formal status through clear guidelines and support. It is only recognized when success is met by an individual and a personal contact results in a potential collaboration. The system also lacks coordination services between the internal and the external organisations. This has created discrepancies between research centers within the organisation where center directors find their own way to facilitate liaising systems within their small research centers. The practice of liaising has become inconsistent and lacks expertise. International agreements fall under this system. It is somewhat slow at the case study organisations.</p>	Red
5.6.13	Lack cohesive local systems	<p>"I am talking about our center. We faced a problem that the way of learning in China compared to the way of learning in Saudi Arabia is different. Arabic people, especially the Saudi people, such as our fresh graduates, have been received doing the spoon-feeding way and this is not the Chinese way. Some of us expect [spoon-feeding] especially the fresh graduates who only have bachelors in some majors. When they come they expect the Chinese to give them homework and give them books to read and something like the spoon-feeding way but the Chinese just give us broad lines and ask that you do it by yourself. Read this and do that, if you finish come back to me. If you don't know something come back to me, so this was very difficult for some people here. Some people just gave up,</p>	<p>Fresh researchers are not motivated with regards to career development. When external experts arrive to continue their serious careers, they expect internal researchers to be as serious. I have chosen to log this code as an Internal-Internal teaching node because it is talking about someone who exists onsite and has been hired to work internal, although temporarily. The process of teaching and learning covers many factors (see literature on adult education). However, the problem here lies with two main issues: AC of learners, and behavioural skills of learners. From the K-providers side, I would recommend some initial training on teaching methods for Saudi learners (i.e. language barriers, cultural barriers, hard work attitude, etc.).</p>	Orange

5.6 FINDINGS ON ORGANISATIONAL SYSTEMS				
Code	Knowledge blockage	Sample coded reference quote/s	Analysis	Rating
		they just stopped. [they say] I cannot do this in that way so I will stop".		
5.6.14	Internal System HRM	<p>"But many of the expats, let me say it clearly, and it's not me, they say out loud that we are not happy about that policy but it is a unified policy from the government".</p> <p>"Centre director position here is another side job, it is not my main job... There is always some paperwork to be signed but, it is just a formality".</p> <p>"Even for evaluation, when it comes to the end of the year, I am the one to write my evaluation and this depends on how many papers I have, I mean teaching evaluations, students are going to evaluate me, but maybe he will put his input on how this person is interacting with his colleagues, how this gentleman is acting with extracurricular activities. The main criteria which will make the final say if I should stay or should leave, he doesn't have the authority... if you are in charge of something like a certain task of research so if you are not doing that, no one will say anything to you".</p> <p>" I think we have the wrong way of evaluating our people in the RI. We don't evaluate them in the proper way. So this is creating an unclear picture, and moral is down. If you talk to people you are going to see it very clear".</p> <p>"don't forget the factor of employment here, like issuing a visa for secretaries for example. The university is fighting with the ministry of labour to get visas from them because the ministry is considering these secretaries as a low ranked people and are available from the Saudi graduates who have technical college or just graduated from school with 2 years diploma, so they want us to hire saudis ... The problem is the mindset and the system".</p>	<p>KT relies on interaction and a genuine interest to pass knowledge to others. Any disturbance to the human factor in this system will have negative effects to the KT process. A major source for KT success is the involvement of expatriate human resources at the case study organisations as these individuals act as knowledge catalysts. This needs to be addressed. Also, another catalyst for KT is the frontline managers - the research centers directors. This important human resource group is not well acknowledged by the case study organisations. They are considered as research center coordinators who smooth the administrative process for their respective research center. Rather than being innovatively involved in creating and sharing knowledge within and outside their research centers, they tend to feel temporary and powerless. This does not help KT to take place at a sub-organisational level. On the level of human resources as a whole there is little attention given over to aligning KT expectations to performance and job objectives. The focus is too broad and subjective. Respondents express what is expected with regards good teaching and good research. This needs further detail and focus to align with KT requirements. The evaluation process is not appealing to researchers and they feel that it impacts on low performance. The human resources evaluation system needs improvement. Respondents also raised issues relating to Saudization. Threading human resource skills into the operational structures is lacking at the case study organisations, hence, creating an artificial barrier between researchers:</p>	Red

5.6 FINDINGS ON ORGANISATIONAL SYSTEMS				
Code	Knowledge blockage	Sample coded reference quote/s	Analysis	Rating
		"What we feel is a bottleneck, in that the university has not yet clearly identified the responsibilities of the different categories of manpower. The senior people, the midcareer people, and the junior people, and how to thread that. The university should try to get the maximum of each one of them".		
5.6.15	Research Commercialization Systems	<p>"I'm talking about not taking research to the next level. There is no spin of accomplishment yet. We just started, but hopefully in the coming year because there is a great potential, great, great, great potential and some of these patents and achievements made by other faculty members in the University is sold to many manufacturers who works and publishes, I mean we are not a profitable organisation, firstly. This is an academia then, I mean we should have the next step, from this research and spin-off companies. Something can be developed here ... There are mega projects in developing new materials hopefully that can and will pass to the stage of spin-off companies".</p> <p>"And I think what we need is to have a real office that can spend time with the researcher to discuss the idea first of all, and to put it together and evaluate it very well and then get the patent and try to commercialise the patent. By the way this is not easy, ok, it is difficult because out of 1000 may be we can commercialise one".</p>	The case study organisations have always been lacking in commercialisation capabilities. Recently, they have been engaging with industry in ways to resolve this shortage. Still, there are no clear systems to execute strategies and policies related to commercialisation of research and IP capital. The understanding researchers and their directors have relating their work to commercialisation is limited. There are limited management guidelines in this regard. This needs improvement.	Red
5.6.16	System Bureaucracy	<p>"... it [paperwork such as approvals] takes a long time. Many times, I'm talking as an individual not as a director, you give up, you give up and you don't want to do it again ... Definitely, but until when? If you fight for this, and then you fight again for that, and then again you fight for this, until when can you fight? Because if the system as I told you, even the financial is there, but when you want to spend the resources and the way how to spend them ... Ah, oh, well bureaucratic is not the leadership only but the one below as well"</p> <p>"I mean you are fighting the WHOLE SYSTEM. So, let's say... I mean [our organization] in the country where we have the largest</p>	The way in which different systems function at the case study organisations proves to be rooted in inefficiencies. In many ways, respondents feel the problem is complicated because of this problem is acknowledged properly due to current bureaucratic mindsets.	Red

5.6 FINDINGS ON ORGANISATIONAL SYSTEMS				
Code	Knowledge blockage	Sample coded reference quote/s	Analysis	Rating
		reserves and still we are importing technology, oil and gas technologies and even the establishment of Organisation Y back in [Year of establishment] was meant to be leading in the industry of oil and gas under the umbrella of the ministry of oil and petroleum and minerals. Part of the system is like this, I mean if we bring a high scholar and he is reporting to an assistant professor as a head of department, how do you want that to work? We are not happy about that, the whole university is not happy about that".		
5.6.17	Students Recruitment Systems	"we are fighting to get 11 to 15 graduate students. So, satisfaction, improvement, it's not just we hire people and even graduate students is one of the issues we are having with visas. Most of, you are here because of what? Because you are doing your thesis, I mean dissertation and the research coming from that is gonna be published, it gonna have reputation. Who did it? You did it with your supervisor. Most of the, I mean, the one behind development especially in academia is graduate students. If you have in one department 5 or 6 students and you have the constraints from the ministry of labour or .. you don't have Saudis because they are not interested in graduate studies".	Graduate students play a vital role in research projects at the case study organisations. However, there is a system problem at the student recruitment level.	Green
5.6.18	Logistics Systems	<p>"If you compare and benchmark with other peer research institutes or universities, say in Europe, or Canada or USA, they have certain systems, for example, getting certain materials related to their instruments or chemicals or supplies or accessories, for them it is much easier. Getting the man power, for them, is much easier. Getting the help from other experts is even much more easier. For us, everything is not easier. We are converting this 'not easier' to 'still possible', 'doable with quality', this is our uniqueness".</p> <p>"We need to interact with world-class leaders but at the same time how did these people become world-class? The ingredients which they had are not present in the infrastructure here. Even if they liked to give us, they will not be able to retain that ... He wants a thing to be done in two days, here I don't think it can be done in two months,</p>	Logistics is a major barrier to the smooth flow of knowledge and resources across and within the case study organisations. Issues related to speed and efficiency is always discussed. There is common factors across all logistical failures. Researchers waste a large portion of their time and concentration on things that are very far from their main research activity:	Red

<b>5.6 FINDINGS ON ORGANISATIONAL SYSTEMS</b>				
<b>Code</b>	<b>Knowledge blockage</b>	<b>Sample coded reference quote/s</b>	<b>Analysis</b>	<b>Rating</b>
		<p>then this will be a source of demotivation for him ... more or less so. For this, you know, you have to excuse me, I am an expatriate. Whenever I discuss these matters with my colleagues they say we have governmental problems, and this and that, but I don't believe in that. I don't believe in that. It is our honest intent, do we really want? Then we can always make our own ways, even to the government, we can propose. This is for the benefit of the nation. If changes are required, why not?".</p> <p>"instead of working on research, we are doing these things. I will show you an order that now it is taking more than a year, and we have committees and all of this is going on to make this order so the faculty and researchers are spending their time to follow up these things".</p>		
<b>5.6.19</b>	Grievances Systems	"I think as per the culture of the university and being an expat, I will be more of a loser if I feel like that I should take an action. Here the culture does not permit that. You will be more losing, you have to at least weigh that I be patient, ok, and this was in my fate, and I would still continue working, and create my own success. This is one way. If you confront, you will be a great loser. I think the local culture does not permit that".	With all the defective practices that take place at the case study organisations, many respondents expressed numerous grievances that they feel helpless to report or even discuss with the management. Many view the current systems as ignoring their problems as well as having no clear support systems that can help them solve grievances. This affects the moral of many researchers and likewise affects KT. It is not an easy task to record grievances on tape or have respondents discuss their grievances, however, one respondent stated:	Green

## 1. NATIONAL LEVEL OF ANALYSIS

6.1 NATIONAL CULTURE				
Code	Knowledge blockage	Sample coded reference quote/s	Analysis	Rating
6.1.1	Gender Policies	"I believe our culture will have or can have an impact on cooperation with experts from outside especially when it comes to ladies, that's an important issue".	When KT takes place on an international level, it is very difficult to discriminate between genders.	Green
6.1.2	Researchers Blaming The Rules	"researchers want to help their country, their society but sometimes the rules, the planning, and the management rules is a problem in his way."	Most respondents are uncomfortable with the rules and regulations that govern the research organisations, and they believe this heavily affects their work quality and KT practices. The interesting point is whether the rules are the source of discomfort or the way the rules are being implemented and dealt with.	Orange
6.1.3	Senior Generation	"I noticed this in the old generation more than the younger generations. For example, in the university, the old professors were not cooperatives. I noticed this clearly, but the younger generations' mind changed because most of the work require teamwork to carry out a project so you couldn't work alone."	It is important to engage senior researchers in the KT process. However, if they do not feel comfortable to engage with younger generations then the effectiveness of the KT will be compromised.	Red
6.1.4	Community Habits	"I think its [KT] not effective in [organisation X] because many people don't work hard. I think the people in [organisation X] are very rich and they don't work hard because they don't need to work hard ... I think its not the knowledge, it's the habit of the people. Most of the knowledge, you can transfer to Saudi Arabia and they can accept it but some knowledge they don't need and they don't accept because of the habit of the peoples' life and society because every country has its own face and I think every country would defend	Seriousness, attentiveness, thirst for knowledge, time management, are attributes of advanced communities. These attributes drive organisations to be productive and efficient, supporting knowledge flow and better KT. The respondents are not satisfied with the commitment of some researchers. The life style in the community does not support technology research and development since it requires tremendous efforts and timely achievements. Researchers feel that they are in an ocean of ill planning and chaos that they cannot control using their individual energy.	Orange



6.1 NATIONAL CULTURE				
Code	Knowledge blockage	Sample coded reference quote/s	Analysis	Rating
		some things that they don't need. So I think most of the knowledge can be transferred to Saudi."		
6.1.5	Religion	"Yes, even the religion, RAMADAN played... it was very difficult for us to cope up. Even the Chinese, it was very difficult for them, even we cut the lectures, we couldn't, they couldn't give lectures in RAMADAN. The religion believe it or not plays an important role in KT."	The community at the case study organisations at the national level makes allowances for, on the whole, for the main religion of the community. However, this is changing with more flexibility and acceptance of other cultures and religions. There are a few occasions that all researchers, regardless of their beliefs, need to adhere to specific religious rules in the country such as RAMADAN, the month of fasting. Drinking and eating is not allowed during the day until sunset in all public places including work places. This could cause serious distress to people who do not fast and possibly affect their work performance. The respondent finds it difficult to cope with foreigners not used to such religious practices. It is quite naive to suggest any changes in the culture in this context; rather the system that manages the process of daily work during the fasting month of Ramadan needs to be revisited. The respondent points out that this month is quite different and can't be treated like any other working month. All activities, including KT, face this barrier. Other religious matters, like prayer breaks, do not seem to have as great effect. Perhaps some behaviour from some individuals towards people from other faiths may be investigated; however, none of the respondents showed any need in this regard.	Green
6.1.6	National Educational System	"I think we can if we started from the early beginning at schools and universities because you have studied here except [Organisation Y], other universities are still the same I think. I hope they solved these problem but I graduated from another university if they don't give us a book to read, then it is not like Australia you have to create your own project or even give an idea... This is not currently in our universities..."	KT practices need to start from the early years of education. Students should be acquainted with the idea of sharing knowledge, teaching and learning from others. This cultural mindset can then be carried over into the workplace. KT continues to benefit all involved as well as their organisations. The idea of sharing, giving and caring for others are all attributes that are necessary on communal levels. When a community is not used to the above, it is extremely difficult to institute such mindsets with adults who already have a culture of not telling, not sharing and perhaps preventing knowledge from others. National schools do not offer community engagement or student interaction programs that enhance KT. It is therefore a barrier to KT when researchers begin work at their organisations. This is an important issue that talks about the educational processes prior to employment in the research organisation. The	Red

<b>6.1 NATIONAL CULTURE</b>				
<b>Code</b>	<b>Knowledge blockage</b>	<b>Sample coded reference quote/s</b>	<b>Analysis</b>	<b>Rating</b>
			respondent is pointing to the inheritance of national culture and transferring it to the organisational culture.	
<b>6.1.7</b>	Changing Values	<p>"I mean, from the Islamic point of view. If you look at openness, transparency and KT as a Moslem, these values are part of the teachings of the religion, but even as people living in this area, I think some opposite values exist. That's a recent nature of Arabs."</p> <p>"For example, a person had good education, but in his family he never learned how to be thankful to others and how to appreciate others, how to care for others, he didn't learn it. For him, it will be very difficult; you will see that when he is in his profession, he would reflect actually what he attained from his family. It's very difficult for him to change, even if he was in a different society for a number of years, it's still difficult. Why? These are ingredients. If someone developed them during his grooming then it is very difficult for him to adapt at a later part of his life."</p>	<p>Communities change over time. The change in direction and form is dependent on environmental, political, economical and social factors. Honesty and trust are necessary values in this process. To establish a LO where people can trust each other on sensitive knowledge results in effective KT. The barrier here is that some important values affecting KT are new attributes surfacing from the community. Values have been changing with new lifestyles and changing family habits. Such changes affect the way people are interacting.</p>	Red

<b>6.2 NATIONAL POLICIES</b>				
<b>Code</b>	<b>Knowledge blockage</b>	<b>Sample coded reference quote/s</b>	<b>Analysis</b>	<b>Rating</b>
<b>6.2.1</b>	National Spending Policies	<p>"They try to reduce the Saudi financial commitments which would harm the objective of the cooperation as a whole".</p> <p>"...it's not the president, it's the ministry of finance who will need justifications for what they would consider ill decisions. They might simply question why are you conducting research with risk that is costing us 5 billion, at a time that you can wait and buy it ready made for the same price from its IP owners with no risk of getting out with nothing, like you did now? So they ask why do you start from scratch?".</p>	The regulations governing research spending does not meet the researcher's needs nor flexible in supporting research activities. Spending often fluctuates causing frustration. The attributes of research spending is very different from civil work projects that have strict specifications for execution. Research is sometimes vague and requires risk spending. Applying national spending policies to scientific research inhibits a lot of research and the flow of knowledge, thus is considered a barrier to KT.	Red
<b>6.2.2</b>	National Policies On Research	"the problem is the regulations that the companies need to have. One of the problems we had with some companies is that they find it difficult to deal with us because we are a government. Since we are a government, it's difficult to sign an agreement with us. They cannot for example, if we don't perform then there is no... they would not know who to go to, for example to resolve the issue".	Case study organisations are governmental. The private sector feels less powerful when dealing with government run research organisations. The government does not support national private research institutions. There is no known privately owned research institute in Saudi Arabia up to the date this research is published.	Red
<b>6.2.3</b>	Governmental Accountability Policies	"It's a difficult question. I think there is a solution and that is to ask or to put everyone accountable, to ask these bosses, directors, why do you do this? and why do you do that? In Saudi Arabian organizations and [Organisation X] is one of these organizations, there is no one behind this. There is no one asking the big bosses why are they doing things like this".	Government officials tend to have less efficiency measures and productivity accountability. The case study organisations believe they can redesign processes to be much more productive.	Red
<b>6.2.4</b>	Bureaucratic Policies	<p>"yes it is governmental policy, it's a unified policy from the Ministry of higher education. The university has no say on that at all. There is no head that is not Saudi".</p> <p>"because... that... don't forget the factor of employment here, like issuing a visa for secretaries for example. The university is fighting with the ministry of labour to get visas from them because the ministry is considering these secretaries as a low ranked people and are available</p>	Although not all the case study organisations follow the same affiliation, they all have a leadership that is tied to external control of finance, employment, and logistics. The simplest issues, like offering visas to external staff and deciding on employment percentages, are all controlled from outside the case study organisations. The controlling ministries apply uniform regulations without looking into the size and	Red

6.2 NATIONAL POLICIES				
Code	Knowledge blockage	Sample coded reference quote/s	Analysis	Rating
		<p>from the Saudi graduates who have technical college or just graduated from school with 2 years diploma, so they want us to hire saudis".</p> <p>"Don't look at it as [Organisation Y]. When the government looks at it, they look at [Organisation Y] as any other university. AlJouf university [a very small uni] in the eyes of the ministry of labour or even the ministry of let's say finance honestly sees it as equal to [Organisation Y] so they see any university as they see [Organisation Y]. So you have to justify and put, like, I mean ..."</p> <p>"we started to do something that is coming from the British embassy but we found that we are not allowed to do it so we stopped".</p> <p>"there is other societies or other partners from Germany just 3 years back they paid us 250,000 Saudi riyals for research here in the kingdom But there is regulations, you cannot do services for external companies, for your information. You have to take the permission, not from the ministry, but from the Prime Minister, so usually we go around this subject, without reporting this, by requesting the external entity to have a partner within Saudi Arabia and the paperwork should be coming through the partner inside Saudi Arabia, so in front of the government, all the paperwork is done through the partner in Saudi Arabia".</p>	<p>differing circumstances. Another example is when all governmental departments and ministries are forbidden from giving its services to foreign agencies or companies. This makes sense for governmental sectors where the sole purpose of the government is to serve the national population. However, for research, such activities could help generate more knowledge and increase KT and to forbid dealings with foreign agencies on a transactional basis is a barrier to KT. These policies don't help except to add frustration among the case study organisations.</p>	
6.2.5	National Policies On Strategic Planning	<p>"... I mean it's [one of the case study organisations] in the country where we have the largest reserves and still we are importing technology, oil and gas technologies and even the establishment of [Organisation Y] ... was meant to be leading in the industry of oil and gas under the umbrella of the ministry of oil and petroleum and minerals".</p> <p>"So sometimes moving in upscale management, and of course it gives prestige, and more respect but how much you can do or contribute is what matters. ... but in our culture here, I think, still, we don't believe in some issues that you need time to convince people ... No one is going to come today and I will believe his ideas next day. Forget it ... because</p>	<p>Strategic planning needs to consider scientific research plans for time spans that exceed 10 years. Most plans are 5 years which creates damaging effects once a 5 year plan is finished and then not renewed or approval for extension is delayed. The planning practice is weak on the national level. This is creating barriers to establish strategic projects that have long term dimensions:</p>	Orange

<b>6.2 NATIONAL POLICIES</b>				
<b>Code</b>	<b>Knowledge blockage</b>	<b>Sample coded reference quote/s</b>	<b>Analysis</b>	<b>Rating</b>
		sometimes some little issues you don't see in your vision because it is too big. Like this subject, 20 years back, they talked about establishing a big testing laboratory for high voltage and high power ... Then they couldn't do it because the capital cost was too high and there was no market ... Then for one and a half year they were discussing, and finally we said the first step that we should do is to do a feasibility study and a clear one, financial, technical and management. Now we need money, who was in the committee? ... We've found ourselves with some good guys, some of them very strong financially, some of them politically strong and some of them technically strong and I was the head of the committee. Then we had a lot of meetings and then collected 3 million SR. We invited, professionally, five entities to participate in this study and three committed and we interviewed them and we came up with the finest one. So, they did the feasibility study for us".		
<b>6.2.6</b>	National Policies On Engaging Local Industry With Research	"... ARAMCO and SABIC now they have their own RandD, and they have their own inside business. So sometimes it is not easy, this is another point, to penetrate and have good communication with them because they just started or they believe this is their own business, core business that nobody shall see or interact with them".	The government applies little pressure to encourage a strong research relationship between the case study organisations and the local industry.	Red
<b>6.2.7</b>	National Social Responsibility Of Local Industry	"ARAMCO can always get their problems solved when they hire people from outside but this means that they are shying away from their social responsibility towards these research institutions. They are obliged to help these institutions to help them to flourish. Provide them with more challenging problems, be patient when it comes to executions of projects, and try to foster and enrich the research culture at these institutions".		Red

6.4 NATIONAL RESOURCES BARRIERS				
Code	Knowledge blockage	Sample coded reference quote/s	Analysis	Rating
6.4.1	National Funding Resources For Scientific Research	<p>"Sometimes, the process stops at the ministry of finance especially that many agreements include funding requirements and in this case the ministry of finance has its say on this agreement ... The problem from our side, is that if we go in this risky path, then would this cooperation [with external organisations] result in obtaining a new technology or something tangible and useful? this is the gamble. We don't know. We would have to pay a lot of money, establish the research, fund it, and then we might reach nothing, and that's the main hurdle in making these decisions. The problem is that there is high possibility that big research efforts can have no results at the end. This may cause inability to justify all the money spent and this could cause problems for the executives with the government".</p> <p>"The problem is that sometimes more than one organization in Saudi Arabia signs with the same international partner and all of them pay to this foreign organization, while all of them source money funding from the same ministry which means there is no reference".</p>	<p>This is a broad subject and needs to be narrowed down. It is of extreme importance to the nation to develop its internal scientific capabilities. The national resources, especially funding schemes, should direct considerable attention to scientific research. The government should direct its efforts to build a knowledge economy. However, to build a nation in science and technology with little infrastructure both in human resources and assets, a lot of wise spending is required. At the moment, respondents feel that spending exists but wise spending is lacking in terms of strategy and implementation. This is true if the picture is clear to the government that risk is involved and that sufficient effort has been exerted to come up with results. Auditing the progress, execution of projects and spending details is lacking at an organisational level from an expert point of view. The current auditing practices come from an accounting perspective that does not assess scientific legitimacy for specific high spending schemes. This needs to be addressed to avoid unnecessary tension that could save time and energy. As an example of smart spending, a respondent raised the issue of similar international agreements that are signed on a transactional basis by more than one national research organisation with a single international organisation, hence, two or three national organisations paying the same overseas organisation for the same service and funded by the same finance ministry.</p>	Orange
6.4.2	National Human Resource	<p>"we know that the number of researchers in Saudi Arabia as specialists compared to the numbers in other countries is low ... The other thing is the average age of researchers, they are mostly young".</p> <p>"The number of geophysicists is very limited, actually it is limited all over the world but here its even more limited".</p>	<p>When human resources in advanced engineering and technology fields are lacking on the national level, it is essential to apply tight planning for the available resources. This means when allowing free autonomy to engineers to specialize, this will result in a more scattered structure and would not result in niche expertise in any field. National strategy should guide specialisation to allow emerging technologies to be generated based on national scientific consensus on the routes for</p>	Red

<b>6.4 NATIONAL RESOURCES BARRIERS</b>				
<b>Code</b>	<b>Knowledge blockage</b>	<b>Sample coded reference quote/s</b>	<b>Analysis</b>	<b>Rating</b>
			research. Scattered specialisation routes reduce KT since the intensity of shared knowledge usually is low between experts of different fields. It is a KT barrier to see too few people sharing the same field of expertise, and this would result in less knowledge flow. A respondent raised the issue of not having enough people in his specialty to talk to, hence, limiting KT from the start.	
<b>6.4.3</b>	National Local Industry Drive	<p>"companies here don't allocate budgets and time to investigate in research work".</p> <p>"Private companies are far away from this subject. Private companies now are owned now by big businessmen and they are looking for quick revenues ... So they don't have time, really for research ... The problem here is who will give the fund, who will..."</p> <p>"Now, I believe those guys have an obligation towards Saudi institutions in a sense that ARAMCO can always get their problems solved when they hire people from outside but this means that they are shying away from their social responsibility towards these research institutions. They are obliged to help these institutions to help them to flourish. Provide them with more challenging problems, be patient when it comes to executions of projects, and try to foster and enrich the research culture at these institutions".</p>	Almost all large, medium and small industries on the national level are driven by short-term financial gains. Strategic competitive advantage planning is lacking and this hinders KT and research activities in general. Spending time and funds by local industries on research is limited and does not include any activities by them regarding KM. The demographics of local industry plays a vital role in this regard as it is mostly owned by business families who do not share their resources to benefit the national economy, rather, for their individual goals. Bigger local industries owned by the government or those with shareholders still align its strategy with shareholders interests rather than aligning it with building a knowledge economy. The executive management see their responsibility is to satisfy their board who hired them, especially as the government has not assigned any rules or regulations to change this way of building internal strategy.	Red
<b>6.4.4</b>	Knowledge Resources	"we are physically or geographically far from a lot of research activities so if you are in Europe or America or in Australia there is a lot of research activities going around which means more lectures, more conferences, more workshops, so this is, we have to understand this fact..."	In order to participate in a KT process, most specialised experts need to travel overseas. This is a real barrier to KT. Local knowledge engagement does not offer the quality needed by senior experts and hence forces them to travel.	Red

<b>6.5 NATIONAL SYSTEMS BARRIERS</b>				
<b>Code</b>	<b>Knowledge blockage</b>	<b>Sample coded reference quote/s</b>	<b>Analysis</b>	<b>Rating</b>
<b>6.5.1</b>	IT Systems That Require Governmental Authority	"...the national Saudi database will help us a lot to improve the way we work, but it is just starting to be developed. We need to know the national institutes, the experts, the active research areas, publications, etc."	The case study organisations have limited authority in gathering and sustaining national data bases of individuals and institutions. It is important that data of experts and organisations are available to increase efficiency of collaboration targeting as well as reduce searching time. The absence of such systems causes serious barriers to KT.	Orange
<b>6.5.2</b>	National Coordination Systems	<p>"the problem is that there is no national agency responsible for this task".</p> <p>"The problem is that the ministry of higher education has an international cooperation department and also signs cooperation agreements with international universities. We wanted their experience in this same field and the obstacles they face. We are working here on a national project that requires everyone's participation".</p>	The national level systems do not provide a dedicated system such as a ministry for centralized research coordination or a national research coordination center. This problem results in activity duplication, conflict, and in many ways, a waste of funding resources, time and opportunities. Duplication of research planning on a national level weakens the task and allows for flaws to emerge. No single research organisation can comprehensively uncover the research needs on the national level. Input must come from all entities to uncover the mysteries of the research puzzle. The summation of plans of each research organisation does not result in an overall solution. Instead, it complicates the situation. Synergy between all research organisations in the nation is needed to yield a clear and accurate proposal for activation.	Red
<b>6.5.3</b>	Bureaucratic Systems	<p>"we have no control over this process and even our President has no hand in this process. Sometimes it stays with the Kings' office for around 4 to 5 months. Sometimes, it becomes more smooth after that. The committee has authority more than us so we really wait for the response ... the main problem researchers face, and they have the right in raising this, is that they want agreements to be finalized more quickly, but this is not in my hands. I can't tell the ministries council to expedite".</p> <p>"Sometimes, the process stops at the ministry of finance especially that many agreements</p>	The case study organisations are the most knowledgeable on the national level in research activities and should be allowed to lead the way for research advancement. While maintaining accountability measures, the decisions for research collaboration is being slowed down by national level approvals, hence, slowing down important potential knowledge flows across the national borders. Other matters of frustration are bureaucratic interference in specialised decisions where national level ministries, who know little about research activities, require to be acquainted on specialised details in order to approve funding. Further, the case study organisations are very different from other younger institutions building their new organisations with much less infrastructure. The result of centralizing decisions makes reputable national organisations follow the same rules as that the new organisations have to follow.	Red



6.5 NATIONAL SYSTEMS BARRIERS				
Code	Knowledge blockage	Sample coded reference quote/s	Analysis	Rating
		<p>include funding requirements and in this case the ministry of finance has its say on this agreement".</p> <p>"[Organisation Y] is part of a whole number of universities, unfortunately, the minister when he came a couple of years back, he came with the worst thing ever in higher education which was the unified regulations where what obliges a Mickey mouse university in nowhere, obliges as much a leading or scientific university like [Organisation Y]. Unified regulations is in everything, I mean I'm talking about everything".</p>		
6.5.4	National Urge For Publicity	<p>"I was stunned actually, I looked into the news papers on Monday and I have seen some universities signing more than 6, 7, 10 agreements in one shot. And I know some institutions in the kingdom who are having over 60 signed agreements with institutions outside. And I spoke to that guy, I was thrilled at the beginning, I said to our people, guys these guys are moving forward but I found out when they said none was fully activated, I would say 50% of these activities have not been activated at all".</p>	<p>Many organisations, especially in the governmental sector, tend to target attractive topics and to publicize unrealistic achievements. There is no accountability with regards to agreements signed, at least not from the respondents' points of view.</p>	Orange

## 1. INTERNATIONAL LEVEL OF ANALYSIS

7. INTERNATIONAL LEVEL BARRIERS				
Code	Knowledge blockage	Sample coded reference quote/s	Analysis	Rating
7.1	International Legal Barriers	"biggest problems related to this issue [KT] are legal barriers. May be we can overcome translation challenges but ... you get so many legal barriers. Legal barriers are the number 1 problem in international cooperation, in my perspective... For example, in the Russian agreement, there were pure legal matters that is delaying the agreement for the last 4 years... If you put conditions from your side, and at the same time, you are the party who needs the knowledge, then the agreement will be rejected by the other party, which we don't want."	KT on the international level is a common practice. However, this kind of knowledge engagement sometimes becomes sensitive and requires pre-designed agreements to govern the process. These agreements usually follow a legal-based design and require professionals to be involved in creating them. The problem in this case is the time, cost and expertise required to put a legal agreement that governs KT between two entities from two different countries. The possible result of this is delay of the research topic and perhaps a loss of motivation of the researchers and engineers involved, hence, becoming a barrier to KT.	Red
7.2	The Reputation Of Saudi Research	<p>"You must know that Saudi research activities is rated internationally in a low category. We must confess that our research institutes were not able to achieve good ranking in the international scientific research arena."</p> <p>"we get suggestions, good ones [overseas research institutions suggested by internal staff], but we find out that these institutions are not cooperative or not interested."</p> <p>"If you are doing a paper, let's say with someone in the US, they will see my name then they will see only his [US name] name and they will see his address is the US and they will forget that I am here and from Saudi Arabia... You have to remember that people have the mindset that Saudi Arabia is all about money.... They say they have the money and buy the brains [laughs]. That's what they say. Because when I was coming here [from the US], my advisor was shocked. He was like, the middle East!... a Nano fabrication lab?! and he thought I was just lying to him to get out of the university or</p>	Most internally renowned research institutions and prominent research scientists in the world seriously consider who they engage with in terms of the reputation and internationally scaled rank. This means that Saudi research institutions may face difficulties to engage with those international organisations and individuals for ranking reasons. A sense of lack of confidence in the capabilities of Saudi research institutions could be a barrier to realize KT. This has been found when international research institutions were approached by the case study organisations and were rejected to proceed with research collaborations. Even when the case study organisations attempts to establish KT with foreign entities through hiring individual experts to visit the local case study organisations, the rank was a barrier.	Red

7. INTERNATIONAL LEVEL BARRIERS				
Code	Knowledge blockage	Sample coded reference quote/s	Analysis	Rating
		something and then my manager was talking to him about my reference and he told him it was true so then he wouldn't believe it. One more guy, from the NIH ... told me you are committing scientific suicide by coming here [Saudi Arabia], these were his words exactly. They believe that..."		
7.3	Political Issues	<p>"...would India give you everything, no it wouldn't. Even if you try to offer to pay double, they would not accept. Its political sometimes... For example, Japan has expertise in some technologies but it is known by experienced specialists that they would not give these technologies away. So it is useless to go to Japan... Signing an agreement with Japan would be weightless... You may be able to buy the IP for commercial based knowledge but it is not possible to get the strategic based knowledge even if we wanted to pay for the IP because its not for sale. The French wanted to retain their nuclear power technology IP...."</p> <p>"I think the others, if you are talking about researchers from the United States or Europe, they might be reluctant to share knowledge with us because of some political reasons, but for us, I think we are more and more encouraged."</p>	Science, technology and engineering are strategic knowledge areas for nations. Some types of knowledge are classified by governments as restricted. When KT is proposed as part of research collaboration, the barrier of political decisions may intervene negatively. Therefore, in some situations the organisations and their respective researchers have no choice but to hold on KT. The issue of politics is not restricted to a specific country or a specific group of countries; it is actually a global issue when it comes to strategic knowledge.	Red
7.4	Governing Law	"Other significant problems relate to legal cooperation with some countries, such as [...] some countries insisting on applying international law to the agreement, which we refuse completely... They say when our committees disagree, where do we go? They want international law, and we don't."	When dispute takes place between two organisations, the KT agreement should specify where the dispute should be trialled. One country should house the trial but there is also international law to consider as well. Saudi institutions do not accept any governing law system but their own when they engage in KT agreements. This means that the governing law could be a barrier to KT if the overseas organisation refuses to follow this law in dispute matters.	Orange
7.5	Knowledge Value Issues	<p>"I find IP issues to be the main issue. We are required to look after many IP issues that could prevent KT due to non-ownership of knowledge..."</p> <p>"some guys with knowledge who may feel that they will not have future projects may try to retain some knowledge that</p>	Specialized knowledge has a financial value. This means that sharing such knowledge is similar to giving money away. The value of knowledge is usually protected by IP rights, which has its value. In order to engage in KT, IP matters need to be exchanged with its value to allow KT to take place. When there is disagreement on the value of IP rights, the situation becomes a barrier to KT activities. Even when an agreement	Orange

7. INTERNATIONAL LEVEL BARRIERS				
Code	Knowledge blockage	Sample coded reference quote/s	Analysis	Rating
		will make you come back to him. This is a business activity you can say."	is signed, the knowledge provider tries to reduce the KT in some cases to increase the return (i.e. less knowledge for more money).	
7.6	Local Industry Motives	"private companies sometimes would not be able to sign on their own because many international organizations would not sign with a private company without an umbrella from the Saudi government. In this case, we would have to participate in the agreement."	Many international research institutions prefer, and sometimes mandate, that the Saudi Arabian government would be the entity that signs KT agreements rather than local industries. This means that the local industry would have to approach the national research institutions to be able to access international knowledge. The barrier to KT here is that the local industry, instead of putting pressure on national research institutions to access foreign knowledge, take the silent role, that leaves the impression to local governmental research institutions that interest is low, hence, not much motivation for national knowledge reform. Keeping this status quo would be a demotivation to researchers and to the domestic research institutions at the case study organisations to enhance their KT practices. Bringing up the urge for local industries to push domestic research institutions is one way to lift up this barrier.	orange
7.7	International Competition Locally	"the competition that we are having because ... there are many competitors from outside the kingdom who can perform or do the job because they have less, or because they can by cost really compete... a technician from India will cost them SR2000 [a month], a technician from Saudi Arabia would cost around SR5000... I mean if we need to perform by money, time, quality, then its difficult to really compete with these companies who are doing the work without the difficulties we have ..."	For KT to take place between research institutions and the local industry, there must be interest from the local industry side. When the local industry set their goals for knowledge development, they consider all option including the international ones. The domestic research institutions including the case study organisations begin to find themselves competing with international institutions to win research projects. The KT between the local industry and the domestic research institutions becomes obstacle by international organisations. Although, it is rewarding that local industry interacts with international research, most engagements comprise of transactional business, leaving the KT and knowledge retention to a bare minimum. When the local industry works with domestic research institutions then even if their relationship is transactional, the research institute would develop their knowledge, hence build national capabilities. The local industry is facing the barrier of poor confidence in local research.	Red
7.8	International KT As A Distract	"if you want to see the goal that [Organisation Z] should be among, like overtake, top universities ... it [research activities] should be internal..."	Many of the domestic research institutions are distracted by an eagerness to sign as many international collaboration agreements as possible, forgetting that a sustainable approach is to focus on internal collaborations. When everyone is running after international KT, this	Orange

7. INTERNATIONAL LEVEL BARRIERS				
Code	Knowledge blockage	Sample coded reference quote/s	Analysis	Rating
			becomes a barrier to local and internal KT, reducing an important potential for successful KT opportunities. The international KT focus may become a barrier to useful KT opportunities on the national level.	
7.9	Logistical Barriers To International KT	"there are different parameters and barriers, maybe the other counterpart abroad doesn't have the time to communicate with us ... yes, yes sometimes yes. Personally I have been experiencing that ... he [external expert] does want to, but he is so busy, he cannot spare time to meet... but I respect his decision because I know when I'm busy I don't want to over commit myself."	When KT takes place on an international level, there are many logistical issues involved. This includes but is not limited to setting up communication tools, prep time, distance issues, troubleshooting technological problems, and risk factors. These issues are realistic barriers to KT between international collaborators, especially world renowned individuals who have limited time to lose.	Red
7.10	Cultural Issues	"I sent e-mails and established a database comprising more than 126 individuals worldwide and most of those contacts are from the US. I have received so far a good number of applicants. 90% of them, of the applicants, are from the Arab world, originally, or from the subcontinents ... We've been trying to solve this one problem... There is a cultural issue and always there is this stereotypes about the kingdom and the Middle East in general and there are factors beyond such as woman driving, is it possible? Or is it allowed to drink or not to drink? I have been talking to people I mean from Europe and North America and they are willing to come and maybe they will have better offers here but always this fear in them for making a decision to come or not to come ...".	Although the cultural barriers to KT will be discussed in a separate subject, it is evident that culture does play its part in setting up international barriers to KT. International KT is affected negatively by the cultural mindset. In most cases, culture is misunderstood due to a shallow knowledge about other cultures. When people deepen their understanding about other cultures and sympathize with its traditions, they tend to accept it and give it respect. Once respect is gained, KT flow becomes natural and more rewarding. However, with the knowledge coming from western cultures, there is a big gap in understanding Arabian culture among western researchers as well as western organisations.	Orange
7.11	International Competition Over Renowned Experts	"He will assess and evaluate that these people are not serious and I'm simply wasting my time, because at the same time, his knowledge, there are so many other sources, they are telling him we are ready take from you, and look we will fulfil your requirements."	Many experts are invited to visit the case study organisations to participate in research projects, attend quality audit meetings, conduct lectures and speeches, etc. The incentive for these experts may not be only monetary. In many cases, it is about what infrastructure is available and who the researchers are. The respondent is referring to an important point; it's not only Saudi Arabia trying to speed up KT, there is competition. Scholars are limited and countries compete to persuade them to choose them. Infrastructure is a basic prerequisite both in assets, and systems and processes. This could be a serious barrier to quality KT.	Orange
7.12	Serious Quality	"... if they are doing things on their own [international	Host organisations have their own pace and complexity levels to cope	Red

## APPENDIX

7. INTERNATIONAL LEVEL BARRIERS				
Code	Knowledge blockage	Sample coded reference quote/s	Analysis	Rating
	Engagement	research institution] and you [host organization] are not participating in it, they might not get you into it ... this is a contract, you need to contribute, you need to prove yourself"	with when doing research. When working with international research institutions, it is a whole different level and requires serious attention to be able to match the research level of an international partner. We may assume that the knowledge capability may at times be equal but there is the attitude and seriousness factor to consider. When international research begins collaboration and accepts to work hand in hand on a project, they expect equal contribution. The volume of work as well as the focus and quality are essential ingredients to avoid another KT barrier related to this issue.	