అనుభూతి మరణించాలి

To Sri Lalitha
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The work presented in this thesis is, to the best of my knowledge and belief, original except as acknowledged in the text. I hereby declare that I have not submitted this material, either full or in part, for a degree at this or any other institution.

Sai Kiran Lakkaraju

14 July 2008
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<td>ABS</td>
<td>Australian Bureau of Statistics</td>
</tr>
<tr>
<td>AI</td>
<td>Artificial Intelligence</td>
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<tr>
<td>AIS</td>
<td>Artificial Intelligence Systems</td>
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<tr>
<td>ASIC</td>
<td>Australian Securities and Investments Commission</td>
</tr>
<tr>
<td>ATO</td>
<td>Australian Taxation Office</td>
</tr>
<tr>
<td>BAS</td>
<td>Business Activity Statement</td>
</tr>
<tr>
<td>BI</td>
<td>Business Intelligence</td>
</tr>
<tr>
<td>CAS</td>
<td>Complex Adaptive Systems</td>
</tr>
<tr>
<td>CBR</td>
<td>Case Based Reasoning</td>
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<tr>
<td>CIO</td>
<td>Chief Information Officer</td>
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<tr>
<td>CKO</td>
<td>Chief Knowledge Officer</td>
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<tr>
<td>CMS</td>
<td>Content Management System</td>
</tr>
<tr>
<td>CoP</td>
<td>Community of Practice</td>
</tr>
<tr>
<td>CPA</td>
<td>Certified Practicing Accountant</td>
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<tr>
<td>CRM</td>
<td>Customer Relationship Management</td>
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<tr>
<td>DMS</td>
<td>Document Management System</td>
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<td>DSS</td>
<td>Decision Support System</td>
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<td>EDP</td>
<td>Electronic Data Processing</td>
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<td>EIS</td>
<td>Executive Information System</td>
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<td>ENS</td>
<td>Enterprise Nervous System</td>
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<td>ES</td>
<td>Expert System</td>
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<tr>
<td>FAQ</td>
<td>Frequently Asked Questions</td>
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<tr>
<td>FBT</td>
<td>Fringe Benefit Tax</td>
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<tr>
<td>GMP</td>
<td>Good Manufacturing Practice</td>
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<tr>
<td>GSS</td>
<td>Group Support System</td>
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<tr>
<td>HACCP</td>
<td>Hazard Protection Analysis and Critical Control Process</td>
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<td>HR</td>
<td>Human Resources</td>
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<tr>
<td>IC</td>
<td>Intellectual Capital</td>
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<tr>
<td>ICT</td>
<td>Information and Communication Technologies</td>
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<td>iDA</td>
<td>Intelligent Data Analyser</td>
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<tr>
<td>IQ &amp; OQ</td>
<td>Installation Qualification and Operational Qualification</td>
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<td>KM</td>
<td>Knowledge Management</td>
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<tr>
<td>LAN</td>
<td>Local Area Network</td>
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<td>LO</td>
<td>Learning Organisation</td>
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<td>MBO</td>
<td>Management By Objectives</td>
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<td>New South Wales –Knowledge Management –Forum</td>
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<tr>
<td>ONA</td>
<td>Organisational Network Analysis</td>
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<tr>
<td>PDF</td>
<td>Portable Document Format</td>
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<tr>
<td>PERT</td>
<td>Program Evaluation and Review Techniques</td>
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<tr>
<td>RFID</td>
<td>Radio Frequency Identification</td>
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<tr>
<td>SAN</td>
<td>Storage Area Network</td>
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<tr>
<td>SECI</td>
<td>Socialisation, Externalisation, Combination and Internalisation</td>
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SK  Subjective Knowledge
SPSS  Statistical Package for Social Sciences
TQM  Total Quality Management
WAN  Wide Area Network
WWW  World Wide Web
Abstract

The aim of this study is to develop a model for knowledge synchronisation in organisations. The research aim is further broken down into two research objectives that are handled during this study:

- Examine and measure the gap between a typical organisation and a Learning Organisation and the corresponding organisation’s Subjective Knowledge and Knowledge Management Systems, and
- Examine and create appropriate models and methods to synchronise organisation’s Subjective Knowledge and Knowledge Management Systems.

This research attempts knowledge synchronisation in view of creation and maintenance of Learning Organisations. This study combines three broad areas in an organisation: Learning Organisations, Intellectual Capital, and Knowledge Management Systems.

This research proposes a new organisational epistemology in the context of the Subjective and Objective Knowledge. The organisational ontology consists of five hierarchical layers: observation, data, information, knowledge and wisdom. Wisdom and observations, being embodied, are subjective in nature and they are referred to as Subjective Knowledge throughout the thesis. Data, information and knowledge of an organisation, being objective in nature, are contained in Information Systems or Knowledge Management Systems; and throughout the thesis they are referred to as Objective Knowledge. The significance of this research and its major contribution resides in the development and validation of a
comprehensive model for Subjective - Objective Knowledge synchronisation, with a view of creation and maintenance of Learning Organisations.

A Knowledge Synchronisation Model (KSM) has been proposed to measure the gap between a typical organisation and a Learning Organisation. Furthermore, KSM also deals with the gap between an organisation’s Subjective Knowledge and Knowledge Management Systems.

A web-based survey has been conducted to validate the proposed Knowledge Synchronisation Model. The unit of analysis has been ‘an organisation’ with Knowledge Management initiatives. Snowball sampling technique has been used to contact such organisations and five hundred and ten responses have been received. Four hundred and seventy responses have been considered for analysis. Responses have been classified into four clusters: Learning Organisations, whose Subjective Knowledge and Knowledge Management Systems have been in sync, Technology oriented organisations with high Knowledge Management Systems and relatively low Subjective Knowledge, People oriented organisations with high Subjective Knowledge and relatively low Knowledge Management Systems, and finally, the organisations with no Knowledge Management strategy. Regression analysis has been used to validate the hypotheses. The orientation towards technology or people will present itself as missing organisational characteristics.

Two organisations from the survey participants have been selected for knowledge synchronisation through Action Research Studies. The first organisation has been identified as technology oriented and lacking organisational ‘Awareness’ and
‘Systems Thinking’. A Community of Practice (CoP) and a knowledge portal have been suggested to the first organisation for knowledge synchronisation. The second organisation has been identified as people oriented and lacking ‘Personal Mastery’. A Community of Practice (CoP) and a knowledge base have been suggested to the second organisation.

The limitation posed by the sampling technique ‘snowball sampling’ is a significant limitation in this research. This research does not consider the effects of location and investor capital on the proposed model. This is another limitation of this research.

This research has academic implications for the theories of Learning Organisations, Intellectual Capital and Knowledge Management. Further investigations will be necessary to study the effects of location and investor capital, human related issues such as trust and culture, and the latest technologies such as web 2.0 and mobile devices, on the proposed model.
Chapter 1 : Introduction to the Knowledge Synchronisation Model

1.1 Overview

An organisation is defined as people, process, and technology brought together to achieve a common purpose (Sharpe, 1989). Adapting and extending another understanding from Senge (2006), a Learning Organisation (LO) is further understood as an organisation which continuously enhances its capacity to create and update ‘knowledge’ by synchronising its Subjective Knowledge and Knowledge Management Systems.

Knowledge Management, a management strategy of the 20\textsuperscript{th} century, is pertinent to Learning Organisations. Knowledge Management focuses on knowledge synchronisation by capturing, storing, and disseminating knowledge. The ontological (Awad & Ghaziri, 2004; Kakabadse, Kakabadse, & Kouzmin, 2003; Spiegler, 2000) and epistemological (Blumentritt & Johnston, 1999; Collins, 1993; Firestone & McElroy, 2005; Lundvall, 1996; Nonaka & Takeuchi, 1995; Tywoniak, 2007) differences between the three generations of Knowledge Management (Deeper, 2004; Snowden, 2002), that are discussed in greater detail in Chapter 3, results in a need for various Knowledge Management models. Although many Knowledge Management models exist, the difference in their generations leads to a need to have these formal models and study them. These
models for Knowledge Management can help in reducing the differences between the knowledge that is held subjectively by people, and the Knowledge Management Systems that hold a body of knowledge explicitly in their databases. However, based on the earlier survey of literature undertaken by this research, there appears to be no universally accepted model or methodology for knowledge synchronisation.

This research proposes a model for synchronisation of knowledge called Knowledge Synchronisation Model (KSM). This Knowledge Synchronisation Model is initially created in this research by undertaking through literature review of the material existing in the area of Knowledge Management. The difference between a typical organisation and a Learning Organisation, according to the proposed Knowledge Synchronisation Model, lies within the organisational characteristics. These characteristics have been identified in the model as:

- Awareness
- Environment
- Leadership
- Empowerment
- Personal Mastery
- Shared Vision
- Team Learning
- Systems Thinking

The higher the presence of these aforementioned characteristics in an organisation, the closer will be the organisation to a Learning Organisation. These organisational characteristics can be inculcated, enhanced and promulgated within the organisation by synchronising organisation’s Subjective Knowledge (SK) and Knowledge Management Systems (KMS).
A survey explained in Chapter 5, conducted during the study, indicates that any organisation can be classified into one of the following four categories:

- Learning Organisations,
- Organisations inclined towards systems development,
- Organisations inclined towards people development, and
- Organisations with no proper direction.

Learning Organisations, according to the analysis of the data gleaned during the survey in this research, demonstrates high levels of the characteristics of a Learning Organisation mentioned earlier (Awareness, Environment, Leadership, Empowerment, Personal Mastery, Shared Vision, Team Learning and Systems Thinking). Moreover, the survey data analysis also identifies that a specific inclination of the organisations towards either systems development or people development results in a loss of some or all of the aforementioned organisational characteristics.

A significant part of the research methodology followed during this research was 'action research study'. Two such action research studies conducted in two separate Sydney-based organisations, shows that existing Knowledge Management tools and techniques can effectively be used for knowledge synchronisation. Furthermore, the action research studies also reveal that knowledge synchronisation will lead to the making up of missing organisational characteristics or enrichment of existing characteristic.
1.2 Research Background

Knowledge synchronisation in organisations draws upon two major research areas. The theories underpinning these research areas have been discussed in the literature and they are as follows:

1. Organisational Theory (Burrell & Morgan, 1979; Drucker, 1988; Morgan, 1986; Nonaka, Krogh, & Voelpel, 2006; Robbins & Barnwell, 2002; Senge, 1990; Shafritz & Ott, 2001; Tsoukas, 2005; Unhelkar 2003-a; 2003-b), and


The problem of knowledge synchronisation in an organisation can be identified by, but not limited to, the following symptoms:

- Employees or channel partners (customers, suppliers) requesting information or knowledge that is readily available to them. This symptom of missing ‘Awareness’ can be viewed in technology oriented organisations.

- Management fears about ‘knowledge walking in and out of the business premises’. This symptom of missing ‘Environment’ can be viewed in people oriented organisations.

- Organisations reinventing the wheel. This symptom of missing ‘Systems Thinking’ can be viewed in both the technology and people oriented organisations.
• Organisations not able to create new services or products. This symptom of missing ‘Leadership’ is pervasive in almost all organisations.

• Ageing employee force and increasing costs involved in training the new employees. This symptom of missing ‘Personal Mastery’ is again ubiquitous in the industry.

These above mentioned symptoms were evident when this researcher carried out action research studies as a part of validation of his model at two Sydney-based organisations namely, Biotec Australia and a Certified Practicing Accountant’s (CPA) practice, whose name is withheld due to prior agreement relating to safeguarding the privacy of the participant.

For example, when quizzed, the employees working in Biotec Australia answered that they are not in a position to access the complete product list of their own offerings. Furthermore, the customers of Biotec are found to be asking for solutions that are already available to them in the technical manuals that accompany the machines that are sold by Biotec. This lack of awareness on the part of both customers and employees demonstrates the existing knowledge gaps in Biotec Australia. These knowledge gaps present themselves as missing organisational ‘Awareness’ and ‘Systems Thinking’ in the Knowledge Synchronisation Model (KSM).
The clients of the CPA practice always request service from the principle partner, due to the knowledge gap between the employees of the CPA practice. The knowledge gaps within the CPA practice present themselves as missing ‘Personal Mastery’. Chapter 6 further discusses the knowledge synchronisation problem in detail and also describes how the application of the Knowledge Synchronisation Model can help reduce and even eliminate this problem.

Most organisations acknowledge the issues relating to the knowledge gap and missing organisational characteristics and, as a result, have been looking for solutions to bridge this gap. The concept of Learning Organisations, “organisations where people continually expand their capacity to create the results they truly desire, where new and expansive patterns of thinking are nurtured, where collective aspiration is set free, and where people are continually learning how to learn together” (Senge, 2006, p. 3), appeared to be a good solution to most of the organisations in the recent past. However, the characteristics of Learning Organisations are still being debated (Leitch, Harrison, Burgoyne, & Blantern, 1996; Senge, 2006). Literature review, in Chapter 3, presents a discussion about the characteristics of Learning Organisations (Lee-Kelley, Blackman, & Hurst, 2007; Örtenblad, 2007; Teo, Wang, Wei, Sia, & Lee, 2006).

Knowledge Management is the most widely used methodology for managing organisational knowledge and this methodology is also pertinent to Learning Organisations. Knowledge Management addresses the knowledge synchronisation problem by improving the processes of creation, capture, storage, validation,
dissemination and application of knowledge (Alavi & Leidner, 1999-a). Wiig (1997) states that the objective of Knowledge Management is “to make the enterprise act as intelligently as possible to secure its viability and overall success, and to realise the best value of its knowledge assets”. Organisational knowledge is classified into two categories by this research: Subjective Knowledge and Objective Knowledge. These categories are further discussed in Chapter 3 and Chapter 4. Organisational Subjective Knowledge is being dealt by the academic discipline of Intellectual Capital (Bontis, 1998; Brooking, 1996; Edvinsson & Malone, 1997; Hudson, 1993; Marr, Schiuma, & Neely, 2004; Narvekar, Jain, & Mehta, 2006). Organisational Objective Knowledge is being dealt by the Knowledge Management Systems or Knowledge Management Technologies (Gottschalk, 2005; Gottschalk & Khandelwal, 2006; Khandelwal & Gottschalk, 2005; Sambamurthy & Subramani, 2005; Subramani & Hahn, 2007). The concepts of Intellectual Capital and Knowledge Management Systems are further discussed in Chapters 3 and 4.

### 1.3 Research Aim and Objectives

The research aim of this study is:

‘Synchronising Subjective Knowledge and Knowledge Management Systems in organisations, thereby creating and maintaining Learning Organisations’

This research aim is further divided into two research objectives in order to enable approaching the research in an organised manner. These two research objectives are ascertained from the above mentioned research aim and they are as follows:
• Examine and measure the gap between a typical organisation and a Learning Organisation and the respective organisation’s Subjective Knowledge and Knowledge Management Systems, and
• Examine and create appropriate models and methods to synchronise organisation’s Subjective Knowledge and Knowledge Management Systems.

1.4 Research Strategy

The research strategy for this research is described in Chapter 2. However, briefly, the overall research framework aims to investigate the process of synchronising Subjective Knowledge and Knowledge Management Systems in respective organisations. Such knowledge synchronisation will enable organisations to acquire the characteristics of a Learning Organisation. This research study follows a constructivist philosophy with a combined inductive and deductive approach to facilitate the research’s focus on the aim. This research can be said to have adapted mixed methodologies to achieve the research aim. Thus, this research uses literature review and content analysis to create the Knowledge Synchronisation Model (KSM). Subsequently, this research uses a web-based survey and action research study to validate the Knowledge Synchronisation Model (KSM).

1.5 Scope and Key Assumptions

The scope of the research is limited to investigating the validity and applicability of proposed Knowledge Synchronisation Model for knowledge synchronisation in organisations. Knowledge Synchronisation Model is created through literature
review and content analysis. However, there could be some constructs which can impact the process of knowledge synchronisation but have not been identified by earlier researchers. Existence of those unidentified constructs is evident from the survey data analysis. The survey data analysis could not validate three out of proposed eight hypotheses due to either the existence of such unidentified constructs or unidentified relationships between existing constructs.

Research methods used; literature review, content analysis, web-based survey and action research, are not targeted to identify new constructs. This is to adhere to the research aim and objectives. Identification of new constructs and relationships between existing constructs require an exploratory study, which cannot be conducted simultaneously with the existing research.

Lim and Dallimore (2004) identifies eight streams of capital under the title of Intellectual Capital. This research considers employee, process, customer, and supplier capital, under the title of Subjective Knowledge, and innovation capital under the title of Knowledge Management Systems. This research ignores the location, alliance, and investor capital which are parts of Intellectual Capital (Kaufmann & Schneider, 2004; Lim & Dallimore, 2004), which is another limitation to this research. The reasons are discussed in Chapter 4.

The limitation posed by ‘snowball sampling technique’ which is tracking and evaluating the sampling process is another limitation of this research. This limitation and the reasons for it are further discussed in Chapter 5.
The major assumption behind the unit of analysis in this study is that any organisation with a knowledge management initiative would have dealt with the data management and information management issues completely.

### 1.6 Research Justification

This research is justified for the following reasons:

Organisational survival in knowledge economy depends on creating and maintaining Learning Organisations by leveraging existing knowledge and creating new knowledge. This thesis proposes a model for knowledge synchronisation thereby paving way to creation of new understanding in terms of synchronising knowledge between people and systems within organisations. This synchronisation of knowledge will also enable organisations to leverage existing knowledge within the organisation.

Literature review in Chapter 3 identifies various studies to measure organisational Subjective Knowledge (Marr et al., 2004; Nonaka & Takeuchi, 1995; Sharif, 2006; Sveiby, 1997, 2001; Wiig, 2004), Knowledge Management Systems (Gottschalk, 2005; Gottschalk & Khandelwal, 2006; Rao, 2005), and Learning Organisations (Gardenfors, 2001; Panagiotidis & Edwards, 2001; Senge, 2006), and some cross sectional studies, Learning Organisations and Knowledge Management (Ju, Li, & Lee, 2006; Merx-Chermin & Nijhof, 2005; Sussman, 2005), Knowledge Management and Intellectual Capital (Carol & Brigitte, 2005; Serenko & Bontis, 2004; Snowden, 2005), but shows that there has never been a study focussed on finding the relationship between these three areas. This thesis
proposes a structured approach to knowledge synchronisation and attempts to find that missing relationship between the aforementioned three areas.

This research study is also justified because of its contributions to the management practice. Organisations can use the survey instrument and Knowledge Synchronisation Model created by this research to evaluate themselves in terms of closeness towards becoming a Learning Organisation and in terms of knowledge gaps. Proposed model for knowledge synchronisation will, then, help the organisations to synchronise their Subjective Knowledge and Knowledge Management Systems. This application of Knowledge Synchronisation Model will result in these organisations becoming Learning Organisations by inculcating the corresponding characteristics of such organisations.
1.7 Thesis Outline

1.7.1 Road Map

Figure 1-1: Thesis Structure
1.7.2 Chapter Descriptions

This thesis comprises seven chapters, as outlined below:

**Chapter 1 – Introduction to the Knowledge Synchronisation Model**

Chapter 1 introduces this research study. The chapter discusses knowledge synchronisation problem and its symptoms. The chapter presents the research aim and objectives. In addition, the chapter also highlights the justification for this research study and its contribution.

The structure of the rest of the chapters is as follows:

**Chapter 2 – Research Framework Using Mixed Methodologies**

Chapter 2 describes the research framework adapted for this study to achieve the research aim and objectives discussed in Chapter 1. Chapter 2 discusses various research methodologies used in management research starting with a brief discussion on research and framework. This chapter discusses various research methodologies and methods. The research framework for this study is then presented, which comprises action research and a web-based survey. Moreover, Chapter 2 provides justification for the research framework followed by this research study.

**Chapter 3 – Literature Review of Knowledge Management and the Learning Organisation**

Chapter 3 reviews the literature pertinent to the study: Learning Organisations, Knowledge Management, Subjective Knowledge and Knowledge Management.
Synchronising Subjective Knowledge and Knowledge Management Systems in Organisations
Chapter 1: Introduction to the Knowledge Synchronisation Model

Systems. The literature review discusses the characteristics of Learning Organisations and Knowledge Management according to the prominent researchers in respective areas. This chapter discusses the organisational ontologies. Discussions in this chapter paves the path to and substantiates the need for the organisational ontology and the Knowledge Synchronisation Model (KSM) presented in Chapter 4.

Chapter 4 – Knowledge Synchronisation Model

Chapter 4 builds on the literature review presented in Chapter 3. This chapter identifies the constructs for Learning Organisations, Subjective Knowledge and Knowledge Management Systems. These constructs form basis for the proposed Knowledge Synchronisation Model (KSM). A further literature review is carried out in this chapter to identify the relationships between the constructs of Learning Organisations, Subjective Knowledge and Knowledge Management Systems. The Knowledge Synchronisation Model is constructed, in this chapter, using those relationships identified.

Chapter 5 – Validating the Knowledge Synchronisation Model through Survey

Chapter 5 describes a web-based survey carried out in order to validate the model proposed in chapter 4. The purpose of this survey is three fold. The first purpose is to verify whether the participating organisation is a Learning Organisation. The second purpose is to evaluate the significance of the identified constructs of Learning Organisations, Subjective Knowledge, and Knowledge Management
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Systems. The third purpose is to identify the gap between Subjective Knowledge and Knowledge Management Systems in the participating organisation. The survey questionnaire comprises sixty two questions, which are explained and analysed in this chapter.

Chapter 6 – Validating the Knowledge Synchronisation Model through Action Research Studies

Chapter 6 focuses on two action research studies carried out to verify the Knowledge Synchronisation Model (KSM) proposed in chapter 4. Two organisations from the survey participants are selected for further analysis and knowledge synchronisation. Action research conducted at the first organisation, Biotec solutions, lead to the development of a knowledge portal and initiation of a Community of Practice (CoP). Action research conducted at that second organisation, a CPA practice, led to the development of a knowledge base and initiation of a Community of Practice (CoP). The three phases of action research: Think, Look, and Act for these two action studies are discussed in this chapter.

Chapter 7 – Conclusion and Future Directions

This final chapter concludes the thesis, by presenting the key findings of the research work carried out, and also gives a brief outline as to how this research work could be extended to future such studies.
Chapter 2: Research Framework Using Mixed Methodologies

2.1 Overview of the Research Framework

This chapter describes the research framework adopted for this research study. This research framework is formed after a discussion of common research methodologies. The research aim and objectives, discussed in Chapter 1, suggest that there are many aspects to investigate and explore in this research. These research areas range from the ontological and epistemological aspects of organisations, investigations into organisational characteristics, characteristics of Subjective Knowledge (SK) through to a formal study of Knowledge Management Systems (KMS). The way to achieve these study aims is to create a research framework that coordinates these investigations and explorations. A research framework based on mixed methodologies is adopted to construct the research framework for this study. This framework comprises two major sections: theory generation and theory evaluation. These two sections spans over three research cycles. These three research cycles use different research methods such as literature review, survey and action research. Literature review is used to create the Knowledge Synchronisation Model (KSM). A web-based survey is conducted to assess the validity of the Knowledge Synchronisation Model (KSM) in practice. Action research is conducted to apply the Knowledge Synchronisation Model
(KSM) in specific organisations. This chapter explains and then justifies the research framework created for the purpose of this study.

This chapter starts with a discussion about research and the nature of researchers. This discussion is followed by a discussion on the dimensions of research in Section 2.3. Section 2.4 describes different research methodologies and Section 2.5 describes research methods. Section 2.6 describes various research frameworks paving the way to the research framework adopted by this research as discussed in Section 2.7. Section 2.8 summarises and concludes this chapter.

2.2 Research

The word research is composed of two syllables, re and search. The dictionary defines the former as a prefix – whose meaning is again, anew or over again and the latter as a verb meaning to examine closely and carefully, to test and try, or to probe. Together they form a noun describing a careful, systematic, patient study and investigation in some field of knowledge, undertaken to establish facts or principles (Grinnell, 2001).

Research plays an important role in creating and adding to the body of knowledge in most professions. More than a set of skills, research is a way of thinking; examining critically the various aspects of the research question; understanding and formulating guiding principles that govern a particular procedure; and developing and testing new theories for the enhancement of knowledge (Kumar, 1999, p. 2). Alternatives to research include authority, gaining knowledge from parents, teachers and experts, tradition, a special case of authority, the authority of the past, common sense, media, and personal experience (Neuman, 2003).
Research is the best possible way to answer any question. This is so because research is controlled, rigorous, systematic, valid and verifiable, empirical, and critical (Kumar, 1999, p. 7). A research study to answer research questions implies that the process:

- is being undertaken within a framework of a set of philosophies;
- uses procedures, methods and techniques that have been tested for their validity and reliability; and
- is designed to be unbiased and objective (Kumar, 1999, p. 4).

Burrell and Morgan (1979) argue that there are two paradigms to any research: scientific and sociological as research being scientific and a researcher conducting that research belongs to a society that affects the reasoning capability of the researcher. The nature of science can be understood in terms of subjective and objective dimensions. Subjectivists believe that every individual involved in research has a unique view of the subject matter. Objectivists believe in a perceived common view of the subject matter by all the research participants. Nature of the society can be understood in terms of regulation and radical change dimensions. As the names imply, regulation dimension tries to explain why society needs to hold together, whereas radical change dimension tries to explain the need for a radical change in the society. Based on this discussion, researchers are classified into four categories: functionalist, interpretive, radical humanist, and radical structuralist. This researcher adopted functionalist and interpretive approaches to address the research aim and objectives. Following is a brief description of these two approaches.
**Functionalist** category represents a perspective which is firmly rooted in the sociology of regulation. A researcher in this category approaches the subject matter from an objectivist point of view. Functionalist approach is often problem-oriented in approach, concerned with providing practical solutions to practical problems (Burrell & Morgan, 1979). Functionalist researchers tend to adopt deductive reasoning (Guo & Sheffield, 2006).

Boje (2005) says that functionalist knowledge managers tend to develop Socialisation Systems and adopt storytelling strategies to develop Subjective Knowledge. Socialisation Systems are further discussed in Chapters 3 and 4. Schultze (1998) says that a functionalist considers knowledge as an object that can exist independent of human action and perception. Schultze (1998) cites the works of Nonaka (1994) in this regard.

The first cycle of this research study adopted functionalist approach towards the research objectives and conducted pure research. This is so because of lack of suitable knowledge synchronisation model in the literature. The research cycles and their rationale are discussed in Section 2.7.

**Interpretive** category represents a perspective which is firmly rooted in the sociology of regulation. The researchers in this category approach the subject matter from a subjectivist point of view. The interpretive paradigm is formed by a concern to understand the world as it is, to understand the fundamental nature of the social world at the level of the subjective experience. Interpretivists approach...
to social science tends to be nominalist, anti positivist, voluntarist and ideographic (Burrell & Morgan, 1979). Interpretive researchers tend to adopt inductive reasoning (Guo & Sheffield, 2006).

Schultze (1998) says that the interpretivists view knowledge as the social practice of knowing and cites the works of Kogut and Zander (1996) and Spender (1996) as examples of interpretive approach to knowledge.

The second cycle of this research study has adopted interpretive as well as functionalist approach. The second cycle of this research is validating Knowledge Synchronisation Model through a survey. The purpose of the survey is twofold. First purpose of the survey is to elicit the state of the participating organisation and thus interpretive in nature. Second purpose is to elicit the reasons for the state of the organisation and thus, functional in nature.

2.3 Dimensions of Research

Four dimensions of research are identified in the literature: *The use of research, purpose of the study, the way time enters in, and the technique for collecting data* (Neuman, 2003, p. 21). Table 2-1 adapted from Neuman (2003, p. 21) depicts the research dimensions and the major types.

Ranjit Kumar (1999, p. 8) argues that the research be classified based on three dimensions: application, objectives, and type of information sought, ignoring the time dimension. However, in case study research and applied research, especially in action research studies, time plays a vital role. For example, in action research
the researcher participates in the research by changing the environmental variables, thereby trying to achieve optimum solution for the problem at hand.

<table>
<thead>
<tr>
<th>Dimension of research</th>
<th>Major types</th>
</tr>
</thead>
<tbody>
<tr>
<td>How research is used</td>
<td>Basic, applied</td>
</tr>
<tr>
<td>Purpose of the study</td>
<td>Exploratory, descriptive, explanatory</td>
</tr>
<tr>
<td></td>
<td>Descriptive, correlational, explanatory, exploratory</td>
</tr>
<tr>
<td></td>
<td>(Kumar, 1999, p. 9)</td>
</tr>
<tr>
<td>The way time enters in</td>
<td>Cross-sectional, longitudinal (time series, panel, cohort), case study</td>
</tr>
<tr>
<td>Technique for collecting data</td>
<td>Experiments, surveys, content analysis, existing statistical studies.</td>
</tr>
<tr>
<td>Qualitative</td>
<td>Field research, historical comparative research.</td>
</tr>
<tr>
<td>Quantitative</td>
<td>Ethnography, Phenomenology (William, 2004).</td>
</tr>
</tbody>
</table>

Table 2-1: Dimensions of Research  
Source: (Neuman, 2003, p. 21)

While some researchers use research to advance the body of knowledge others use research to solve specific problems. These two usages of research create the dimensions in the use of research: basic research and applied research.

**Basic research**: often referred to as ‘pure research’, advances fundamental body of knowledge. The focus of basic research is supporting or refuting existing theories. The results of basic research are generally applied to problems at a later
date, thus seeming to have no practical applications. Building, testing, connecting to a larger theory, developing a long-term general understanding, and carrying out a large scale investigation are very common in basic research (Neuman, 2003, p. 22). Current research study built the Knowledge Synchronisation Model (KSM) using pure research.

**Applied research:** contrary to basic research, tries to find solutions to practical problems, thereby generating knowledge. Applied research means a quick, small-scale study that provides practical solutions which people can use in short term. There are three major types of applied research: evaluation, action, and impact assessment (Neuman, 2003, p. 23). Current research study validated the Knowledge Synchronisation Model (KSM) using a survey and two action research studies.

**Evaluation research:** widely used in large organisations to find whether a program, a marketing campaign, a policy and so forth, is effective – in other words, “Does it work?” (Neuman, 2003, p. 24). Two types of evaluation research can be found in literature: formative evaluation and summative evaluation. Formative evaluation is a built-in monitoring or continuous feedback on a program used for program management. Summative evaluation looks at final program outcomes (Neuman, 2003, p. 25). However, evaluation research has some limitations and problems. Limitations, such as no peer review process for the final report, unavailability of the raw data to reviewers outside the research group, and the narrowed focus on the selected inputs and outputs, and ethical,
political conflicts, are to be considered before choosing evaluation research. Formative and summative evaluations have been used in the action research studies conducted as a part of this research.

**Impact analysis:** used to identify the impact of a change in the organisation or the society. Impact analysis has been conducted as a part of the action research studies for measuring the effectiveness of the transformed organisation as explained in Chapter 6.

**Action research:** treats knowledge as a form of power and abolishes the line between research and action (Neuman, 2003, p. 25). Guba explains that the action research exhibits three characteristics: *decentralisation*, because action research tries to focus on the local context and moves away from the efforts to uncover the generalisable “truths”, *deregulation*, because action research moves away from the restrictive conventional rules of the research game, the overweening concern with validity, reliability, objectivity, and generalisability, and *cooperativeness*, because in action research there is no functional distinction between the researcher and the researched subjects. The researcher and the researched subjects are all defined as the participants (Stringer, 2007, p. XI). Francis Lau (1999-b) classifies action research into four categories, *action research, participatory action research, action science and action learning* and furthered the body of knowledge. Two action research studies have been conducted as a part of this research. The details are discussed in Chapter 6.
The objectives of a research provide the necessary guidance to the researcher in conducting the research appropriately. The following is a brief discussion about research objectives.

Neuman (2003, p. 29) presents three objectives of research: exploratory research - explore a new topic, descriptive research- describe a situation, or explanatory research- explain why something occurs. Ranjit Kumar (1999-b, p. 9) presents a fourth objective correlational research- discover or establish the existence of a relationship, association, or interdependence.

**Exploratory research:** carried out to investigate the possibilities of undertaking a particular research study. Exploratory research helps the researcher to become familiar with the basic facts, setting and concerns about the field of interest. The results of an exploratory study include hypothesis generation, formulation of research question, and scale development (Kumar, 1999, p. 9; Neuman, 2003, p. 29). An exploratory research has been conducted at the beginning of this research. Knowledge Synchronisation Model is created and a new scale has been developed. The details are discussed in Chapter 4 and Chapter 5.

**Descriptive research:** carried out to provide a detailed, systematic, highly accurate picture of the research area. Descriptive research helps the researcher to locate new data that contradicts past data. The results of a descriptive research include documentation of a casual process or mechanism, report on the
background or context of a situation, and data classification into types/categories (Kumar, 1999, p. 9; Neuman, 2003, p. 29).

**Explanatory research:** attempts to clarify why and how there is a relationship between two aspects of a situation or phenomena. Explanatory research tests a theory’s predictions or principles. The results of an explanatory research include theory extension to new issues, hypothesis validation, linking issues with a general principle, and determination of the best available solution (Kumar, 1999, p. 9; Neuman, 2003, p. 29).

**Correlational research:** attempts to discover or establish the existence of a relationship or association or interdependence between two or more aspects of a situation (Kumar, 1999, p. 9). The Knowledge Synchronisation Model (KSM) is validated using a web-based survey which is a correlational research.

The time dimension of research is crucial in choosing the research methods to solve the research question. Research methods, such as surveys, give a snapshot of reality at a single, fixed point in time and allow the researcher to analyse a situation in detail. Research methods, such as case studies, give snapshots of the reality across multiple time periods and allow the researcher to perform impact analysis.
2.4 Research Methodologies Available to Researchers

The term methodology refers to a set of methods following which a researcher approaches research problems and seeks answers. Two major approaches are identified in the literature: Inductive approach and deductive approach (Blaikie, 1993). The inductive approach helps to build a theory, and the deductive approach validates a theory, using appropriate research methods (Chalmers, 1982). This research adopts both inductive and deductive approaches. The Knowledge Synchronisation Model (KSM) is created through inductive approach and is validated through deductive approach.

Three methodologies are identified in the literature: Quantitative, qualitative, and mixed methodologies (Burrell & Morgan, 1979; Creswell, 2003; Leedy & Ormrod, 2005; Maylor & Blackmon, 2005; Neuman, 2003; Veal, 2005).

The methodology chosen by a researcher directly relates to the available technology infrastructure, assumptions, interests, and the purpose of the research. Research methodology is derived from the research framework for that reason. The following sections describe the three research methodologies.

2.4.1 Quantitative Research

Most of the quantitative research is done by the positivists. Quantitative research emphasises on precisely measuring variables and testing hypotheses that are linked to general causal explanations.
According to Neuman (2003), the characteristics of quantitative research are as follows:

- Tests hypothesis that the researcher begins with;
- Concepts are in the form of distinct variables;
- Measures are systematically created before data collection and are standardised;
- Theory is largely causal and is deductive;
- Procedures are standard, and replication is assumed; and
- Analysis proceeds by using statistics, tables or charts and discussing how what they show relates to hypothesis.

Three major quantitative research methodologies are identified by Neuman (2003): experiments, survey, and content analysis.

### 2.4.2 Qualitative Research

Qualitative research is mostly done by researchers belonging to interpretive category. Qualitative research uses a transcendent perspective which is applying ‘logic in practice’ and follows a non linear research path. Qualitative researchers speak a language of ‘cases and contexts’. They emphasise conducting detailed examinations of cases that arise in the natural flow of social life.

According to Neuman (2003), the characteristics of qualitative research are as follows:

- Capture and discover meaning once the researcher becomes immersed in the data;
• Concepts are in the form of themes, motifs, generalisations and taxonomies;
• Measures are created in an ad hoc manner and are often specific to the individual setting or researcher;
• Data are in the form of words and images from documents, observations and transcripts;
• Research procedures are particular, and replication is very rare; and
• Analysis proceeds by extracting themes or generalisations from evidence and by organising data to present a coherent, consistent picture.

Four major qualitative research methodologies are identified by William (2004): ethnography, phenomenology, field research, and grounded theory.

2.4.3 Mixed Methodologies

Critical theorists point out that no one method is complete and that both qualitative and quantitative methods have limitations. They propose the use of mixed methods in conducting research.

Creswell (2003) states that “the concept of using mixed methods can be traced back to 1959, when Campbell and Fiske used multiple methods and introduced Multi Method Matrix to examine multiple approaches to data collection in a study”. Since then, approaches associated with field methods such as observations and interviews (qualitative data) have been combined with traditional surveys (quantitative data).
Creswell (2003) explains that positivists adopt quantitative research, interpretivists adopt qualitative research and critical theorists adopt mixed methodologies. This research adopted mixed methodologies to achieve its aim and objectives as discussed in Section 2.7.

The following section describes various research methods used in quantitative, qualitative, and mixed methodologies.

2.5 Research Methods Used in Research Methodologies

Research methods, commonly referred to as data collection methods by researchers, are the way of collecting secondary data for any research project. These research methods are a part of the overall research methodologies. A wide variety of research methods are available for qualitative and quantitative research. Observation, interviewing, and case studies are the most common qualitative research methods (Neuman, 2003) while experiments, content analysis, and surveys are the most common quantitative research methods (William, 2004). Researchers can use two or more research methods in a research study. This research study adopted observations, content analysis and survey as the research methods. Following is a brief description of research methods.

2.5.1 Observation Research

Observational research is non-experimental qualitative research. The raw data gathered in an observational study can come in the form of visual observations, audio or written observations. Observational research is concerned with the observation, the researcher and the environment. Observations are classified into
two different categories based on its nature: structured observations and unstructured observations. Observations are also classified into two categories based on the researcher type: participant observation and non-participant observation. Finally, observations are classified into two categories based on the environment: naturalistic observation and controlled observation. This research study uses observational research in the action research studies.

2.5.2 Interview

An interview is a self-reporting method using a structured, semi-structured and unstructured approach. Interviews are seen as a useful way of collecting data since the beginning of qualitative research.

Based on the questions, interviews can be classified into formal interviews, directive interviews and informal interviews. Based on the numbers of people involved, interviews can be classified into one-to-one interview, conversational interview, or focus groups. Advances in Information and Communication Technology have resulted in popularising of email and telephone interviews. This research study uses unstructured interviews to elicit general information and surveys to elicit specific information in the action research studies.

2.5.3 Case Study

A case study is an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between the phenomenon and the context are not clearly evident (Gomm, Hammersley, & Foster, 2000).
Case study research can be classified into two categories: single-case study, or multiple-case studies. The case study as a research strategy comprises an all encompassing method covering the logic of design, data collection techniques, and specific approaches to data analysis. The quality of case study research depends on four major issues: construct validity, internal validity, external validity and reliability. Case study research is often criticised on the grounds that its findings cannot be generalised, especially in comparison to those of survey research (Creswell, 2003).

Case study method is not used by this research. However the researchers have made plans to conduct case studies of the action research participants after a year of completion of this research study.

2.5.4 **Content Analysis**

The content analysis method consists of establishing a number of different categories, and counting up the number of times items relevant to each of those categories as they occur in a particular set of data.

Two essential components of content analysis are categorisation and summary tables. Categorisation means splitting the data into various categories. Summary tables summarise more than one set of data, so that the similarities and differences produced by variables or factors can be seen as easily as possible. Content analysis converts qualitative data (data that appears as words) into quantitative information (describing it in numbers). The constructs for the Knowledge
Synchronisation Model (KSM) are generated through content analysis and literature review.

2.5.5 Survey

Survey research is a way of collecting information from a large and dispersed group of people. Two foundational concepts of this method of research are the concepts of “population” and “sample”. Population is the target group of interest for the researcher and sample is the group of individuals selected from within a larger population by means of a sampling procedure.

Surveys can be classified into two categories based on their nature, descriptive and explanatory surveys. Descriptive surveys describe a group in relation to some specific characteristics. Explanatory surveys aim to find explanations by asking questions about possible cause and effect relationships between different variables. This research study adapts descriptive survey method to validate the Knowledge Synchronisation Model (KSM).

2.5.6 Experiment

Investigators, in an experiment, identify a sample and generalise it to a population like in a survey. However, the basic intent of an experiment is to test the impact of an intervention on an outcome, controlling all other factors that might influence that outcome. An experiment, in general, involves four major factors: participants, materials, procedures, and measures (Stringer, 2007). This research study conducts two action research experiments to synchronise knowledge in two different organisations.
2.6 Research Frameworks

Numerous frameworks have been put forth by the practitioners; three step model (Stringer, 2007, p. 8), four step model (Kemmis & McTaggart, 1999), five step model (Bennett & Oliver, 1988, p. 9) seven step model (Neuman, 2003, p. 13), eight step model (Kumar, 1999, p. 17), to name a few. Table 2-2 describes various research frameworks and the steps involved in each framework.

<table>
<thead>
<tr>
<th>Author</th>
<th>Research Framework</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Stringer, 2007, p. 8)</td>
<td>Look, Think, Act</td>
</tr>
<tr>
<td>(Kemmis &amp; McTaggart, 1999)</td>
<td>Plan, Act, Observe, Reflect</td>
</tr>
<tr>
<td>(Bennett &amp; Oliver, 1988, p. 9)</td>
<td>Situation, Goals and assumptions, Data, Options, Actions</td>
</tr>
<tr>
<td>(Neuman, 2003, p. 13)</td>
<td>Select topic, Focus question, Design study, Collect data, Analyse data, Interpret data, Inform others</td>
</tr>
<tr>
<td>(Kumar, 1999, p. 17)</td>
<td>Formulate a research problem, Conceptualising a research design, Constructing an instrument for data collection, Selecting a sample, Writing a research proposal, Collecting data, Processing data, Writing a research report</td>
</tr>
</tbody>
</table>

Table 2-2: Research Process Models

Pure researchers tend to adopt seven step model of Neuman (1997) or eight step model of Ranjit Kumar (1999-b). Where as applied researchers tend to adopt
either one of the models proposed by Stringer (2007), Kemmis and McTaggart (1999), or Bennett and Oliver (1988). Fulfilment of the aim and objectives of this research study require pure research as well as applied research. This research study adopts the models of Stringer (2007) and Ranjit Kumar (1999) for that reason. The research framework adhered to by this research is further discussed in Section 2.7.

2.7 Research Framework for this Research Study

The aim of this research, as discussed in Chapter 1, is “synchronising Subjective Knowledge and Knowledge Management Systems in organisations, thereby creating and maintaining Learning Organisations” and also two objectives are identified to achieve this aim. A three cycle action research framework is adopted for this research study. The basic action cycle consists of three stages: Look, Think, and Act (Stringer, 2007). The research framework and the tasks carried out in each stage are shown in Figure 2-1. The first cycle focuses on theory generation and the second and third cycles focus on theory validation. An alternative view is that the first and second cycles focus on pure research and the third cycle focuses on applied research in the form of two action research cycles. These three cycles are further discussed in the following sub sections. An argument might arise due to use of the term ‘action research’ while conducting pure research in the first two cycles, which is explained below.

This is an Action Research

Any research study has to be classified by its aim. As already mentioned, the aim of this research is to ‘synchronise organisation’s Subjective Knowledge and
Knowledge Management Systems, thereby creating and maintaining Learning Organisations’. This aim is achieved in the third research cycle by transforming two typical organisations into Learning Organisations. Therefore, this research study is an applied research as it applies the theory of the Knowledge Synchronisation Model (KSM) in practice. This research study, due to lack of a suitable, standard model, adopted pure research to create the Knowledge Synchronisation Model (KSM). Hence, it can be concluded that this is an action research study.

To be more specific, this research study adopted three research methods: literature review, survey and action research. Literature review and model creation are explained in Chapters 3 and 4. Chapter 5 explains the survey and Chapter 6 explains the action research studies. Section 7.2 summarises the outcomes of the application of these research methods. Briefly, the Knowledge Synchronisation Model (KSM) was developed using literature review in four steps namely, Investigation of organisational characteristics, Investigation of Subjective Knowledge characteristics, Investigation of Knowledge Management Systems, and Development of the Knowledge Synchronisation Model (KSM).

The Knowledge Synchronisation Model (KSM) was subsequently validated using a survey of four hundred and seventy organisations from around the world. Hypothesis validation is conducted to see how many organisations agree with the Knowledge Synchronisation Model (KSM). This is further explained in Chapter 5 and also in Section 7.2. Action research studies are conducted in two
organisations for knowledge synchronisation and to validate the Knowledge Synchronisation Model (KSM). This is further explained in Chapter 6 and also in Section 7.2.
Figure 2-1: Research framework for this research
The first research cycle: This research takes a functionalist approach and a positivist view towards the research problem. Pure research is conducted in this cycle. Ontology of a Learning Organisation, and two types of knowledge: Subjective Knowledge and Objective Knowledge, which are spread through the entire ontology, are identified in this cycle. Furthermore, a conceptual model, Knowledge Synchronisation Model (KSM) is developed to measure the gap between a typical organisation and a Learning Organisation, and the corresponding organisation’s Subjective Knowledge and Knowledge Management Systems. The following is a brief description of the three stages of the first cycle: Look, Think, and Act.

Look: An extensive literature review was conducted in the disciplines of Learning Organisations, Knowledge Management and Intellectual Capital to see whether there were any past works by researchers in the area of synchronising an organisation’s Subjective Knowledge and Knowledge Management Systems resulting in the organisation’s transformation into a Learning Organisation. Lack of standard models and empirical evidence of the existing models encouraged this research. The details are discussed in the literature review in Chapter 3.

Think: The think process of this cycle was conducted again using the literature review. Several models of Learning Organisations are derived from the literature. Selected models were compared for their merits and demerits. Literature review identifies eight prominent characteristics of Learning Organisations, four characteristics of Subjective Knowledge and five characteristics of Knowledge Management Systems. The details are discussed in Chapter 3.
**Act:** The act process in this cycle led to the development of the ontology and epistemology of Learning Organisations. A conceptual model, Knowledge Synchronisation Model (KSM), was developed using the characteristics of Learning Organisations, Subjective Knowledge and Knowledge Management Systems. The details are discussed in Chapter 4.

**The Second Research Cycle:** Continuing with the functionalist approach and positivist view, pure research was conducted to assess the validity of the Knowledge Synchronisation Model (KSM) in practice. A web-based survey was conducted for this purpose and the data was analysed using the software package, Statistical Package for Social Sciences (SPSS). The following is a brief description of the three stages of the second cycle: Look, Think, and Act.

**Look:** The output of the first action research cycle, the Knowledge Synchronisation Model (KSM), is carefully analysed. Various research methods were contemplated for validating the Knowledge Synchronisation Model’s acceptability by the Knowledge Management practitioners, especially to answer the following questions:

- Can Knowledge Synchronisation Model (KSM) differentiate organisations based on their characteristics?
- Can Knowledge Synchronisation Model (KSM) identify the gap between a typical organisation and a Learning Organisation?
• Can Knowledge Synchronisation Model (KSM) identify the gap between the Subjective Knowledge and Knowledge Management Systems?

**Think:** A survey was chosen as the appropriate data collection method. Various survey methods were contemplated and finally a web-based survey was chosen for its virtues. A number of sampling techniques were discussed and the Snowball Sampling Technique was chosen. Many statistical packages were tested as data analysis tools and the SPSS (Statistical Package for Social Sciences) was chosen. Cluster analysis and Regression analysis were chosen as data analysis functions. A survey questionnaire was then developed.

**Act:** A web-based survey was employed. Data was collected and analysed to answer the questions talked about in the *look section* discussed above. The survey and data analysis details are discussed in Chapter 5.

**The Third Cycle:** Applied research, in the form of action research, was conducted to achieve the research aim and also to tackle the issues with a positivist approach and cross-sectional research. Two organisations were chosen from among the survey participants. Action research studies were conducted to synchronise their Subjective Knowledge and Knowledge Management Systems. Many Knowledge Management tools and techniques were contemplated for their suitability and a few techniques were used for knowledge synchronisation in both the organisations. The following is a brief description of the three stages of the third cycle: Look, Think, and Act.
**Look:** Two organisations from the respondents to the survey were chosen as potential candidates for action research. The Knowledge Synchronisation Model (KSM) identified that one organisation was lacking organisational ‘Awareness’ and ‘Systems Thinking’, while the other was lacking ‘Personal Mastery’, implying that both were in need of knowledge synchronisation.

**Think:** The Knowledge Synchronisation Model (KSM) identified the gaps in both the organisations. Various knowledge management tools and techniques were contemplated. Knowledge portals and Community of Practice (CoP) were identified as the tools and techniques suitable for knowledge synchronisation in both the organisations.

**Act:** A knowledge portal and a Community or Practice (CoP) were suggested to the first organisation. A knowledge base and a Community of Practice (CoP) were suggested to the second organisation. An exit survey indicated that both the organisations became Learning Organisations by adopting the Knowledge Synchronisation Model (KSM), thereby validating the Knowledge Synchronisation Model (KSM) longitudinally.

### 2.8 Summary

Research is a process of answering questions within a framework, commonly referred to as research framework. This research framework is constructed based on the philosophical nature and the social beliefs of the researcher as well as the aims and objectives of the researcher. A research framework explains the type, purpose, study mode and data elicitation techniques.
The research framework for this research study consists of three inter-connected action research cycles, thereby creating an action research spiral. Each action research cycle consists of three stages: Look, Think, and Act as suggested by Stringer (2007). This research study takes a functionalist stand and positivist approach in the first two action research cycles and conducts pure research therein, while taking an interpretive stand and a subjectivist approach in the third action research cycle, and conducts applied research.

The first cycle, creation of the Knowledge Synchronisation Model (KSM), is explained in Chapter 4. Validation of the Knowledge Synchronisation Model (KSM) through a web-based survey is explained in Chapter 5 and through action research, is explained in Chapter 6. The next chapter presents the literature pertinent to the research aim and objectives of this research study.
Chapter 3: Literature Review of Knowledge Management and the Learning Organisation

3.1 Overview of the Literature Review

This chapter reviews the literature in the areas of Knowledge Management, Learning Organisations, and Intellectual Capital that form the basis of this research study. The research aim, summarised by the title *Synchronising Subjective Knowledge and Knowledge Management Systems in Organisations*, reveals that the focal point of this research study is an organisation, people connected to it, and its Knowledge Management Systems. Further, these focal points evolve into a mechanism to synchronise these varying elements of the organisation, people and systems. The literature review undertaken in this chapter provides the basis for creating the Knowledge Synchronisation Model (KSM).

Organisations have been in existence since 1491 BC (Shafritz & Ott, 2001). These organisations have been going through various eras as identified in organisational theory (Clegg, Hardy, & Nord, 1996). The latest era in organisational theory is creating and maintaining Learning Organisations (Garratt, 1987; Pedler, Boydell, & Burgoyne, 1988; Senge, 1990, 2006) that result in organisational sustenance and increased productivity.

Numerous management strategies have emerged corresponding to these generations of organisational theory. Knowledge Management is pertinent to
Learning Organisations (Nonaka, 1994; Sveiby, 2001; Wiig, 1994). The taxonomy of knowledge (Polanyi, 1983) leads to the development of two major sub branches of Knowledge Management: the area of Intellectual Capital, to measure and manage intangible knowledge or Subjective Knowledge, and the area of Knowledge Management Systems, to manage tangible knowledge or Objective Knowledge. Both these branches of Knowledge Management are reviewed here.

Section 3.2 in this chapter begins with defining the terms used in this thesis. Section 3.3 describes organisations, organisational characteristics, and organisational frameworks adapted by prominent organisational ontologists. Section 3.4 describes the need for Learning Organisations in the knowledge/information age and the characteristics of Learning Organisations according to prominent Learning Organisation theorists. Knowledge Management, the management methodology pertinent to the creation and maintenance of Learning Organisations, is discussed in Section 3.5. Section 3.5 also discusses the three generations of Knowledge Management, their merits and demerits, organisational ontologies in the third generation, and the classification of knowledge in all three generations. Section 3.6 describes the area of Knowledge Management Systems and Section 3.7 describes Intellectual Capital. Section 3.8 concludes this chapter and paves the way to Chapter 4.

3.2 Definitions

This section discusses the terms “observations, data, information, knowledge and wisdom” which are frequently used in the areas of Knowledge Management,
Learning Organisations, and Intellectual Capital which are defined in Section 3.4. Furthermore, this section also defines the terms used in designing the survey discussed in Chapter 5.

**Observations:** Observations are subjective in nature. Observations are the basis by which one attempts to recognise the facts. Observations are, however, perceptions of the observer about reality. These observations are usually experimental in nature and deal with the act of noting some object, or occurrence of some phenomenon in reality. Facts are those things or phenomena which the observer believes to be true. Facts are generally consensual in nature and will lead to the creation of data. However observations themselves still continue to remain subjective in nature. The observers, who have observed the same phenomena, agree to their existence (Davis & Cosenza, 1988).

**Data:** Data is objective in nature. Data is observations organised for analysis. Data refers to chunks of facts about the domain under observation. Data may be either quantitative or qualitative in nature.

Quantitative data is data in numerical form. Qualitative data includes any information that can be captured but that is not numerical in nature. The observations made by researchers who follow qualitative research methods like participant observation, direct observation, un-structured interviews and case studies, generate qualitative data. Quantitative data is 'hard', 'rigorous', 'credible', and 'scientific' whereas the qualitative data is 'sensitive', 'nuanced', 'detailed', and 'contextual' (William, 2004).
Most researchers emphasise the quantitative form of the data that is easily stored and manipulated by computer systems. However, a recent shift in Knowledge Management from content based to context based (Stacey, 2001) is forcing researchers to also consider qualitative data. Data in this thesis refers to both qualitative and quantitative data.

**Information**: Information, like data, is objective in nature. Information is generated from data. Information generation from data is undertaken in four steps in order for it to be useful beyond the moment of observation or useful to individuals and groups other than the observer (Galliers, 1987; Giese, 1962; Nichols, 1969). These steps are as follows:

- **Classification of data** – Relating the observations to anticipated situations of all classes. This classification reduces the complexity of the material, provides a means of identification by grouping like things together, provides a record of experience and orders and relates classes of events. Three major characteristics of any classification system are: classes must not overlap; any classification system must be exhaustive—each item to be classified must be placed in some distinct category; and the basis of classification must be significant (related to some specific goal) and in accordance with some predetermined pattern.

- **Establishment of procedures for recording data** in a manner that facilitates recall of the recorded data yet is simple enough to enable the operation of recording data to be automated.

- **Summarisation of data** classified and recorded.
• Specification of the collection procedure of the system.

Tiwana (2000) says that a very similar idea about creating information from data has been expressed by Davenport and Prusak using the 5C’s: Condensation, Contextualisation, Categorisation, Calculation, and Correction. Figure 3-1 from Tiwana (2000 p. 61) depicts Davenport and Prusak’s idea of converting data into information.

![Figure 3-1: Data to Information Source: (Tiwana, 2000 p. 61)](image)

**Knowledge**: Knowledge is objective in nature. Knowledge is the rationalisation of information through reflection, learning and logical reasoning. This definition follows Kantian epistemology in which knowledge is perceived as a thing, something absolute, awaiting discovery through scientific reasoning. This definition is inline with the beliefs of the functionalists and radical humanists discussed in Chapter 2. One can say that knowledge was treated as an object until
the emergence of the third generation of Knowledge Management which argues that knowledge is a process (Stacey, 2001). Sveiby (2001) takes it further by stating that, “Knowledge can be a process or an object”. Knowledge can also be understood as correlations between otherwise separate islands of information within and outside an organisation (Unhelkar, 2007). A detailed discussion about this definition is given in Section 3.5.

**Wisdom**: Wisdom is subjective in nature. Knowledge applied repeatedly to justify the logical basis for an action or belief becomes wisdom. Wisdom is the bearers’ intellectual capacity to consistently distinguish what is important, true, correct and fundamental. There are no processes of reasoning in the state of wisdom. The definitions of wisdom and knowledge may seem similar to the definitions of tacit and explicit knowledge respectively (Nonaka & Takeuchi, 1995; Polanyi, 1958). However that is not the case. Firstly, wisdom is embodied and cannot be transferred even though Nonaka and Takeuchi’s Socialisation, Externalisation, Combination and Internalisation (SECI) model tries to transfer knowledge between tacit and explicit states. Secondly, wisdom guides the observations which in turn starts the cycle of Objective Knowledge (data-information-knowledge) creation. There is a quantum leap from knowledge to wisdom that may be derived by exercising the repeated application of knowledge. Thus, SECI (Socialisation, Externalisation, Combination and Internalisation) model can not create wisdom.

**Knowledge manager**: A knowledge manager is a knowledge worker, whose activities include influencing, building and changing organisational culture, and
creating policies and procedures for knowledge creation. A knowledge manager’s tools include corporate memories, knowledge portals, and e-learning systems.

**Knowledge consumer**: A knowledge consumer is a knowledge worker, whose activities include searching, browsing, accessing, applying, and learning, through using portals, search engines and workflow systems (Awad & Ghaziri, 2004; Rao, 2005).

**Knowledge creator**: A knowledge creator is a knowledge worker whose activities include publishing, improving, classifying and discussing and uses content management, authoring, taxonomy and online Community of Practices (CoP) (Awad & Ghaziri, 2004; Rao, 2005).

**Knowledge editor**: A knowledge editor is a knowledge worker, whose activities include interviewing experts, storytelling, and managing content using Content Management Systems (CMS) and taxonomy tools (Awad & Ghaziri, 2004; Rao, 2005).

**Knowledge expert**: A knowledge expert is a knowledge worker, whose activities include validating, certifying and legitimizing using online CoPs, ranking/rating tools, and best practice repository (Awad & Ghaziri, 2004; Rao, 2005).

**Knowledge broker**: A Knowledge broker is a knowledge worker, whose activities include locating experts/knowledge, identifying gaps and organising.
filtering and coordinating CoPs using enterprise portal, audit tools, online forums, and organisational knowledge maps (Awad & Ghaziri, 2004; Rao, 2005).

**Knowledge leader:** A Knowledge leader is a knowledge worker, whose activities include shaping knowledge management agenda, aligning knowledge management agenda with business objectives, using intellectual capital navigators and industry knowledge maps (Awad & Ghaziri, 2004; Rao, 2005).

### 3.3 Organisation

An organisation is a social entity comprising a group of people following a set of processes using technology and working towards achieving a common goal. A more formal definition is that an organisation is a consciously coordinated social entity, with a relatively identifiable boundary, that functions on a relatively continuous basis to achieve a common goal or set of goals (Robbins & Barnwell, 2002, p. 6). The theory of organisations dates back to 1491 BC (Shafritz & Ott, 2001). Clegg, Hardy, and Nord (1996) argue that there is no one theory of organisations. There are several competing schools, perspectives, traditions, frameworks, models, paradigms, and, occasionally eras of organisational theory (Shafritz & Ott, 2001).

Nine eras of organisational science have been identified (Shafritz & Ott, 2001, p. 6) namely, Classical Organisational Theory, Neoclassical Organisational Theory, Human Resource Theory, Modern Structural Organisational Theory, Systems Theory and Organisational Economics, Power and Politics Organisations Theory, Organisational Culture and Sense Making, Organisational Culture Reform.
Movements, and Postmodernism and the Information Age. Currently we are in the Information Age. These nine eras of organisational science led to the creation of a number of organisational frameworks, which are used to create and maintain an organisation. The following section describes organisational frameworks discussed by prominent organisational ontologists.

3.3.1 Organisational Frameworks

The core of this research study, as mentioned in the overview, is organisations, people relating to them and their Knowledge Management Systems. The role of the people and the Knowledge Management Systems in an organisation will be defined by the organisations framework. This literature review has identified numerous frameworks of organisations. Gareth Morgan (1986) presented eight frameworks of organisations using metaphors: Organisations as machines, Organisations as organisms, Organisations as brains, Organisations as cultures, Organisations as political systems, Organisations as psychic prisons, Organisations as flux and transformation, Organisations as the instruments of domination.

Organisations falling under the metaphoric category of machines tend to develop hierarchies of management and Knowledge Management Systems. The considerations for human factors such as ego and social interactions are given far less importance in such machine type organisations. The Army is a typical example of such an organisation. However organisations that fall under the metaphoric category of organisms have a different type of organisational structure and hierarchy to the machine type organisation and in them human factors are
highly regarded. Similarly, each metaphoric category for organisations defines the roles of people and Knowledge Management Systems differently. The organisational framework plays a vital role in the efforts of knowledge synchronisation undertaken in this research study.

Robbins and Barnwell (2002, p. 10) present the following organisation conceptualisations as the most referred to in the literature:

- **Rational entities in pursuit of goals**: organisations exist to achieve goals, and the behaviour of organisation members can be explained to be in the rational pursuit of those goals.

- **Coalition of powerful constituencies**: organisations are made up of groups, each of which seeks to satisfy its own self-interest. These groups use their power to influence the distribution of resources within the organisation.

- **Open systems**: organisations under this system are input-output transformation systems that depend on their environment for survival.

- **Meaning producing systems**: organisations are artificially created entities. Their goal and purposes are symbolically created and maintained by management.

- **Loosely coupled systems**: organisations are made up of relatively independent units that can pursue dissimilar or even conflicting goals.
• **Political systems**: organisations are composed of internal constituencies that seek control over the decision processes in order to enhance their position.

• **Instruments of domination**: organisations place members in job boxes that constrain what they can do and with whom they can interact. Additionally, they will have a boss who has authority over them.

• **Information processing units**: organisations interpret their environment, coordinate activities and facilitate decision making by processing information horizontally and vertically through a structural hierarchy.

• **Psychic prisons**: organisations constrain members by dictating job descriptions, departments, divisions, and standards of acceptable and unacceptable behaviours. These dictations, when accepted, become artificial barriers that limit choices for members.

• **Social contracts**: organisations are composed of sets of unwritten agreements whereby members are expected to confine to certain behaviours in return for compensation.

An understanding of the organisational framework is required by the Knowledge Management practitioners to implement the Knowledge Synchronisation Model (KSM) presented in Chapter 4. Further investigations are required to measure the effect of organisational framework on knowledge synchronisation. This research study considers that the Knowledge Synchronisation Model (KSM) is valid in all of the aforementioned frameworks. This is so because of the results of the action research studies explained in Chapter 6.
3.3.2 Organisational Characteristics

Organisational characteristics, irrespective of the frameworks discussed in Section 3.3.1, include boundary, membership, location, interaction, and hierarchy (Robbins & Barnwell, 2002; McNurlin & Sprague Jr., 2006; Unhelkar, 2003-a; 2003-b). These characteristics contribute to the creation of the aforementioned frameworks. The following is a brief description of these characteristics.

**Boundary:** An organisation has an identifiable boundary, which can change over a period of time and may not always be clear. This boundary is used to distinguish between the members and non-members (Robbins & Barnwell, 2002). The knowledge age, with the help of Information and Communication Technologies (ICT), is creating dynamic boundaries for organisations. An extranet can expand the boundary of an organisation to include its customers and suppliers. The boundaries of an organisation, in the knowledge era, are dependent on the knowledge within the organisation and on the technology, to access the external world or allow the external world to access the organisation’s knowledge.

**Membership:** People in organisations have continuing membership in the organisation, which however, is not lifelong (Robbins & Barnwell, 2002). People, like consultants, due to changing job environment, can have membership in two different organisations which may be competing in the same market. This type of situation is leading to more complicated membership access rights in organisations and requires sophisticated technologies to implement.
Location: Organisations in the knowledge era span over continents for increased productivity. Location influences the work of an organisation, especially collaborative work, prior to the knowledge era. The knowledge era with the help of Information and Communication Technologies (ICT) has minimised the importance of location. McNurlin and Sprague Jr. (2006, p. 501) notes that it is not uncommon to see the departments of a multinational organisation in Asia perform their work on a project and pass that work on to their European counterparts when the Asian workday ends. The European division processes the work, and then passes it to a group in the Americas when the European workday ends. This process of transferring work globally gets the work done round-the-clock until the desired result is achieved. This research study ignored the location capital in developing Subjective Knowledge constructs due to the possibility of an around-the-clock work culture.

Interaction: The interaction between people connected to the organisation can be classified into three types: interactions within the organisation (employees), interactions between the organisation and its suppliers, and interactions between the organisation and its customers. Interactions are taking various forms and directions in the knowledge era. The interaction which used to be limited by the dimensions of time and space are now free from those constraints and has achieved zero latency with the help of technology, such as emails and Radio Frequency Identification (RFID) tags.

Hierarchy: The management structures of an organisation are changing rapidly in the knowledge era. The chain of command in an organisation is affected by the
knowledge age and becoming shorter in length. The jobs of middle management are becoming scarce, as the organisations are becoming loosely affiliated groups of experts. Thus, the middle management functions are shrinking rapidly, due particularly to the advent of the latest technology in communication and in monitoring the front line employees (Unhelkar, 2003-a; 2003-b).

The ever-changing characteristics of organisations coupled with the need for profitability and competitive advantage, lead organisations to realise the need for continuous learning or organisational learning, thus leading to the era of Learning Organisations. The following section describes Learning Organisations.

### 3.4 Learning Organisation

The idea of the Learning Organisation emerged towards the end of 1980s based on the works of Garrett (1987) and Pedler et al., (1988). The paper by De Geus (1988) published in Harvard Business Review brought the concept to wider attention. The works by Senge (1990; 2006; Senge, Kleiner, Roberts, Ross, & Smith, 1994) were crucial in arousing enormous interest at the right time, when the companies and consultants were searching for new ideas on organisations in order to replace the largely discredited concepts of corporate excellence (Peters & Waterman, 1982). Senge’s work has been both foundational and a populariser and as a result, it has rapidly become a source for academics as well as inspiration for practitioners. Adapting from Senge (2006), this research study defines a Learning Organisation as follows:
**Definition:** An organisation which continuously enhances its capacity to create and update knowledge, by synchronising its Subjective Knowledge and Knowledge Management Systems.

The following section describes characteristics of Learning Organisations discussed by prominent Learning Organisation theorists.

### 3.4.1 Characteristics of Learning Organisations

Understanding of the characteristics of Learning Organisations can vary from researcher to researcher. However, understanding of a Learning Organisation is important in order to achieve the aim of this research study i.e. to transform a typical organisation into a Learning Organisation. The following is a brief discussion of the characteristics of a Learning Organisation as identified by the seminal works of Pedler et al., (1988) and Senge (1990) for their popularity (Leitch et al., 1996; Senge, 2006). Moreover, characteristics of Learning Organisations as per Leda Vassalou (2001), Gardiner and Whiting (1997) and Kontoghiorghes, Awbre and Feurig (2005) are also discussed in Chapter 4 for their role in constructing the Knowledge Synchronisation Model (KSM).

**Pedler et al., (1988)**: Leitch, Harrison, Burgoyne, & Blantern (1996) discuss the eleven characteristics of Learning Organisations as proposed by Pedler et al., (1988), which are

- A *learning approach to strategy*: organisation’s strategy formation and policy encompassed with implementation, evaluation and improvement.
• **Participative policy making:** all members of the organisation have a chance to take part, discuss and contribute to major policy decisions.

• **Informating:** the state of affairs in which the Information Technology is extensively used to inform and empower the people.

• **Formative accounting and control:** part of informating as explained above, this has been given a separate specific characteristic because of the importance given to the accounting and budgeting systems in most organisations.

• **Internal exchange:** all internal units and departments in an organisation are regarded as customers and suppliers.

• **Reward flexibility:** alternative ways of rewarding employees. If finance is used as the reward system, employees are given an opportunity to discuss how the reward should be distributed.

• **Enabling structures:** flexible rules and structures to facilitate rapid responses to demanding situations, and to allow current needs to be met as well as catering for future changes.

• **Boundary workers as environmental scanners:** all members of the learning organisation will collect data from its external environment.

• **Inter-company learning:** in this characteristic, two competitors for instance, may get together for mutual learning, a process known as bench learning. Mutual learning meets the interests of both companies’ for example, by increasing the market, aiding in technological advance and establishing joint industry standards, *e.g.* Microsoft Corporation and
Google inc. are amongst members of the World Wide Web consortium, where they can share their knowledge to establish an industry standard.

- **Learning climate**: managers see their primary task as facilitating members’ experimentation and learning from experience. Importance is attached to the idea of continuous improvement.

- **Self-development opportunities for all**: resources and facilities for self-development are made available to all members of the company.

**Senge (1990)**, identifies five characteristics necessary to create and maintain Learning Organisations, namely, *systems thinking, personal mastery, mental models, shared vision,* and *team learning*.

- **Systems thinking**: a framework for identifying patterns and relationships. Systems thinking seeks the big picture, while avoiding simplification and overcoming linear thinking as well as dealing with issues holistically and comprehensively (Senge, 1990). Systems thinking is only possible in an organisation that has the flexibility to change and which follows the principles of open communication such as allowing the employees to speak their mind (Jamali, Khoury, & Sahyoun, 2006). This characteristic is further explored in Chapter 4 as it is also considered as a characteristic of Learning Organisation by this research study.

- **Personal mastery**: continuous clarification and deepening of the employees’ personal visions. Personal mastery involves awareness of personal weaknesses, growth areas as well as humility, objectivity and
the persistent willingness for self-development (Senge, 1990). Personal mastery in an organisation requires empowerment, commitment and communication (Jamali et al., 2006). This characteristic is further explored in Chapter 4 as this characteristic is also considered as an attribute of Learning Organisation by this research study.

- **Mental models**: a Learning Organisation clarify the deeply ingrained assumptions, pictures/images that influence employees’ understanding of the world and the actions they take. Change in organisations rarely take place in the absence of systematic attempts at unearthing these internal pictures, bringing them to surface and holding them to rigorous scrutiny (Senge, 1990). Mental models in an organisation require teamwork and communication (Jamali et al., 2006). This research study considers mental models as a part of Subjective Knowledge based on Jamali et al., (2006) as opposed to a stand-alone organisational characteristic based on Senge (1990).

- **Shared vision**: a Learning Organisation creates a shared picture of the future that fosters genuine commitment and engagement. Shared vision, in an organisation, binds people together for a common identity and a sense of destiny, giving an awareness of purpose and coherence to all activities undertaken (Senge, 1990). Shared vision in an organisation requires communication, commitment and trust (Jamali et al., 2006). This characteristic is further explored in Chapter 4 as it is also considered as a property of Learning Organisations by this research study.
• **Team learning:** a Learning Organisation raises the collective Intelligence Quotient (IQ) of a group and capitalizes on the greater knowledge and insights of the collective. Team learning involves dialogue and overcoming patterns of defensiveness that undermine group learning (Senge, 1990). Team learning in an organisation requires teamwork and communication (Jamali et al., 2006). This characteristic is further explored in Chapter 4 as it is also considered as a property of Learning Organisation by this research study.

_Leda Vassalou (2001),_ further extending the theory of Goh (1998), proposes five characteristics of Learning Organisations: *mission and vision, leadership, experimenting culture, transfer of knowledge, teamwork and cooperation*; and two supporting foundations: *the organisational design and employee skills and competencies.*

Leda Vassalou (2001)’s organisational design, in fact, is the organisational framework discussed in Section 3.3.1 above and *employee skills and competencies* is the employee Subjective Knowledge that is discussed later in this chapter. The following is a brief description of the five characteristics:

• **Mission and Vision:** the mission should enable the staff at all levels to develop their skills and capabilities. The vision should encourage the employees to acknowledge the expectations-reality gap and provide incentives for learning and improvements.
• **Leadership:** Leadership of a Learning Organisation should empower employees, encourage an experimenting culture, reward learning, support innovation and generate frequent learning opportunities. This characteristic is further explored in Chapter 4 as it is also considered as a property of Learning Organisation by this research study.

• **Experimenting Culture:** a Learning Organisation must set aside resources for employees to engage in employee pet projects, develop rewarding mechanisms and tolerate errors.

• **Transfer of knowledge:** a Learning Organisation must have well defined ways to transfer knowledge among the employees and between the organisational units.

• **Teamwork and cooperation:** the employees of a Learning Organisation must work in teams, be willing to become learners and at the same time help each other to learn.

**Kontoghiorghes, Awbre, and Feurig’s (2005)** extensive literature review has identified the following characteristics of Learning Organisations:

• **Open Communications and Information Sharing:** a Learning Organisation is a participative organisation with a high degree of employee involvement and with constant communication between departments across all levels. Managers and supervisors share information openly and there will be no boundary interferences between organisational units to solve joint problems. Business information is
shared with employees. Finally, organisational policies do not restrict innovation.

- **Risk Taking and New Idea Promotion:** a Learning Organisation encourages its employees to experiment and does not punish them for their failures. Innovators in the organisation get recognition and new ideas are constantly sought and tried.

- **Support and Recognition for Learning and Development:** a Learning Organisation encourages personal development by providing learning opportunities and appreciates a job well done. Supervisors and managers expect applications for new learning and praise employees when they put a new learning to practise.

- **Information, Facts, Time, and Resource:** employees of a Learning Organisation help each other with respect to the materials and equipment, facts and information, and with sufficient time to perform their job in a professional manner.

- **High-Performance Team Environment:** a Learning Organisation encourages its employees to work in teams. Team members share their knowledge among themselves and with other teams. Teams are willing to help the organisation to develop through quality work.

- **Rewards for Learning, Performance, and New Ideas:** a Learning Organisation quickly recognises outstanding performance. The employees receive a fair pay and receive extrinsic rewards when they apply for new learning.
• Positive Training Transfer and Continuous Learning Climate: a Learning Organisation creates a continuous learning climate by motivating employees to learn while training. The employees feel accountable for training received and motivated to apply the learning back at the job.

• Knowledge Management: a Learning Organisation encourages its employees to manage their own learning and develop necessary skills and knowledge to perform their job. Information and Communication Technologies (ICT) are used to capture and distribute knowledge that influences employee’s work.

Penny Gardiner and Peter Whiting (1997) proposed eight characteristics of Learning Organisations, as listed below:

• Individual learning and Self-development: the employees of a Learning Organisation shall be allowed to work without close supervision and shall be given opportunities for problem solving. Supervisors shall provide support rather than control. Every employee must obtain job satisfaction, feel a sense of belonging to a group and frequently contribute ideas.

• Learning strategy: a Learning Organisation must have a clear vision for the future. This vision must be clearly communicated and a learning strategy must be created to achieve the organisation’s vision. Employees must be trained well enough to understand and believe the changes
which have been taking place. The learning strategy must include a plan to incorporate into practice new ideas and different ways of working.

- **Learning climate**: a Learning Organisation must provide knowledge and resources so that high quality work can be performed. Employees must be tolerated and themselves be considered learning opportunities enabling other employees to learn from them. Employees must be encouraged to share skills and resources to perform their job. A reward and recognition system must be in place to encourage such knowledge sharing.

**Employee participation in policy making**: a Learning Organisation must allow employees to participate in policy making. Employees’ views should be taken into account and reflected in policy statements. The management must discuss the conflicts openly and allow the employees to offer their opinions.

- **Use of information**: a Learning Organisation must share information adequately, between teams and among employees. Information and Communication Technology (ICT) must be used to create an effective communication system within the organisation. Feedback on employees’ performance must be available.

- **Empowerment**: a Learning Organisation must delegate responsibilities to its employees. A fair amount of freedom should be given to the employees to make decisions without being supervised. Supervisors must provide appropriate help and advice rather than control and command their teams.
• **Leadership and organisational structure:** A Learning Organisation’s structure must be flexible enough to incorporate new processes seamlessly so as not to distract the existing ones. Each department should treat the other departments as customers and provide necessary services. The leadership must be open and honest with the employees. The leadership should create trust and provide security for the employees. The leadership must be capable of motivating employees to navigate through its vision for the future.

• **Links with external environment:** A Learning Organisation must share its information and expertise with other organisations, for example, suppliers and customers. A Learning Organisation should collect as much information as possible from the external environment. The employees must be kept informed of the external environment that affects the organisation.

Table 3-1 summarises the characteristics of a Learning Organisation according to the aforementioned researchers.
Author | Learning Organisation characteristics

(Pedler et al., 1988) | Learning approach to strategy, participative policy making, informating, formative accounting and control, reward flexibility, enabling structures, boundary workers as environmental scanners, inter-company learning, learning climate, and self-development opportunities for all.

(Senge, 1990) | Systems thinking, personal mastery, mental models, shared vision, and team learning.

(Vassalou, 2001) | Mission and vision, leadership, experimenting culture, transfer of knowledge, and teamwork and cooperation.

(Kontoghiorghes et al., 2005) | Open communication, risk taking, support and recognition for learning, resources to perform the job, teams, rewards for learning, training and learning environment, and knowledge management.

(Gardiner & Whiting, 1997) | Self-development, learning strategy, learning climate, employee participation in policy making, use of information, empowerment, leadership and structure, and links with external environment.

Table 3-1: Characteristics of a Learning Organisation According to Various Authors Reviewed in this Study

Qualitative and quantitative instruments have been developed to assess whether an organisation is a Learning Organisation (Aramburu, Saenz, & Rivera, 2006; Goh & Richards, 1997; Marquardt, 1996; Marsick & Watkins, 1999; Pedler et al.,
1988; Phillips, 2003; Rosemary, 1996; Simonin, 1997). However, there are only a few tools which have been put to adequate scientific testing for reliability and validity (Moilanen, 2001; Nonaka, Byosiere, Borucki, & Konno, 1994). This lack of adequacy led to the development of a new scale which is explained in Chapters 4 and 5. Moreover, this research study is unique and differs from the above mentioned studies in three aspects as discussed below:

- Firstly, this research study summarised all the characteristics and selected the most popular ones from the above mentioned list to construct the Knowledge Synchronisation Model (KSM).
- Secondly, this research study not only assesses whether an organisation is a Learning Organisation but also tries to ascertain the reasons for an organisation not being a Learning Organisation in terms of the people connected to the organisation and its Knowledge Management Systems.
- Finally, this study creates an enabling model for an organisation to transform from a typical organisation into a Learning Organisation. This is achieved by synchronising organisational Subjective Knowledge and its Knowledge Management Systems.

Typical organisations have to acquire the characteristics of Learning Organisations, irrespective of their framework as discussed in Section 3.3.1. Nevertheless, building and nurturing these characteristics depends on the individual organisation.

Tiwana (2000) notes that organisational management has continuously evolved and taken many forms in the recent past. Electronic Data Processing (EDP),
Quantitative Management and Diversification, Management by Objectives (MBO) and Program Evaluation and Review Techniques (PERT) were the management strategies in the 1950s. Centralisation and De-centralisation, T-Groups, Conglomeration, and Theory-Y were the management strategies in the 1960s. Portfolio Management, Automation, Experience Curve, and Strategic Planning made the management strategies in the 1970s. Total Quality Management (TQM), Management by walking around, Theory-Z, Downsizing and Corporate culture formed the management strategies in the 1980s. Market valuation, Strategic Information Systems, Intranets and Extranets became the management strategies in the 1990s. Knowledge Management is the current management strategy and it is pertinent to creation and maintenance of Learning Organisations. The following section describes the field of Knowledge Management.

3.5 Knowledge Management

Sveiby (2001) explains that Knowledge Management has three distinct origins: Artificial Intelligence (Wiig, 1994), Organisational Theory and Innovation (Nonaka & Takeuchi, 1995), and the field, what we know now as Intellectual Capital, adding value to organisation by measuring intangibles (Sveiby, 1997).

The Artificial Intelligence (AI) dimension of Knowledge Management can be traced back to the works of Debra Amidon (1987) and Carl Wiig (1986; 1988). The works in this direction led to the development of Knowledge Management Systems or Knowledge Management Technologies to perform knowledge management tasks such as capturing, storing, and distributing knowledge. Wiig (1997) summarises the aim of Knowledge Management as
to make the organisations act as intelligently as possible to secure their viability and overall success, and

to otherwise realise the best value of its knowledge assets

This definition by Wiig (1997) is obviously referring to creation and maintenance of a Learning Organisation (Senge, 1990).

Nonaka and Takeuchi (1995), in Japan, published their path breaking book, “The Knowledge Creating Company”, based on the works of Polanyi (1958; 1983). Nonaka and Takeuchi’s approach is mainly concerned with transfer of knowledge between Tacit and Explicit states based on Socialisation, Externalisation, Combination, and the Internalisation (SECI) model. The SECI model suggests the use of Knowledge Management Systems as well as Knowledge Management processes such as Community of Practices (CoPs).

Sveiby (1986) published “The Know-How Company” in Swedish, to create and measure the knowledge of an organisation. The works of Sveiby (1989; 1986) in the area of strategy and measuring the intangibles led to the development of the area of Intellectual Capital.

### 3.5.1 Three Generations of Knowledge Management

Three generations of knowledge management are identified (Deeper, 2004; Snowden, 2002). The first generation which was prior to 1995 saw knowledge being managed. Knowledge, following Kantian epistemology, was considered as an object that can be managed. The focus was on appropriate structuring and flow
of information to decision makers. The idea of knowledge, being an object, led to the computerisation of major business applications, which in turn led to a technology enabled revolution dominated by the perceived efficiencies of process re-engineering.

Organisations which adapted the first generation Knowledge Management strategies recognised that the trade-off for achieved efficiencies was their effectiveness. Organisations, through re-engineering, had laid-off vital people with experience or natural talents. Organisations were unaware of this loss of talents until the late 1990s. This can be attributed to the first generation Knowledge Management’s failure to recognise the value of tacit knowledge gained through experience, through traditional forms of knowledge transfer such as apprentice schemes, and the collective nature of knowledge.

The second generation of Knowledge Management started with the popularisation of the Socialisation, Externalisation, Combination, and Internalisation (SECI) model (Nonaka & Takeuchi, 1995). The knowledge was considered an object, like the first generation. The focus of the second generation Knowledge Management was however, on the movement of knowledge between tacit and explicit states through the four processes of Socialisation, Externalisation, Combination and Internalisation. This generation focussed on creating more knowledge processes to transform a typical organisation into a knowledge based community. Assessment, measurement and benchmarking became characteristics of this generation (Snowden, 2002).
Snowden (2002) claims we are in the third generation of Knowledge Management. The third generation started with Stacy’s (2001) argument that knowledge is not a thing, or a system, but an ephemeral, active process of relating. Knowledge itself cannot be stored, nor can intellectual capital be measured, and certainly neither of them can be managed. This definition opposed the mainstream thinking that knowledge is perceived as a thing, something absolute, awaiting discovery through scientific reasoning. The main focus of the third generation Knowledge Management was on context rather than content. The dimensions of abstraction, culture, time and space were also considered.

Sveiby (2001) argues that knowledge can be considered as an object as well as a process, thus identifying two tracks of knowledge management: Information and Communication Technology (ICT) and Human Resources (HR). Sveiby (2001) argues that if organisations consider knowledge as an object then they must invest in the Information and Communication Technology (ICT) infrastructure and if the organisation considers knowledge as a process then they must invest in Human Resources (HR). Sveiby (2001) defines knowledge as “the capacity to act”, thus considering both the views of knowledge being an object and a process. This research study defines Knowledge Management as follows:

**Definition:** *A methodology to simplify and improve the processes of storing, distributing, creating, capturing, validating and applying knowledge.*

Knowledge Management methods include tools and techniques from both the areas of Knowledge Management Systems and Intellectual Capital. Knowledge
Management professionals need to understand organisational ontology and knowledge taxonomy, to perform Knowledge Management tasks and to choose the right Knowledge Management methods.

The following section describes three popular organisational ontologies and their drawbacks that are being used by most of the third generation knowledge management professionals.

### 3.5.2 Organisational Ontologies

The third generation Knowledge Management professional adapt any one of the three organisational ontologies proposed by Spiegler (2000), or Kakabadse et al., (2003), or Awad and Ghaziri (2004). An understanding of organisational ontology is necessary as it segregates the organisation (people, processes and technologies) into unique ontological units. The following is a brief discussion of these three ontologies.

**From reality to wisdom by Spiegler (2000)**

Spiegler (2000) proposes a model that has four states: data, information, knowledge and wisdom. According to this model as illustrated in Figure 3-2 an Organisation creating wisdom from data starts with the external environment (reality). The four states are then described as follows:

- *Data* are the attributes of the entities. Data (bases) represent, record, store, and maintain those attributes.
• **Information** is ‘knowing-that’ and is the result of data processing operations such as organising, storing, calculating, retrieving and reporting.

• **Knowledge** is defined as ‘knowing-how’ and is a consequence of information processing operations such as reformatting, quantification, qualification, clustering, learning, and dissemination.

• **Wisdom** is ‘knowing-when’ and/or ‘if’. Knowledge contributes to wisdom through activities such as discovery, inference, value, experience, judgement, intuition and abstraction.

![Diagram of Knowledge Hierarchy](image)

**Figure 3-2 : Creating Wisdom from Reality based on Spiegler (2000)**

According to Spiegler (2000) knowledge is the process of knowing, a reflexive process that takes data and information, in a social (organisational) context, together with values and beliefs, needs, emotions, desires and socialising into a culture. This process of knowing generates new data, information and/or
knowledge. This definition concurs with the idea of Stacey (2001). Spiegler (2000) further explains that knowledge and information turn with time into data, updates, reuse, application and more.

Wisdom, according to Spiegler (2000) is subjective in nature. This is so because of the factors or knowledge processing operations that convert knowledge into wisdom, such as values, judgement, intuition, insight, and creativity are subjective in nature.

However, this model neither explains the function of wisdom nor its effect on the reality, which is a drawback to this model. As discussed earlier an organisation consists of people, processes and technologies. Such an organisation, especially where people are concerned, has tangible and intangible attributes. Spiegler (2000) does not discuss how to handle the intangible attributes, which is another drawback.

From data to wisdom by Kakabadse et al., (2003)

Kakabadse et al., (2003) proposes a model that has five states: data, information, realisation, action/reflection, and wisdom. According to this model, for an organisation the process of creating wisdom from data follows the following sequence.

- **Data** that are events observed explicitly, represented and organised, and are context free.
- **Information** is the data converted through manipulation, evaluation and interpretation.
• **Realisation** is the information converted through validation, internalisation, and codification.

• **Action/Reflection** is the will applied to realisation.

• **Wisdom** is the experience of action/reflection.

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**Figure 3-3 : Creating Wisdom from Data based on Kakabadse et al., (2003)**

Figure 3-3 shown above depicts the model proposed by Kakabadse et al., (2003). The action/reflection and wisdom are subjective in nature. One can classify data either as subjective or objective. If considering data as objective in nature, then observations mean observations made by processes, or technology such as data mining tools. The observations made by people have not been considered. In such
case this model has the same drawbacks as the model of Spiegler (2000) shown in Figure 3-2. Alternatively, if one considers data as subjective by incorporating human considerations, then this model fails to explain questions such as, what triggers such observations. The major question ‘is the data subjective or objective?’ remains unexplained in this model.

**From data to wisdom by Awad and Ghaziri (2004):**

![Figure 3-4: Creating Wisdom from Data based on Awad and Ghaziri (2004)](image)

Awad and Ghaziri (2004) propose a model, shown in Figure 3-4, that has four states: data, information, knowledge, and wisdom. According to this model, for an organisation, the process of creating wisdom from data takes the following sequence.
• **Data** is unrecognised and unprocessed facts. Data is algorithmic and programmable.

• **Information** is the data ‘in formation’, which is an aggregation of data.

• **Knowledge** is the actionable information, human understanding of a specialised field of interest, that has been acquired through study and experience.

• **Wisdom** is non-algorithmic and non-programmable.

The definitions and explanations given by Awad and Ghaziri (2004, p: 40) makes it evident that they only considered the objective nature of data. Rather than maintaining a balance, the authors leaned more towards Knowledge Management technologies than Knowledge Management processes. However, both the technologies and processes play a vital role in creating a knowledge organisation. This model fails to explain how knowledge (actionable information) turns into wisdom. The major draw back of this model is that it does not discuss the subjective nature of data or observations.

The organisational ontologies identified (Awad & Ghaziri, 2004; Kakabadse et al., 2003; Spiegler, 2000) do have some ambiguities as discussed in this section. Therefore, this research study attempts to remove them and presents a more comprehensive ontology of an organisation in Chapter 4.

The ambiguity in the Knowledge Management paradigm lies within knowledge taxonomy or epistemology. The core of the Knowledge Management,
‘knowledge’, has taken many forms depending on the ontological perspectives of
the knowledge workers responsible for devising Knowledge Management
strategies. The following section describes knowledge taxonomy and arguments
surrounding those knowledge types.

3.5.3 Taxonomy of Knowledge

The three generations of Knowledge Management have seen knowledge classified
into various types: tacit and explicit (Nonaka & Takeuchi, 1995), biological,
mental, and cultural knowledge (Firestone & McElroy, 2005), personal, common,
tacit, and explicit natures (Tywoniak, 2007), know-what, know-why, know-how,
and know-who (Lundvall, 1996), symbolic, embodied, embrained, and encultured
(Collins, 1993), and codified, common, social, and embodied knowledge
(Blumentritt & Johnston, 1999). The following is a brief explanation of these
classifications.

Tacit – Explicit knowledge: Nonaka and Takeuchi (1995), citing the works of
Polanyi (1958; 1983), classifies organisational knowledge into two categories:
tacit and explicit.

Explicit knowledge is the codified component of organisational knowledge.
Explicit knowledge can be transmitted in a systematic way using formal language.
Documents, databases, email and charts, in an organisation, contain explicit
knowledge.
Tacit knowledge is personal, context specific, and is difficult to formalize, record, or articulate. Tacit knowledge is stored in the minds of people. The tacit component of knowledge is developed through a process of a trial and error mechanism applied to real life situations.

This classification of knowledge, tacit – explicit, was most widely used by the second generation knowledge management practitioners (Awad & Ghaziri, 2004; Davenport & Prusak, 2000; Gamble & Blackwell, 2004; Tiwana, 2000).

Wilson (2002), argues that the concept of ‘tacit knowledge’ was wrongly understood by the knowledge management practitioners. The term tacit knowledge originated by Polanyi (1983), with the statement “we know more than we can tell”, in Wilson’s opinion, actually means that there exists some knowledge that can not be made explicit. Tacit knowledge is a hidden knowledge, hidden even from the consciousness of the knower (Wilson, 2002).

Wilson (2002), further argues that tacit knowledge involves the process of comprehension, which itself is little understood. Thus, tacit knowledge is an inexpressible process which enables an assessment of phenomena in the course of becoming knowledgeable. Idolisation of Wilson’s (2002) definition has led to a conclusion that capturing tacit knowledge is impossible. Zappavigna-Lee (2007), while investigating the process of capturing tacit knowledge through linguistic analysis and grammar targeted interviews, presents a review of models to capture tacit knowledge. The Socialisation, Externalisation, Combination, and Internalisation (SECI) framework proposed by Nonaka and Takeuchi (1995),
though practically sound, fails to achieve it’s purpose of complete transferral of knowledge between tacit and explicit states. This partial failure can be imputed to Wilson’s (2002) argument. This research study concurs with the ideas expressed by Nonaka and Takeuchi (1995), Wilson (2002) and Zappavigna-Lee (2007) and hence agrees that some tacit knowledge can be captured.

**Biological – mental – cultural knowledge:**

Joseph and Mark (2005), considering organisations as Complex Adaptive Systems (CAS), referring to the ontological propositions of Karl Popper (1972), classified knowledge of CAS into the following three categories:

- **Biological knowledge:** The component of knowledge that is genetic and synaptic. Biological knowledge is tested, evaluated, and then the surviving structures of information in physical systems allow them to adapt to their environment.

- **Mental knowledge:** The component of knowledge that is subjective, or non-sharable. Mental knowledge resides in the minds of people. Mental knowledge is tested, evaluated and then the surviving beliefs present themselves as their values and attitudes.

- **Cultural knowledge:** The component of knowledge that arises from claims and meta-claims based on speech or artefacts, or culture. Cultural knowledge is tested, evaluated and then the surviving knowledge becomes sharable (objective) linguistic formulations about the world.
Personal – common – tacit – explicit:

Tywoniak (2007), considering organisational knowledge as a complex system, classifies knowledge into four “interdependent deformation dimensions”: personal knowledge, common knowledge, tacit knowledge, and explicit knowledge.

- Tywoniak (2007), citing the works of Polanyi (1958) and Varela et al., (1993), defines personal knowledge as the component of the knowledge that is stored in the physical organs of individuals of differentiated perceptual and cognitive abilities, including their brain and nervous system.

- Common knowledge: the component of knowledge embedded in the environment, in which the interaction is taking place, and is displayed by the use of common language, symbols and artefacts.

- Tacit knowledge: the component of knowledge that has been generated, through action, and has not been noticed due to the attention in taking the action.

- Explicit knowledge: the component of knowledge that leads to formalisation and codification.

Tywoniak (2007) argues that the interdependency of these categories of knowledge leads to six pairs of interactions namely, personal-common, personal-tacit, personal-explicit, common-tacit, common-explicit, and tacit-explicit.
Know – what – why – how – who:

Lundvall (1996) , by extending the traditional epistemology, classified knowledge into four categories: know-what, know-why, know-how, know-who.

- **Know-what**: the component of knowledge about facts that can be easily codified.
- **Know-why**: the component of knowledge about principles and laws.
- **Know-how**: the component of knowledge that deals with the skills and capability to undertake a given task successfully.
- **Know-who**: the component of knowledge that deals with information regarding who knows what and who knows how to do what.

Symbolic – embodied – embrained – encultured knowledge

Collins (1993) classified knowledge into four categories namely, symbolic, embodied, embrained, and encultured knowledge.

- **Symbolic-type knowledge**: the component of knowledge that can be transferred without loss in codified form.
- **Embodied knowledge**: the component of knowledge that is held within the body of a human.
- **Embrained knowledge**: the component of knowledge within the physical matter of the brain.
- **Encultured knowledge**: the component of knowledge that is linked to social groups and society.
Codified – common – social – embodied knowledge

Blumentritt and Johnston (1999), classified knowledge into four categories: codified, common, social, and embodied.

- **Codified knowledge**: that component of knowledge which has been articulated through the means of writing or demonstration. Codified knowledge is readily transferable.

- **Common knowledge**: that component of knowledge which is accepted as a standard without having been made explicit. Common knowledge often takes the form of routines or practices. Common knowledge is learned through working in a particular context.

- **Social knowledge**: that component of knowledge which deals with interpersonal relationships and cultural issues.

- **Embodied knowledge**: that component of knowledge which includes the experience, background and skills that a person has accumulated during their lifetime. Embodied knowledge is strongly connected to the person themselves and relies on patterns and links that a person can make to a given set of information.

The knowledge taxonomies, discussed above, have their own merits and demerits as discussed in the literature (Blumentritt & Johnston, 1999; Wilson, 2002). The knowledge in this research study has been classified into two categories to suit the organisational ontology proposed for this study: subjective Knowledge and objective Knowledge. The definitions of Subjective Knowledge and Objective Knowledge, and the discussions have been presented in Chapter 4.
Subjective Knowledge refers to that component of knowledge which cannot be articulated. Objective Knowledge is that component of knowledge which has been and/or can be articulated. Subjective Knowledge is being dealt within the area of Intellectual Capital and Objective Knowledge is being dealt within the area of Knowledge Management Systems. The following sections describe Knowledge Management Systems and Intellectual Capital.

### 3.6 Knowledge Management Systems

A Knowledge Management System is defined, adapting from Alavi and Leidner (1999-a), as a system targeting professional and managerial activities by focussing on creating, gathering, organising and disseminating organisations ‘Objective Knowledge’ as opposed to ‘information’ or ’data’. Figure 3-5 demonstrates the function of a Knowledge Management System and its role in an organisation.

![Knowledge Management Systems and their Role in Organisations](image-url)
Knowledge Management Systems have been in existence since the 1950s helping business managers in using organisational knowledge to the best of their abilities and to the advantage of the organisation. The first generation of these Knowledge Management Systems were rooted in analytical applications and can be broadly categorised into the following types:

- **Management Information systems (MIS):** Information and Communication Technology (ICT) bundled together to help management by mimicking the human decision process through stored routines and procedures.
- **Decision-Support Systems (DSS):** Information and Communication Technology (ICT) bundled together to help management in decision making by providing a detailed analysis of alternative decisions.
- **Executive Information Systems (EIS):** Information and Communication Technologies (ICT) bundled together to provide necessary information for decision making to executives.
- **Artificial Intelligence Systems:** Information and Communication Technology (ICT) bundled together to mimic human intelligence in various ways such as speech, vision, and reasoning.
- **Semantic Networks:** Information and Communication Technology (ICT) bundled together to represent organisations knowledge.
- **Groupware systems:** Information and Communication Technology (ICT) bundled together to support collaboration in the organisation.
The World Wide Web (WWW) is the prime initiator of the second generation of the Knowledge Management Systems. Organisations during the second generation of Knowledge Management Systems looked at the Internet (instead of Intra-nets or Extranets) as the basis for communication as these organisations built Knowledge Management Systems around web technologies. Second and third generation Knowledge Management Systems can be broadly classified into the following types:

- **Portals**: provide organisations with virtual presence over the Web. Organisations are providing offsite services to their clients using portal technology. Moreover, portal technology, with its ubiquitousness is helping organisations to reach destinations which were previously unreachable. Two types of organisational portals are popular: information portals and knowledge portals.

- **Business Intelligence (BI)**: Information and Communication Technology (ICT) development in the dimensions of processing power, storage, and ubiquitousness led to the development of Business Intelligence systems such as data warehousing systems to store enormous amounts of data and data mining systems to mine the stored data for useful information.

- **Document Management Systems (DMS)**: organisations not only depend on data but also the processes stored in organisational documents. Document Management Systems serve as a central repository for organisational documents allowing fast and accurate access to the documents.
• **Intelligent agents:** a software agent that acts in the web space on behalf of and according to the wishes of a real person.

• **Search engines:** information retrieval systems to assist the members of the organisation in finding relevant information.

• **Knowledge repository:** often referred to as organisational brain, is the Information and Communication Technology (ICT) bundled together to continuously capture and analyse the knowledge assets of the organisation.

• **Customer Relationship Management (CRM) Systems:** Information and Communication Technologies (ICT) bundled together to manage the organisation’s relationship with its customers by capturing, storing and analysing customer data.

• **Messaging/e-mail Systems:** provide a systematic way of composing, storing, sending and receiving messages over the web. Messaging systems allow transfer of information between computer systems within the organisation. Both messaging and email systems facilitate collaboration within the organisation through information transfer.

• **Groupware:** build upon messaging/e-mail systems and provide enhanced facilities for team collaboration. Groupware systems include text chatting, audio-video conferencing facilities as well as the e-mail and messaging services.

• **Web calendars/reminders:** allow groups to plan, schedule, and conduct meetings over the Web.
• **Workflow and tracking:** Information and Communication Technology (ICT) bundled to represent end to end organisational process flows in terms of resources, roles and action sequences.

• **Webcasting:** organisation’s top management started reaching the bottom of the hierarchy using Webcasting, streaming media files over the internet.

• **Content Management:** refers to anything that can be transferred over the net. Content includes data, documents, and audio visual material. The developments in Information and Communication Technology (ICT) facilitate centralised management of content.

• **Web/multimedia based training/e-learning:** the content management systems discussed above facilitate online training and learning within the organisation.

The basic difference between second and third generation systems is the shift in focus from the content to the context. Second generation systems concentrate on capturing an expert’s tacit knowledge and eventually replacing them with software systems, whereas third generation systems look at the expert as a constant source of knowledge, thus being human-centric. The aforementioned Knowledge Management Systems are categorised by researchers as discussed in the following paragraphs.

Tiwana (2000, p. 72) classifies Knowledge Management Systems into three categories: knowledge acquisition systems, knowledge sharing systems, and knowledge utilisation systems.
Becerra-Fernandez et al., (2004, p. 41) classifies Knowledge Management Systems into four categories: Knowledge discovery systems, knowledge capture systems, knowledge sharing systems, and knowledge application systems. These four categories underpin the Socialisation, Externalisation, Combination, and Internalisation (SECI) model as well as ‘Direction’, application of knowledge, as identified by Becerra-Fernandez et al., (2004).

Madanmohan Rao (2005, p. 38) classifies Knowledge Management Systems into eight categories: knowledge creation systems, knowledge codification systems, knowledge retrieval systems, knowledge application systems, knowledge distributions systems, knowledge validation systems, knowledge tracking systems and knowledge personalisation systems.

Gottschalk and Khandelwal (2006) classifies Knowledge Management Systems into four categories: knowledge distribution systems, knowledge sharing systems, knowledge capture systems, and knowledge application systems.

The prominent classification, following Nonaka and Takeuchi (1995), has always been Socialisation Systems, Externalisation Systems, Internalisation Systems and Combination Systems.

This research study considers information systems, which form the basis for development of Socialisation, Externalisation, Combination, and Internalisation (SECI) systems, and the classification of Nonaka and Takeuchi (1995) as constructs for Knowledge Management Systems.
3.7 Intellectual Capital


The definition of Intellectual Capital, after extensive literature review, has been succinctly given by Renu Burr and Antonia Girardi (2001, p. 5) as

- **Capacity:** capacity of the people in the areas of knowledge, skills, abilities, information and experience.
- **Willingness:** readiness of the people to apply capacity
- **Opportunity:** provided by the work system to activate stocks of intellectual capital.

The literature review of Kaufmann and Schneider (2004) identifies various terms used by researchers as synonyms for Intellectual Capital: intangibles, intangible assets, intangible capital and intellectual property.

The research community has adapted the classification provided by Sveiby (1997) and Stewart (1997). However, in the recent past more detailed classifications have been proposed. Osterland (2001) coins a term “knowledge capital” and classifies knowledge capital into intellectual capital, human capital, customer capital, and supplier capital.

Lim and Dallimore’s (2002; 2004) framework classifies Intellectual Capital into eight categories: human capital, corporate capital, business capital, functional capital, customer capital, supplier capital, alliance capital, and investor capital.

Kaufmann and Schneider (2004) explains that the works of most of the authors, irrespective of the term used, include knowledge and refer to some form of economic value that is attached to intangible assets.

The focus of this research is on synchronising the Subjective Knowledge and Knowledge Management Systems and hence it does not consider the economic value of the knowledge. However, the economic value of knowledge
Synchronising Subjective Knowledge and Knowledge Management Systems
Chapter 3: Literature Review of Knowledge Management and the Learning Organisation

synchronisation, considering the Knowledge Management initiatives in organisations, is well understood. This research study, following Popper’s (1972) epistemological beliefs, uses the concept of Subjective Knowledge. The use of Popper’s theory is well justified by Nonaka and Peltokorpi (2006), in which they compared the top 20 authors in the area of Knowledge Management for their ontological and epistemological beliefs.

According to this research study Subjective Knowledge is classified into four categories, namely, employee Subjective Knowledge, customer Subjective Knowledge, process Subjective Knowledge, and supplier Subjective Knowledge. These four categories are discussed in Chapter 4.

3.8 Summary

Organisations naturally try to become Learning Organisations. The changes in the business environment such as globalisation, competition, the advent of Information and Communication Technology (ICT), shifting business models from product base to information/knowledge base, can be attributed to the organisations quest for becoming Learning Organisations.

The Learning Organisation is a state of being of an organisation and it is dependent on organisational characteristics. The Literature review in this chapter shows that there are many propositions for creating and maintaining Learning Organisations. However, very few of these propositions appear to have been empirically tested and validated. Moreover, the characteristics of Learning Organisations are still being debated. This research study uses eight
characteristics, namely, Awareness, Environment, Leadership, Empowerment, Personal Mastery, Shared Vision, Team Learning, Systems Thinking, as the constructs for Learning Organisations as presented in Table 5.1. These eight constructs are discussed in Chapter 4.

Knowledge Management is the management strategy pertinent to the creation and maintenance of Learning Organisations. The literature review shows that there are three generations of Knowledge Management. A number of frameworks have been proposed to manage the knowledge of an organisation. The taxonomy of knowledge led to the creation of two identifiable branches of Knowledge Management: Intellectual Capital to measure and manage the intangible component of knowledge, and Knowledge Management Systems to manage the tangible component of knowledge. The characteristics of Intellectual Capital are discussed in this chapter. The concept and constructs of Subjective Knowledge are also introduced. These constructs are further discussed in Chapter 4. Similarly, classifications of Knowledge Management Systems are discussed in this chapter and the constructs for Knowledge Management Systems are introduced, which are discussed further in Chapter 4.

Chapter 4 presents a model constructed using the characteristics of Learning Organisations, Subjective Knowledge and Knowledge Management Systems. This model is called Knowledge Synchronisation Model (KSM).
Chapter 4: Knowledge Synchronisation Model

4.1 Overview of the Knowledge Synchronisation Model

This chapter presents a formal Knowledge Synchronisation Model (KSM) to measure the gap between a typical organisation and a Learning Organisation (LO), and corresponding organisation’s Subjective Knowledge and Knowledge Management Systems.

The aim of this research study, as discussed in Chapter 1, is to determine ways to synchronise an organisation’s Subjective Knowledge and Knowledge Management Systems so that the organisation will become a Learning Organisation. This research study discussed organisational ontologies in Chapter 3 and indicated the need for a new ontology. This chapter starts by presenting ontology of Learning Organisations developed for this study in Section 4.2.

Based on the literature review presented in Chapter 3 a number of constructs are developed and presented in this chapter. These are constructs for Subjective Knowledge namely, employees, suppliers, customers, and processes; constructs for Knowledge Management Systems namely, Information Systems, Socialisation Systems, Externalisation Systems, Combination Systems, and Internalisation Systems; and constructs for Learning Organisations namely, Awareness, Environment, Leadership, Empowerment, Personal Mastery, Shared Vision, Team.
Learning, Systems Thinking. These constructs are explained in Sections 4.3, 4.4, and 4.5.

Subsequently in Section 4.6 this chapter presents the Knowledge Synchronisation Model (KSM), which is based upon aforementioned constructs. According to the Knowledge Synchronisation Model (KSM) typical organisations have to instil aforementioned Learning Organisations’ constructs to become one. Furthermore, these constructs can be instilled into the organisation by developing its Subjective Knowledge and Knowledge Management Systems. The gap between a typical organisation and a Learning Organisation presents itself as the absence of one or more of these constructs of Learning Organisations, for example, missing organisational awareness. Moreover, according to the Knowledge Synchronisation Model (KSM) this gap could be because of the following three reasons:

- Organisations paying too much attention towards the development of Knowledge Management Systems and little attention towards Subjective Knowledge development, thus becoming technology oriented.
- Organisations paying little attention towards the development of Knowledge Management Systems and too much attention towards Subjective Knowledge development, thus becoming people oriented.
- Organisations’ ignorance of the need for becoming a Learning Organisation, thereby ignoring the need for Knowledge Management.

Finally, in Section 4.7, the Knowledge Synchronisation Model is summarised, paving the path to validation which is explained in Chapter 5 and Chapter 6.
4.2 Ontology of Learning Organisations in the context of KSM

The literature review presented in Section 3.5.2 identified the need for a new organisational ontology. To this end this research study proposes organisational ontology consisting of five stages: observations, data, information, knowledge and wisdom. Figure 4-1 depicts the ontology of a Learning Organisation in the context of the Knowledge Synchronisation Model (KSM).

![Ontology Diagram](image)

Figure 4-1: From Observations to Wisdom (Unhelkar, 2007)

An organisation creates wisdom from observations through a systematic and self-consistent, intellectual and experimental structure. This structure consists of five steps as discussed below:
• **Observations**: are the perceptions of people linked to the organisation. Observations may or may not be true. Different people observing the same phenomena may not make the same observation. People’s capacity to make observations depends on their wisdom. Observations are subjective in nature.

• **Data**: is the set of observations agreed upon by the majority of people linked to the organisation. Data forms a fact base for the organisation which can be manipulated using Knowledge Management Systems. This fact base is objective in nature.

• **Information**: is the data placed into one or more structures of organisational processes and Knowledge Management Systems. Information is objective in nature.

• **Knowledge**: is information rationalised through the processes of reflection, learning, and logical reasoning. Knowledge is objective in nature.

• **Wisdom**: is knowledge applied repeatedly to achieve the organisation’s vision. Wisdom is subjective in nature.

The process of creating wisdom from observations is cyclical in nature. Wisdom gained from previous pursuits will guide current observations. This cycle of creating wisdom from observations guides the creation of the organisation’s vision for the future.

The process of creating wisdom from observations is systematic as every organisation will adhere to an organisational framework to create processes and to
develop relevant technology to achieve its vision as discussed in Section 3.3.1. This process is self-consistent. Though, an organisation is created using people, processes and technologies, it does not depend on a particular person or technology or process. People will come and go, processes might be proven wrong and new processes replace the old ones, and new technologies surface over time to perform the same tasks more effectively and efficiently. Still, this framework remains intact. This process is intellectual, as a number of rationalisation processes have to be performed to create wisdom from observations. Finally, this process is experimental, as in the stage of wisdom organisations will have optimum solutions to the known problems. Identification of optimum solution requires at least two solutions to compare and hence, the creation of wisdom is experimental in nature.

The proposed ontology paves the path to the knowledge taxonomy of Subjective Knowledge and Objective Knowledge. Observation and wisdom, as discussed above are subjective in nature and hereinafter referred to as Subjective Knowledge. Data, information and knowledge are objective in nature and referred to as Objective Knowledge. Subjective Knowledge in organisations is contained in the organisational processes, employees, customers and suppliers. Objective Knowledge in organisations is contained in the Knowledge Management Systems; Information Systems, Socialisation Systems, Externalisation Systems, Combination Systems, and Internalisation Systems. The following sections describe Subjective Knowledge and Knowledge Management Systems in detail.
4.3 Subjective Knowledge

Subjective Knowledge is a combination of observations and wisdom pertinent to an organisation. Subjective Knowledge is mostly embodied in human beings. The word ‘mostly’ is used because the organisational processes specific to an organisation are also a part of Subjective Knowledge. The reason is that the organisational processes facilitate the conversion of observations into data. Hence, Subjective Knowledge is contained in people linked to the organisation and in the organisational processes.

Three kinds of people are directly connected to an organisation: employees, suppliers and customers. These days, customers and suppliers may not necessarily be human beings. They could be other organisations. This however does not make any difference to the current discussion of Subjective Knowledge being constituted by the four constructs. The rationale is that the actions performed by suppliers or customers still depend on their Subjective Knowledge.

To summarise, Subjective Knowledge, in the context of the Knowledge Synchronisation Model, is jointly constituted by four constructs; employee Subjective Knowledge, customer Subjective Knowledge, supplier Subjective Knowledge and process Subjective Knowledge. These are described in the following sections.

4.3.1 Employee Subjective Knowledge

Edvinsson and Malone (1997) define employee Subjective Knowledge as the employee’s knowledge, experience, capabilities, skills, creativity, and
innovativeness. These elements are interconnected and contribute to an employee’s success. Human knowledge as defined by Hudson (1993) is the combination of genetic inheritance, education, experience, and attitude towards life and business. The employee’s human knowledge makes them unique in learning and performing their functions differently from their colleagues. Employee Subjective Knowledge is important for this reason of uniqueness.

The characteristics of employee Subjective Knowledge as described in research (Bontis, 1998; Cantrell, Benton, Thomas, Vey, & Kerzel, 2005; Edvinsson & Malone, 1997; Lepak & Snell, 1999; Porac et al., 2004; Stewart, 1997; Tsai, Yen, Huang, & Huang, 2007) vary from researcher to researcher. A number of empirical studies have also been conducted to measure the effect of employee Subjective Knowledge (Bontis, 1998; Cantrell et al., 2005; Hussi, 2004). These studies emphasise the importance of employee Subjective Knowledge in organisational success.

Cantrell et al., (2005) used five characteristics, workforce proficiency, workforce performance, employee engagement, workforce adaptability, and leadership, to measure Subjective Knowledge capabilities. This research has adopted the first four characteristics to measure employee Subjective Knowledge. Questions relating to these characteristics are developed and used in the questionnaire attached in Appendix B. This research considers the fifth characteristic, ‘leadership’, as a construct for Learning Organisations.
4.3.2 Customer Subjective Knowledge

Customer Subjective Knowledge is the customer’s knowledge about the organisation and the industry in which the organisation operates. Customer Subjective Knowledge makes the customer want a product or service from the industry or organisation. Bontis (1998) says that organisations often do not recognise the value of customer Subjective Knowledge. According to Bontis (1998) the understanding of what customers want in a product or a service is what makes an organisation a business leader.

Customer Subjective Knowledge that can be leveraged is often referred to as ‘market orientation’, meaning:

- Generation of market intelligence pertaining to the customer’s current and future needs using business intelligence tools and techniques
- Distribution of such knowledge within the organisation using organisational information and communication technologies
- Taking appropriate action or preparing the organisation for future action.

A number of frameworks have been proposed to measure the customer Subjective Knowledge and market orientation (Bontis, 1998; A. Chang & Tseng, 2005; Edvinsson & Malone, 1997; Stewart, 1997). Empirical studies by Bontis (1998) and Chang and Tseng (2005) emphasise the effect of customer Subjective Knowledge on organisational success.
Edvinsson and Malone (1997, p. 95) propose a framework to measure customer Subjective Knowledge. Edvinsson and Malone’s (1997, p. 95) framework is based on customer type, customer duration, role of the customer in product design, manufacture, delivery, and service, customer support and customer success. These characteristics are further categorised into twenty seven questions. This research study has adopted Edvinsson and Malone’s (1997) framework to measure customer Subjective Knowledge. Questions relating to customer Subjective Knowledge are developed and used in the questionnaire attached in Appendix B.

4.3.3 Supplier Subjective Knowledge

Supplier Subjective Knowledge is the knowledge of the suppliers or vendors about the organisation and the industry in which the organisation operates. A number of frameworks have been developed to measure supplier Subjective Knowledge (Sveiby, 1997; Wick et al., 2003). The studies conducted by Lim and Dallimore (2002; 2004) and Osterland (2001) emphasise the importance of supplier Subjective Knowledge. Supplier Subjective Knowledge leads to better integration of information and communication technologies between the organisation and its suppliers, either individuals or organisations, consequently leading to better products and services.

This research has adopted Lim and Dallimore’s (2004) framework to measure supplier Subjective Knowledge. Questions relating to supplier Subjective Knowledge are developed and used in the questionnaire attached in Appendix B.
4.3.4 Process Subjective Knowledge

Process Subjective Knowledge of an organisation is the intellectual property, systems and procedures belonging to the organisation. Process Subjective Knowledge helps employees in their quest for optimum intellectual performance. Bontis (1998) states that an individual with a high level of intellect working in an organisation with poor systems and procedures will be disadvantaged.

According to Bontis (1998) organisations with strong process Subjective Knowledge will have a supportive culture that allows individuals to experiment, to fail, to learn, and to try again. If the culture unduly penalises failure, organisations success will be minimal.

The characteristics of process Subjective Knowledge vary from researcher to researcher (Bontis, 1998; Joia, 2000; Lim & Dallimore, 2004). However, the studies conducted by researchers emphasise the importance of process Subjective Knowledge in organisational development.

The framework proposed by Bontis (1998) to measure process Subjective Knowledge consists of elements of efficiency, transaction times, procedural innovativeness and access to information for coding into Knowledge Management Systems. It also supports elements of cost minimisation and profit maximisation per employee. This framework is adopted by this research study. As a result survey questions relating to the measurement of process Subjective Knowledge are developed based on the work of Bontis (1998).
4.4 Knowledge Management Systems

Knowledge Management is the methodology to simplify and improve the processes of creating, validating, storing, distributing, and applying knowledge. Furthermore, Knowledge Management Systems are defined as Information and Communication Technologies (ICT) that support Knowledge Management in organisations.

The literature review, in Chapter 3, presented various classifications of Knowledge Management Systems, and concluded that classification of Knowledge Management Systems into Socialisation Systems, Externalisation Systems, Combination Systems, and Internalisation Systems by Nonaka and Takeuchi (1995) is the most widely used classification. Information Technology in general forms the basis for building Knowledge Management Systems. For example, no organisation can implement an online collaboration system, which falls under Socialisation Systems category, without at least implementing the Intranet, which falls under the Information Technology category. Similarly a number of examples can be cited. However, this example should be enough to justify Information Systems or Information Technology forming the basis for building Knowledge Management Systems. This research study followed the classification by Nonaka and Takeuchi (1995) as well as Information Systems as constructs for Knowledge Management Systems.

To summarise, Knowledge Management Systems in the context of the Knowledge Synchronisation Model is jointly constituted by five constructs; Information
Systems, Socialisation Systems, Externalisation Systems, Combination Systems, and Internalisation Systems. These are described in the following sections.

4.4.1 Information Systems

Information Systems, also referred to as Information Management Systems or Management Information Systems, form the basis for collection, manipulation, storage, retrieval and dissemination of information pertaining to an organisation. Information Systems in an organisation include basic word processing technologies right up to complex enterprise nervous systems (McNurlin & Sprague Jr., 2006, p. 484).

Information Systems can be of three types, basic, intermediate, and advanced. Basic Information Systems include word processing and data processing systems. Intermediate Information Systems include Local Area Networks (LAN), Wide Area Networks (WAN), and Storage Area Networks (SAN). Advanced Information Systems include Decision Support Systems, Data Mining systems, Executive Information Systems, Expert Systems, and Enterprise Nervous Systems.

Enterprise Nervous Systems form the backbone of a real-time organisation in which information is transferred with zero latency and no data redundancy. Four major characteristics of a real-time organisation (McNurlin & Sprague Jr., 2006, p. 484), are:

- *Message based:* the applications, devices, and people, within the organisation, communicate with each other via messages
• **Event driven**: all the events in the organisation are recorded and made available to the entire organisation

• **Publish-subscribe approach**: the information about the event is published at an electronic address and any system, person, or device authorized to see that information can subscribe to that information feed from the electronic address

• **Common data format**: the systems in the entire organisation use common data formats.

This research study considered all the three types of Information Systems in developing questions relating to Information Systems.

### 4.4.2 Socialisation Systems

Socialisation Systems within an organisation are generally built on enterprise nervous systems. As the name implies Socialisation Systems facilitate employee socialisation within an organisation. The purpose of socialisation is knowledge (Subjective and Objective) and information sharing between people, e.g., in meetings. Marwick (2001) says that Subjective Knowledge sharing through socialisation is often done without ever producing Objective Knowledge. Subjective Knowledge is shared in face-to-face meetings and shared experiences, often informal, in which Information and Communication Technology (ICT) plays a minimal role.

These days, the enterprise eco systems span over continents and are physically dispersed. Consequently an increased number of meetings are taking place in
cyberspace using Information and Communication Technology (ICT). The technology support required for employee socialisation can be viewed on time and space dimensions (McNurlin & Sprague Jr., 2006, p. 498). Figure 4-2, based on the ideas of McNurlin and Sprague Jr. (2006), depicts the Information and Communication Technologies (ICT) that are currently being used as Socialisation Systems.

<table>
<thead>
<tr>
<th>Same time</th>
<th>Different times</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electronic copy boards</td>
<td>Team room tools</td>
</tr>
<tr>
<td>Decision Support Systems</td>
<td></td>
</tr>
<tr>
<td>Team-building tools</td>
<td></td>
</tr>
<tr>
<td>Audio conferencing</td>
<td>Voice mail</td>
</tr>
<tr>
<td>Video conferencing</td>
<td>E-mail</td>
</tr>
<tr>
<td>Screen sharing</td>
<td>Fax</td>
</tr>
<tr>
<td></td>
<td>Group editing</td>
</tr>
<tr>
<td></td>
<td>Schedulers</td>
</tr>
<tr>
<td></td>
<td>Work flow systems</td>
</tr>
</tbody>
</table>

**Figure 4-2: Systems Facilitating Socialisation over Time and Space dimensions (McNurlin & Sprague Jr., 2006, p. 510)**

As shown in Figure 4-2 socialisation taking place in same time - same place scenario, for example a meeting in the board room of an organisation, requires little or no technological support. However, electronic copy boards, electronic decision support, and team building technologies are increasingly being used. Socialisation taking place in same time – different place scenario uses audio
conferencing, video conferencing, and screen sharing technologies. Socialisation taking place in different time – same place scenario uses team room tools. Socialisation taking place in different time – different place scenario uses voice mail, e-mail, facsimile, group editing, project management schedulers, and workflow technologies.

Group Support Systems or groupware such as Lotus notes and Microsoft exchange server demonstrates all the technological characteristics discussed above. The wide use of the internet has led to the creation of a new generation of Socialisation Systems such as the Wikis. Web 2.0 is expected to bring more flexibility in socialisation.

This research study has adopted ideas from McNurlin and Sprague Jr., (2006) and developed questions related to Socialisation Systems in the questionnaire.

4.4.3 Externalisation Systems

Externalisation Systems help to convert portions of Subjective Knowledge into Objective Knowledge. Externalisation Systems use the processes of conceptualisation, elicitation and articulation for the conversion purpose. Marwick (2001) says that the typical activities in the externalisation process are dialogues among team members, responding to questions, or through the elicitation of stories. A shared mental model is required to facilitate externalisation and the process of articulation (Nonaka & Takeuchi, 1995).

This research study adopted Becerra-Fernandez et al. (2004) and Marwick’s (2001) classification of Externalisation Systems for developing relevant survey questions.

4.4.4 Internalisation Systems

Internalisation Systems facilitate the rationalisation of information and knowledge by individuals to embody knowledge. Repeated application of this embodied knowledge then facilitates creation of wisdom. Internalisation Systems use the processes of reflection, reasoning and learning. Marwick (2001) gives an example of reading documents. By reading one can learn what others previously learned. However, this process of reading and learning is also becoming challenging because individuals have to deal with ever-larger amounts of information.

Marwick (2001) says that text abstraction and classification systems can help internalisation. Becerra-Fernandez et al., (2004, p. 52) argue that the externalisation process will facilitate knowledge internalisation for the participants. They give an example of preparing reports on lessons learned in a project. The reports thus externalise the lessons learned by project members. At
the same time project members and document writers internalise those lessons and embark on later projects. According to Lindvall et al. (2003) e-learning or e-teaching systems facilitate information or knowledge internalisation.

This research study adhered to the above discussion in developing survey questions relevant to Internalisation Systems.

4.4.5 Combination Systems

Combination Systems facilitate Objective Knowledge sharing within or across organisations. Objective Knowledge can be shared in meetings, via documents, e-mails, etc., or through education and training. Moreover, the developments in Information and Communication Technologies (ICT) allow for the creation of new Objective Knowledge from existing Objective Knowledge. Business Intelligence Systems (Herschel & Jones, 2005), classification systems, and clustering systems are examples of such technology. These technologies are also part of the Combination Systems.

Marwick (2001) says that shared databases, through which people can share documents and e-mails containing Subject Matter Expert’s advise and word processing systems are the examples of Combination Systems. These systems have taken the form of Document Management Systems and Content Management Systems.
4.5 Learning Organisations

The literature review in Chapter 3 discussed a number of frameworks for creating and nurturing Learning Organisations. The literature review also discussed the characteristics of those frameworks. This research study considers eight characterises of Learning Organisations. The characteristics are Awareness, Environment, Leadership, Empowerment, Personal Mastery, Shared Vision, Team Learning and Systems Thinking. According to the Knowledge Synchronisation Model (KSM) a typical organisation can be transformed into a Learning Organisation by inculcating these eight characteristics. Furthermore, these characteristics can be instilled into the organisation by developing its Subjective Knowledge and Knowledge Management Systems as appropriate.

The following sections describe the aforementioned Learning Organisations’ characteristics, and their relationship with Subjective Knowledge and Knowledge Management Systems in the context of Knowledge Synchronisation Model (KSM).

4.5.1 Awareness

The organisational characteristic ’Awareness’ means

- understanding of organisational knowledge (Subjective and Objective) that is strategically important to the organisation,
- having knowledge about the ways and means to share that knowledge within the organisation.
Cohen and Prusak (2001, p. 60) say that knowledge flows along existing pathways in organisations. Understanding of these pathways will give understanding of knowledge. Finding the way to perform a task, for example, is easier to find from a senior rather than looking into the relevant operations manual. Iske (2005) argues that even though these pathways of knowledge flows exist, it is hard to find the source of the knowledge. Moreover, technological barriers will restrict the efforts of such knowledge externalisation. Iske (2005) suggests question answer systems and knowledge maps, and Maybury et al. (2002) suggests expert locaters as solutions to these problems.

The knowledge of strategic importance to the organisation, according to Porter (1998) includes information about regulatory changes, new entrants, products and services introduced by competitors, and general industry environment. Content Management Systems and Document Management Systems can help share this knowledge within and across organisations.

A study by Szulanski, as cited in Anklam, Cross, and Gulas (2005), identifies three significant barriers that hinder organisational awareness, ignorance, absorptive capacity, and lack of relationship. Ignorance hinders organisational awareness as the organisations or individuals on either side of a knowledge pathway do not know that the other is looking for such knowledge. Even though the managers know of a better practice they do not have the time or resources to implement it. That is how absorptive capacity hinders organisational awareness. Lack of relationship between the source and the recipient hinders organisational awareness as people do not feel comfortable asking complex questions of people.
they do not know. The solutions to overcome these barriers include the development of a Community of Practices (CoP) (Hudson, 1993), Organisational Network Analysis (ONA) (Anklam et al., 2005), and employee Subjective Knowledge development (Edvinsson & Malone, 1997).

To summarise, organisational awareness (Anklam et al., 2005; Cohen & Prusak, 2001; Porter, 1998) is strongly associated with employee Subjective Knowledge (Edvinsson & Malone, 1997; Hudson, 1993) and Combination Systems (Iske, 2005; Maybury et al., 2002), as shown in Figure 4-3. Based on the above the following hypothesis is developed.

\textit{Hypothesis 1: ‘Awareness’ of Learning Organisations is strongly associated with employee Subjective Knowledge and Combination Systems.}

![Figure 4-3: Factors Affecting Awareness](image)
4.5.2 Environment

The organisational characteristic ‘Environment’, based on Roth et al., (2006), refers to the physical environment, organisational structure and management philosophies of the organisation. Organisational environment reflects through employee commitment, organisational goal attainment, and autonomy.

McNurlin and Sprague Jr. (2006, p. 499) address the issue of organisational environment and say that organisations are becoming flat and more often physically dispersed, with less middle management as a group of experts. Information and knowledge sharing is becoming difficult due to the changes in physical environment, organisational structure and management philosophies. Managing organisations is becoming so complex that new ways of learning and managing are becoming mandatory. McNurlin and Sprague Jr. (2006, p. 499) suggest that enterprise nervous systems are suitable for creating real time organisations and Socialisation Systems are suitable for managing collaboration and knowledge sharing.

Pearn, Roderick and Mulrooney (1995, p. 2) note that academic credentials of the employees are higher than that in the past and are essential for organisational success. The aspirations of the employees are changing dramatically due to their high academic credentials, so they are seeking better opportunities. Hudson (1993), and Edvinsson and Malone (1997) suggest employee Subjective Knowledge development for employee retention.
Fry et al., (2005) say that employees of Learning Organisations have to be open, generous, capable of thinking in teams, and be risk takers with an innate ability to motivate others. Centralised, mechanistic structures created by the management philosophies of the past such as Taylorism, Management By Objectives (MBO), and Total Quality Management (TQM) are not sufficient to create a good environment for a Learning Organisation. It is necessary for management to take on a new philosophy to encourage openness, generosity, and to accept error and uncertainty. Bontis (1998) and Lim and Dallimore (2004) say that this can be addressed by the development of process Subjective Knowledge.

To summarise, a suitable organisational environment (Fry et al., 2005; McNurlin & Sprague Jr., 2006; Roth et al., 2006) to create and maintain a Learning Organisation can be created by developing employee Subjective Knowledge (Edvinsson & Malone, 1997; Hudson, 1993), process Subjective Knowledge (Bontis, 1998; Lim & Dallimore, 2004), Information Systems (McNurlin & Sprague Jr., 2006), and Socialisation Systems (Marwick, 2001; McNurlin & Sprague Jr., 2006) as shown in Figure 4-4. Based on the above the following hypothesis is developed.

4.5.3 Leadership

The organisational characteristic ‘Leadership’ is a process of influencing and teaching others to understand why and how certain activities and goals need to be accomplished. As such, it constitutes a process of facilitating individual and collective efforts to learn and accomplish the shared goal of organisations (Berson, Nemanich, Waldman, Galvin, & Keller, 2006).

Pearn et al. (1995) say that Learning Organisations have to have a strong vision of their future, therefore the leaders of a Learning Organisation have to be forward thinking, should foster systems thinking concepts and encourage learning to help both the individual and the organisation. Leaders must be aware of the suppliers and customers to create a strong vision for the future. This is only possible with well developed supplier Subjective Knowledge (Osterland, 2001; Sveiby, 1997;
Wick et al., 2003), and customer Subjective Knowledge (Bontis, 1998; Edvinsson & Malone, 1997).

Earlier theories about leadership, on the contrary, proposed the separation of work and learning. Minzberg’s (1975) study showed how managers used their time in numerous brief activities, without any opportunity for reflection and planning. Lisi (2000) suggests that the situation has not changed since ‘75 by stating that learning and education is still being viewed as something to be accomplished in the educational institutions and is not embedded in the work actively.

Lisi (2000) suggests that the leaders of Learning Organisations should rethink their strategies and focus on several factors, namely, teaching their employees and developing Combination Systems such as knowledge bases in order for them to become organisational leaders. Sarin and McDermott’s (2003) study empirically proves that the leaders of Learning Organisations have to adapt a facilitator style management, and be aware of customer requirements.

To summarise, suitable leadership (Berson et al., 2006; Lisi, 2000; Pearn et al., 1995; Sarin & McDermott, 2003) can be formulated by developing customer Subjective Knowledge (Bontis, 1998; Edvinsson & Malone, 1997), supplier Subjective Knowledge (Osterland, 2001; Sveiby, 1997; Wick et al., 2003), Information Systems (McNurlin & Sprague Jr., 2006) and Combination Systems (Iske, 2005; Lisi, 2000; Maybury et al., 2002) as shown in Figure 4-5. Based on the above the following hypothesis is developed.

![Diagram showing relationships between customer Subjective Knowledge, supplier Subjective Knowledge, Leadership, Information Systems, and Combination Systems.](image)

**Figure 4-5: Factors Affecting Leadership**

### 4.5.4 Empowerment

According to Bridges (1995), ‘Empowerment’ means enabling employees in their own actions to obtain a better result. This is achieved by reducing supervisory control. Edvinsson and Malone (1997) argue that empowerment is only possible with a well developed employee Subjective Knowledge. Employees in an empowered organisation will become responsible for their actions to some extent. The managers will still be involved in employees’ actions by encouraging and coordinating the employees. An empowered employee ultimately acts like one who is self-employed, with responsibility for both results and career.
Studies by Conger and Kanungo (1988), Coleman (1996), and Seibert, Silver and Randolph’s (2005) emphasise the need to empower employees for organisational survival.

Conger and Kanungo’s (1988) study identifies three major reasons for empowerment. Firstly, empowerment is a principle component of managerial and organisational effectiveness. Secondly, the total productive forms of organisational power and effectiveness grow with the superiors sharing power and control with their subordinates. Finally, empowerment plays a vital role in group development and team learning. Empowerment is the process by which a leader or manager shares his or her power with subordinates (Conger & Kanungo, 1988). Well developed process Subjective Knowledge can facilitate this power sharing (Joia, 2000).

Coleman (1996) identifies the following seven factors for empowerment:

- Intense global competition and customer demand.
- Need for speed and flexibility, seamlessness and transparency.
- Horizontal structures organised around business processes.
- Emphasis on creating an environment that challenges employees to use their capabilities and take personal responsibility for tasks.
- Encouragement of creativity at all levels, risk-taking and commitment.
- Managers delegate authority and take a supportive role.
- Emphasis on communication, collaboration, and building trust.
Coleman (1996) further argues that empowerment is only possible in an organisation when the emphasis is on organisational learning, information and knowledge sharing, and self-control according to performance feedback. Marwick (2001) and Becerra-Fernandez (2004) argue that well developed Externalisation Systems for information and knowledge sharing, and Internalisation Systems for organisational learning, are required to create such environment.

Seibert, Silver and Randolph’s (2005) survey based on their empowerment multi-model has confirmed that organisational climate and enabled employees are significantly related, and greatly contributes towards the organisational performance.

To summarise, empowerment (Bridges, 1995; Conger & Kanungo, 1988; Seibert, Silver, & Randolph, 2004) can be achieved by developing employee Subjective Knowledge (Edvinsson & Malone, 1997; Hudson, 1993), process Subjective Knowledge (Bontis, 1998; Joia, 2000), Externalisation Systems (Becerra-Fernandez et al., 2004; Marwick, 2001) and Internalisation Systems (Becerra-Fernandez et al., 2004; Marwick, 2001) as shown in Figure 4-6. Based on the above the following hypothesis is developed.

4.5.5 Personal Mastery

Mastery means a certain level of proficiency. The organisational characteristic ‘Personal Mastery’, based on Senge (2006, p. 7), refers to repeated clarification and deepening of one’s personal vision, or focusing one’s energies, of developing patience, and of seeing reality objectively. Employees’ personal mastery is an essential cornerstone of the Learning Organisation. Organisations, having employees with a high level of personal mastery, will be able to realise consistently the results that matter most to them by enhancing and leveraging organisational knowledge. To achieve this organisations have to commit to the employees’ lifelong learning.

Charlotte Roberts (Senge et al., 1994, p. 198) gives an example

An organisation with employees full of personal mastery as, “an organisation full of employees who come to work enthusiastically, knowing that they will grow and flourish, and intent of fulfilling the vision and goals of the larger organisation. There is an ease,
grace and effortlessness about the way they get the things done. Work flows seamlessly among teams and functions. People take pleasure and pride in every aspect of the enterprise – for example, in the way they can talk openly, reflect on each other’s opinions, and have genuine influence on the structures around them.

The above example subtly discusses the need for developing employee Subjective Knowledge to create personal mastery. Charlotte Roberts, elsewhere (Senge et al., 1994, p. 220) describes that Externalisation Systems and Internalisation Systems are essential to create personal mastery.

To summarise, personal mastery (Senge, 2006) can be instilled into an organisation by developing employee Subjective Knowledge (Edvinsson & Malone, 1997; Senge et al., 1994), Externalisation Systems (Marwick, 2001; McNurlin & Sprague Jr., 2006; Senge et al., 1994), Internalisation Systems (Marwick, 2001; Senge et al., 1994), and Socialisation Systems (Levin & Cross, 2004; Marwick, 2001; McNurlin & Sprague Jr., 2006) as shown in Figure 4-7. Based on the above the following hypothesis is developed.

**Hypothesis 5:** ‘Personal mastery’ of Learning Organisations is strongly associated with employee Subjective Knowledge, Information Systems, Socialisation Systems, Externalisation Systems, and Internalisation Systems.
4.5.6 Shared Vision

Shared Vision, based on Senge (2006), refers to all the employees of an organisation adhering to its vision statement. The vision statement of an organisation presents its future picture, where it wants to go, and what it wants to achieve. Senge (2006, p. 9) cites several examples of vision statements, such as of Polaroid, “bringing instant photography to the world”, of IBM, “service”, and of Ford, “public transport for the masses”, which brought their employees together around a common goal. Senge (2006, p. 9) says that the employees inspired by a genuine vision will excel in and learn, not because they are told to, but because they want to.

The practice of shared vision involves the skills of unearthing the shared “picture of the future” that foster genuine commitment and enrolment rather than
compliance (Senge, 2006). This is because the employees, by having a shared vision, start feeling that they belong to a community rather than work for an organisation. Bryan Smith (Senge et al., 1994, p. 312) talks about a thousand employees of an organisation showing their commitment to the organisation’s vision based on shared vision sessions conducted over a year. According to Bryan Smith (Senge et al., 1994, p. 314) the creation of shared vision takes place in five stages: telling, selling, testing, consulting, and co-creating. All the five stages involve employees. Strong employee Subjective Knowledge (Edvinsson & Malone, 1997; Hudson, 1993) will ease the process of creating shared vision, and Information Systems (McNurlin & Sprague Jr., 2006) and Externalisation Systems (Becerra-Fernandez et al., 2004; Marwick, 2001) will help in creating the shared vision as shown in Figure 4-8. Thus the following hypothesis is developed.

4.5.7 Team Learning

The organisational characteristic ‘Team Learning’ (Senge, 2006) is the capacity of members of a team to suspend assumptions and enter into a genuine ‘thinking together’. Team learning is becoming an essential part of Learning Organisations as organisations are becoming information based (Drucker, 1988), composed of groups of specialists who direct their own performance through feedback from others: colleagues, customers, and headquarters (McNurlin & Sprague Jr., 2006, p. 499). Senge (2006) says that if employees think, learn together from their past mistakes and from the environment, it will lead to team learning. When teams truly learn, not only do the team members produce extraordinary results, but the individual members grow more rapidly than could have occurred otherwise. This will enable the organisation to create new knowledge and leverage existing knowledge effectively.
Senge et al., (1994, p. 352) say that team learning requires shared vision among team members. They add that shared vision must be created using “skilfull discussions” and open “dialogues” so that the team learning is successful. Development of employee Subjective Knowledge (Edvinsson & Malone, 1997; Senge et al., 1994) is required to ease the process of skilfull discussions and dialogues. Externalisation Systems (Marwick, 2001), such as news groups and group support systems, will facilitate skilfull discussions and dialogues, and Internalisation Systems (Lindvall et al., 2003; Marwick, 2001) will facilitate the learning as shown in Figure 4-9. Thus the following hypothesis is developed.

Hypothesis 7: 'Team learning’ of Learning Organisations is strongly associated with employee Subjective Knowledge, Externalisation Systems and Internalisation Systems.

![Diagram](image)

**Figure 4-9 : Factors Affecting Team Learning**
4.5.8 Systems Thinking

The organisational characteristic ‘Systems Thinking’, based on Senge (2006), is the ability of the employees to perceive a process workflow, across all the departments within the organisation, from initiation to completion. Systems thinking is becoming essential as the organisations are growing bigger and more physically dispersed. Senge et al., (1994, p. 89) says that organisations can be perceived as systems whose elements “hang together”, continually effecting each other over time and operating towards achieving a common purpose.

The concept of systems thinking can be related to the organisational frameworks discussed in Section 3.3.1, such as organisations as meaning producing systems, organisations as loosely coupled systems and organisations as open systems.

The Acme case study presented by Senge et al., (1994, p. 97) clearly demonstrates the need for developing employee Subjective Knowledge (Edvinsson & Malone, 1997; Hudson, 1993), Information Systems (McNurlin & Sprague Jr., 2006), Socialisation Systems (Marwick, 2001; McNurlin & Sprague Jr., 2006), and Externalisation Systems (Becerra-Fernandez et al., 2004; Marwick, 2001), to achieve systems thinking as shown in Figure 4-10. Employee Subjective Knowledge was developed by narrating stories at Acme. Information Systems were used for problem identification. Socialisation Systems and Externalisation Systems were used to communicate within the organisation. Based on the above, the following hypothesis is developed.

![Diagram showing the relationship between Systems Thinking, employee Subjective Knowledge, Socialisation Systems, Externalisation Systems, and Information Systems.]

Figure 4-10 : Factors Affecting Systems Thinking

4.6 Model for Transforming an Organisation into a Learning Organisation

The conceptual framework for transforming a typical organisation into a Learning Organisation consists of two stages. Firstly the gap between an organisation and the Learning Organisation has to be evaluated. This gap presents itself as one or many missing constructs of the Learning Organisations discussed above. The gap has to be bridged instilling the missing constructs into the organisation in the second stage. This is achieved by developing and synchronising Subjective
Knowledge and Knowledge Management Systems relevant to the missing constructs.

Figure 4-11 showing the augmentation of all eight hypotheses presented in Section 4.5 depicts the framework required to transform a typical organisation into a Learning Organisation. This framework is hereinafter referred to as the Knowledge Synchronisation Model (KSM).

According to the Knowledge Synchronisation Model (KSM), knowledge synchronisation problems discussed in Chapter 1 are due to the absence of one or more constructs of a Learning Organisation. Chapter 5 discusses the empirical validation of the Knowledge Synchronisation Model (KSM) and Chapter 6 validates the Knowledge Synchronisation Model (KSM) through action research studies.
Figure 4-11: Stepping through Subjective Knowledge and Knowledge Management Systems to Arrive at a Learning Organisation
4.7 Summary

This chapter presented an organisational ontology, and classified organisational knowledge into two categories: Subjective Knowledge and Objective Knowledge. Subjective Knowledge is collectively constituted by four constructs: employee, supplier, customer, and process. Objective Knowledge contained in Knowledge Management Systems encompasses information, socialisation, externalisation, combination, and internalisation systems. Section 4.5 discussed the constructs required to transform a typical organisation into a Learning Organisation. The constructs are Awareness, Environment, Leadership, Empowerment, Personal Mastery, Shared Vision, Team Learning and Systems Thinking.

This chapter also presented a conceptual model, called the Knowledge Synchronisation Model (KSM) to measure the gap between a typical organisation and a Learning Organisation, and the organisation’s Subjective Knowledge and Knowledge Management Systems. The gap presents itself as a missing construct which is due to lack of synchronisation between an organisation’s Subjective Knowledge and Knowledge Management Systems. The core idea behind the Knowledge Synchronisation Model (KSM) is that an organisation can be transformed into a Learning Organisation by identifying the knowledge gaps or missing characteristics and then bridging that gap by synchronising relevant Subjective Knowledge and Knowledge Management Systems constructs. Chapter 5 describes a survey that was conducted to validate the Knowledge Synchronisation Model (KSM).
Chapter 5: Validating the Knowledge Synchronisation Model through Survey

5.1 Overview of Survey and Data Analysis

This chapter presents the description and analysis of a survey carried out to assess the acceptability of the Knowledge Synchronisation Model (KSM) in accordance with the research methodology described in Chapter 2.

The survey was conducted in two phases. In the first phase an initial survey instrument and a questionnaire format were developed using formal methods and administered within the New South Wales-Knowledge Management-Forum (NSW-KM-Forum) to test their reliability. NSW-KM-Forum is a not-for-profit Knowledge Management Community of Practice. NSW-KM-Forum’s member base formed a perfect testbed for the pilot survey. The results and the feedback were analysed, which formed the basis for finalising the survey instrument in the second phase. To conduct the survey in this phase the ‘Snowball sampling technique’ was adopted to create the sample group. The unit of reference was an organisation with Knowledge Management initiatives. The survey was web-based and fifteen hundred organisations were contacted out of which, four hundred and seventy valid responses were received. The data analysis resulted in five out of eight hypotheses being verified.
Section 5.2 describes the scale developed for the survey. Section 5.3 describes Response Formatting, or the way the survey was presented to the participants. Section 5.4 describes various survey methods, their merits and demerits, and justification for the survey method chosen. Section 5.5 describes the development of both initial and final instruments. Section 5.6 describes the sampling techniques. Section 5.7 addresses the scale reliability issues and discusses descriptive statistics of the survey data. Section 5.8 validates the hypotheses. Section 5.9 concludes this chapter.

5.2 Scale Development

A scale is a collection of items combined into a composite score to measure the theoretical variables, or constructs, not readily observable by direct means (De Vellis, 2003, p. 8). Generally a new scale is developed when a researcher believes that a relationship exists between the constructs but no scale exists in the literature.

This research study is unique for the reasons discussed in Chapters 1 and 3. A sixty two point scale was created for these reasons. Each hypothesis in the Knowledge Synchronisation Model contains three variables: the Learning Organisation as a dependent variable, and both Subjective Knowledge and Knowledge Management Systems as independent variables. These variables, their constructs and corresponding measurements are presented in Table 5-1. The scale reliability and validity issues are discussed in the Section 5.7.1.
### Variable: Learning Organisation

<table>
<thead>
<tr>
<th>Construct</th>
<th>Measurement of Construct</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Awareness</td>
<td>Infrastructure in place to notify</td>
<td>(Anklam et al., 2005; Cohen &amp; Prusak, 2001; Porter, 1998)</td>
</tr>
<tr>
<td></td>
<td>--Related regulatory changes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>--New entrants</td>
<td></td>
</tr>
<tr>
<td></td>
<td>--Competitors</td>
<td></td>
</tr>
<tr>
<td></td>
<td>--Suppliers and customers</td>
<td></td>
</tr>
<tr>
<td>Environment</td>
<td>Key business resource is knowledge, information, and ideas not capital,</td>
<td>(Fry et al., 2005; McNurlin &amp; Sprague Jr., 2006; Roth et al., 2006)</td>
</tr>
<tr>
<td></td>
<td>personnel, or facilities</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Employees understand the competitive business environment</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Continues incremental innovation and refinement of variety of ideas</td>
<td></td>
</tr>
<tr>
<td>Leadership</td>
<td>Employee retention and promotion</td>
<td>(Berson et al., 2006; Pearn et al., 1995)</td>
</tr>
<tr>
<td></td>
<td>Motivating employees through dynamic, creative management</td>
<td></td>
</tr>
<tr>
<td>Empowerment</td>
<td>Employee empowerment through negotiation</td>
<td>(Bridges, 1995; Conger &amp; Kanungo, 1988; Seibert et al., 2004)</td>
</tr>
<tr>
<td></td>
<td>Ways and means to measure employee creativity</td>
<td></td>
</tr>
<tr>
<td>Personal Mastery</td>
<td>Employees are encouraged to query and explore</td>
<td>(Senge, 2006; Senge et al., 1994)</td>
</tr>
<tr>
<td></td>
<td>Employees having problem identification, solving, and strategic brokerage skills</td>
<td></td>
</tr>
<tr>
<td>Shared Vision</td>
<td>Widespread support and acceptance of organisations mission statement</td>
<td>(Senge, 2006; Senge et al., 1994)</td>
</tr>
<tr>
<td>Team Learning</td>
<td>T- Management and groups from various functional areas to solve issues before discussing</td>
<td>(Senge, 2006; Senge et al., 1994)</td>
</tr>
<tr>
<td></td>
<td>with management</td>
<td></td>
</tr>
<tr>
<td>Systems Thinking</td>
<td>Employee understanding of overall business functions and implications of interventions</td>
<td>(Senge, 2006; Senge et al., 1994)</td>
</tr>
<tr>
<td>Subjective Knowledge</td>
<td>Regular publications and patent applications</td>
<td>(Bontis, 1998)</td>
</tr>
<tr>
<td></td>
<td>Embracing innovation through R&amp;D</td>
<td></td>
</tr>
<tr>
<td>Variable</td>
<td>Construct</td>
<td>Measurement of Construct</td>
</tr>
<tr>
<td>-----------------------</td>
<td>------------------------------------</td>
<td>---------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Employee Subjective</td>
<td>Experienced, highly educated, trustworthy, hard working, and open-minded employees working for a long time</td>
<td>(Cantrell et al., 2005)</td>
</tr>
<tr>
<td>Knowledge Knowledge</td>
<td>Supplier Subjective Knowledge</td>
<td>Strong, supportive, collaborative and encouraging suppliers</td>
</tr>
<tr>
<td></td>
<td>Customer Subjective Knowledge</td>
<td>Loyal customers willing to participate in new product or service development</td>
</tr>
<tr>
<td></td>
<td>Information Systems</td>
<td>Basic word processing systems to enterprise nervous systems</td>
</tr>
<tr>
<td></td>
<td>Socialisation Systems</td>
<td>Chat, messaging, conference, workflow systems, Shared services such as share point portal</td>
</tr>
<tr>
<td></td>
<td>Combination Systems</td>
<td>Corporate yellow pages, content management systems, document management systems, business intelligence systems</td>
</tr>
<tr>
<td></td>
<td>Externalisation Systems</td>
<td>Blog, data mining, text abstraction, classification and clustering systems</td>
</tr>
<tr>
<td></td>
<td>Internalisation Systems</td>
<td>E-learning systems, helpdesk systems, and knowledge databases</td>
</tr>
</tbody>
</table>

**Table 5-1 : Variables, Constructs and Measurements**
Four nominal scale variables namely, the role of the participant, size of the organisation, industry code, and the years in business were added to the scale for descriptive statistics as explained in Section 5.7.2.

5.3 Response Formatting

Response formatting is the way developed scale is presented to the participants to elicit response. Rea and Parker (2005, p. 52) say that question phrasing and formatting plays a vital role in obtaining maximum responses. The graded level of wording, use of ambiguous words and phrases, confusing questions, double-barrelled questions, manipulative questions, inappropriate emphasis, and emotional questions generally tend to reduce the response rate. Pamela and Settle (2004, p. 89) say that survey questions have to have three attributes: focus, brevity, and clarity. The scale discussed in Table 5-1 was converted into questions following the standards discussed by Alreck and Settle (2004) and Rea and Parker (2005).

Close ended questions with checkbox options were chosen for the nominal scale variables namely, role, size of the respondent’s organisation, years in business and organisation’s industry code.

Various scales, such as likert scale, variable frequency scale, ordinal scale, forced ranking scale, paired comparison scale, comparative scale, linear numeric scale, semantic differential scale, adjective checklist scale, semantic distance scale, fixed sum scale and combinatorial scales (Alreck & Settle, 2004) were tested for their
suitability and as discussed below, The Likert seven point scale was adopted for this research study.

**Likert Scale**

Rensis Likert (1932) developed a strict five point scale to measure a respondent’s attitude towards a given research question. Since 1932 the Likert scale has been used by the research community in conducting surveys of opinions, beliefs and attitudes (De Vellis, 2003, p. 79). The respondent’s opinion, belief or attitude towards a survey question or statement is generally captured using a ranked scale with three or more categories. Various methods are available for labelling the categories of which three are famous (Busch, 1993): explicit labelling of the scale categories, or categories may be left without any labelling so that the respondents mark the scale itself, and finally scale categories labelled only at the end points. Busch (1993) adds that the use of a numbered scale has become standard practice because people tend to think in terms of degrees.

Chang’s (1994) literature review reveals the efforts made in testing the reliability of three to eighteen category scales. Chang (1994) cites Cicchetti, Shoinralter and Tyrer (1985) and says that a seven category scale is more reliable than other scales.

In conclusion, the effectiveness of a Likert scale depends on item format (question or statement) (Alreck & Settle, 2004; Rea & Parker, 2005), category labelling (Busch, 1993), and the number of possible categories offered (L. Chang, 1994).
The aim of this survey is to validate the Knowledge Synchronisation Model (KSM) discussed in Chapter 4. The survey achieves its aim by testing eight hypotheses shown later in this chapter. Survey questions are designed to elicit the participants’ opinion about their organisations against each hypothesis and its constructs. The Likert scale is chosen for its simplicity and ease of use (De Vellis, 2003, p. 79). The Likert seven point category is chosen based on Chang’s (1994) work. The points are labelled 'Strongly Agree’, 'Agree’, 'Mildly Agree’, 'Neutral’, 'Mildly Disagree’, 'Disagree’ and ‘Strongly Disagree’ to address Busch’s (1993) concerns. The scale is shown in Table 5-2. An additional option is also provided to mark not applicable if appropriate.

The following section describes the procedure adopted to administer the questionnaire.

5.4 Survey Response Design

Once the questionnaire is designed, a number of ways exist to elicit survey responses like mail-out, web-base, telephone, in-person, intercept, and on-board, to administer the questionnaire (Rea & Parker, 2005).

Mail-out survey involves distribution of the printed questionnaires through post to the selected participants. The participants then respond to the survey by filling in the printed questionnaire and sending it back using the envelope supplied to
them with the survey. Telephone surveys involve a trained interviewer and selected respondents. The interviewer uses the telephone to communicate with the respondents. The interviewers need to be trained in appropriate use of the questionnaire and scope and depth of the required answers, so as to elicit data successfully. In-person surveys permit an interviewer to solicit information from a respondent face-to-face. The advantages of the in-person surveys include, flexibility, as the interviewer can provide detailed explanation, and the ability to make on-site observations which cannot be achieved by any other survey methods. Intercept surveys are a variation of in-person surveys in which the information is obtained from the respondents as they pass by public areas. On-board surveys are a type of intercept survey used for collecting information for transportation planning (Rea & Parker, 2005).

The above mentioned survey methods were not considered for this research due to the large sample size. Moreover, the sample is scattered around the world, which makes these methods invalid.

<table>
<thead>
<tr>
<th></th>
<th>In-person</th>
<th>Telephone</th>
<th>Web-based</th>
<th>Mail-out</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost</td>
<td>High</td>
<td>Medium</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>Time required</td>
<td>Medium</td>
<td>Low</td>
<td>Medium</td>
<td>High</td>
</tr>
<tr>
<td>Sample size for a given budget</td>
<td>Small</td>
<td>Medium</td>
<td>Large</td>
<td>Large</td>
</tr>
<tr>
<td>Data quantity per respondent</td>
<td>High</td>
<td>Medium</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>Reaches high proportion of public</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Reaches widely dispersed sample</td>
<td>No</td>
<td>Maybe</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Reaches special locations</td>
<td>Yes</td>
<td>Maybe</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Interaction with respondents</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Degree of interviewer bias</td>
<td>High</td>
<td>Medium</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Severity of non-response bias</td>
<td>Low</td>
<td>Low</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>Presentation of visual stimuli</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Maybe</td>
</tr>
<tr>
<td>Field-worker training required</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>

Table 5-3: Comparing Survey Types Source: (Alreck & Settle, 2004, p. 33)
Table 5-3 compares four survey types namely, in-person, telephone, web-based, and mail-out survey methods. It is clear that the web-based survey has a number of advantages over the other methods, such as low cost, able to reach widely dispersed sample and no interviewer bias (Alreck & Settle, 2004). Hence, the web-based survey was chosen as the method of data collection.

A website, [http://survey.lakkaraju.info](http://survey.lakkaraju.info) was set up for this study. The website consisted of four sections: home page, definitions, questionnaire and references.

The home page explained the aim and objectives of the survey. The home page also provided contact details of the survey administrators and the ethics committee representatives to address any concerns. The definitions page explained various terms, such as Learning Organisation, Knowledge Management Systems, Subjective Knowledge, knowledge manager, knowledge consumer, knowledge creator, knowledge editor, knowledge expert, knowledge broker and knowledge leader. This was followed by the actual questions. Finally, the reference page consisted of references used in developing the survey.

As mentioned earlier, the survey was administered in two phases. The first phase, a pilot, was conducted to test the scale reliability and format of the questionnaire. The second phase was conducted to collect the data for analysis. The following sections describe these two phases.
5.5 The Survey Instrument

5.5.1 Pilot Instrument

The purpose of the pilot instrument was to verify the scale readability and the questionnaire format. The pilot instrument was administered in a Knowledge Management community of practice, NSW-KM-Forum.

The initial instrument was divided into four sections: personal and organisational details, Subjective Knowledge, Knowledge Management Systems, and Learning Organisations.

The personal and organisational details section consisted of two open-ended questions: participant’s name and respondent’s organisation name, and five nominal scale variables, namely:

- **Participant’s role**: in the organisation according to Awad and Ghaziri (2004) and Rao (2005)
- **respondent’s organisation size**: according to Australian Bureau of Statistics (2005)
- **business type**
- **industry category**: according to Australian Bureau of Statistics (1993)
- **primary region**: of the business.

The sections of Subjective Knowledge, Knowledge Management Systems, and Learning Organisations were based on the constructs discussed in Section 5.2. The questionnaire consisted of fifty nine questions.
The NSW-KM-Forum is a not-for-profit Community of Practise (CoP) of Knowledge Management practitioners. Members include all types of knowledge workers (Awad & Ghaziri, 2004; Rao, 2005) drawn from around the world. The nature of the forum provided a perfect test-bed to evaluate the survey questionnaire. Two hundred and ninety five members subscribed to the forum’s mailing list. An e-mail invitation was sent to all the members requesting them to participate in the survey and to provide feedback concerning the quality of the survey questionnaire. Fifty responses, with numerous suggestions, were received. The final questionnaire, shown in Appendix B, was developed using this feedback.

The following section describes the final questionnaire, sample selection, and the data collection process.

5.5.2 Final Instrument

In the final instrument, shown in Appendix B, two open-ended questions, participant’s name and organisation’s name were used. The number of nominal variables was reduced to four: retaining, role, organisation size, years in business, and the industry code. The ‘primary region of business’ was removed as it was considered inappropriate. The values for the industry code were modified to follow the classification by the Australian Bureau of Statistics (ABS).

Most of the items in the questionnaire were rephrased for clarity and three more items were added making the final number of items to sixty two. The final instrument was as shown in Appendix B.
5.6 The Sample

Sampling, a key factor for any survey, means creating a subset from a larger group called the population. The aim of the survey was to assess the validity of the Knowledge Synchronisation Model (KSM) in practice. Population for this survey comprised of all the organisations in the world. The snowball sampling technique is used to select a smaller sample that best represented the entire population. Following is a brief discussion on sampling techniques.

Two different types of sampling methods are available: probability sampling and non probability sampling. Probability sampling uses a random selection function and provides a statistical basis for a sample to be representative of the target population (Fink, 1995-a, p. 9), thereby allowing generalisation of the survey findings. Non probability sampling, where the sample is chosen based on the characteristics of the target population, does not guarantee that the survey findings are applicable to the general population.

The NSW-KM-Forum, a Community of Practice (CoP) of Knowledge Management professionals, has been chosen to validate the initial instrument in the first phase. The diversity in range and expertise of the forum members and the organisations they represented created a well balanced focus group for this research study.

Suggestions from the pilot study made it clear that most organisations do apply Knowledge Management tools and techniques but under different banners, such as process reengineering and human performance development. Hence, a non
probability sampling technique namely, snowball sampling was chosen as the sampling method for the final study. The advantages of the snowball technique are shown in Table 5-4 (Fink, 1995-a, pp. 22-23) which describes various sampling techniques and their merits and demerits.

The snowball sampling technique uses previously identified members to identify future members of the population. The NSW-KM-Forum was used as the starting point. Members of the forum were requested to forward the invitation to future participants. Fifteen hundred organisations were contacted and four hundred and seventy usable responses for analysis were received.

The drawbacks of the snowball sampling technique are two fold:

- the sample can be biased due to the biased recommendations of current members
- the researcher cannot control the sample

The drawbacks of the snowball technique were overcome through action research studies. The action research studies are described in Chapter 6.
### Description

<table>
<thead>
<tr>
<th>Description</th>
<th>Benefits</th>
<th>Issues</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Probability sampling:</strong> simple random sampling, every unit has an equal chance of selection</td>
<td>Relatively simple to do</td>
<td>Members of a subgroup of interest may not be included in appropriate proportions.</td>
</tr>
<tr>
<td><strong>Stratified random sampling:</strong> the study population is grouped according to meaningful characteristics of strata</td>
<td>Can conduct analysis of subgroups Sampling variations are lower than that for random sampling; the sample is more likely to reflect the population</td>
<td>Must calculate sample sizes for each subgroup. Can be time consuming and costly to implement if many subgroups are necessary.</td>
</tr>
<tr>
<td><strong>Systematic sampling:</strong> every Nth unit in a list is selected. N is determined by the size of the population divided by the desired sample size</td>
<td>Convenient; use existing list as sampling frame. Similar to random sampling if starting point is randomly chosen.</td>
<td>Must watch for recurring patterns within the sampling framework.</td>
</tr>
<tr>
<td><strong>Cluster/ Multi stage sampling:</strong> natural groups of clusters are sampled, with members of each selected sub group sub sampled afterward.</td>
<td>Convenient; use existing units as sampling frame</td>
<td></td>
</tr>
<tr>
<td><strong>Non-probability sampling:</strong> Convenience sampling, use a group of individuals or units that is readily available</td>
<td>A practical method because you rely on readily available units.</td>
<td>Because sample is opportunistic and voluntary, participants may be unlike most of the constituents in the target population.</td>
</tr>
<tr>
<td><strong>Snowball sampling:</strong> previously identified members identify other members of the population</td>
<td>Useful when a list of names for sampling is difficult or impractical to obtain.</td>
<td>Recommendations may produce a biased sample. Little or no control over who is named.</td>
</tr>
<tr>
<td><strong>Quota sampling:</strong> the population is divided into subgroups. A sample is selected based on the proportions of subgroups needed to represent the proportions in the population.</td>
<td>Practical if reliable data exist to describe proportions.</td>
<td>Records must be up-to-date to get accurate proportions.</td>
</tr>
<tr>
<td><strong>Focus groups:</strong> groups of 12 to 20 people serve as representatives of the population.</td>
<td>Useful in guiding survey development.</td>
<td>Must be certain the relatively small group is a valid reflection of the larger group that will be surveyed.</td>
</tr>
</tbody>
</table>

Table 5-4: Sampling Techniques (Fink, 1995-a, pp. 22-23)
5.7 Data Analysis

The data from the five hundred and ten responses received was analysed using software package named Statistical Package for Social Sciences (SPSS). The nominal questions were analysed using the descriptive statistics function. The scale reliability was tested using Cronbach’s alpha. Organisations were classified into clusters to measure the gap between an organisation and a Learning Organisation. Finally, the hypotheses were tested using regression analysis technique. The following section discusses the scale reliability.

5.7.1 Scale Reliability

Cronbach’s coefficient alpha was chosen to measure the scale reliability, or internal consistency. Table 5-5, shown below, confirms the reliability of the scale chosen.
<table>
<thead>
<tr>
<th>Concept</th>
<th>Construct</th>
<th>Number of items</th>
<th>Factor loadings</th>
<th>Item-to-total correlation</th>
<th>Cronbach’s alpha</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Learning Organisation</strong></td>
<td>Awareness</td>
<td>3</td>
<td>0.63 ~ 0.71</td>
<td>0.56~0.64</td>
<td>0.76</td>
</tr>
<tr>
<td></td>
<td>Environment</td>
<td>3</td>
<td>0.62~0.80</td>
<td>0.51~0.68</td>
<td>0.78</td>
</tr>
<tr>
<td></td>
<td>Leadership</td>
<td>3</td>
<td>0.63 ~ 0.75</td>
<td>0.58~0.69</td>
<td>0.78</td>
</tr>
<tr>
<td></td>
<td>Empowerment</td>
<td>3</td>
<td>0.67~0.85</td>
<td>0.58~0.77</td>
<td>0.83</td>
</tr>
<tr>
<td></td>
<td>Personal Mastery</td>
<td>3</td>
<td>0.69 ~ 0.72</td>
<td>0.60~0.64</td>
<td>0.78</td>
</tr>
<tr>
<td></td>
<td>Shared Vision</td>
<td>3</td>
<td>0.64~0.79</td>
<td>0.54~0.68</td>
<td>0.78</td>
</tr>
<tr>
<td></td>
<td>Team Learning</td>
<td>3</td>
<td>0.72 ~ 0.78</td>
<td>0.66 ~0.72</td>
<td>0.83</td>
</tr>
<tr>
<td></td>
<td>Systems Thinking</td>
<td>3</td>
<td>0.76~0.83</td>
<td>0.66~0.74</td>
<td>0.84</td>
</tr>
<tr>
<td><strong>Knowledge Management Systems</strong></td>
<td>Information</td>
<td>4</td>
<td>0.75~0.80</td>
<td>0.56~0.69</td>
<td>0.82</td>
</tr>
<tr>
<td></td>
<td>Socialisation</td>
<td>4</td>
<td>0.74 ~ 0.80</td>
<td>0.63~0.73</td>
<td>0.83</td>
</tr>
<tr>
<td></td>
<td>Internalisation</td>
<td>4</td>
<td>0.76~0.81</td>
<td>0.62~0.73</td>
<td>0.83</td>
</tr>
<tr>
<td></td>
<td>Externalisation</td>
<td>4</td>
<td>0.74~0.77</td>
<td>0.59~0.64</td>
<td>0.80</td>
</tr>
<tr>
<td></td>
<td>Combination</td>
<td>4</td>
<td>0.75~0.78</td>
<td>0.61~0.66</td>
<td>0.82</td>
</tr>
<tr>
<td><strong>Subjective Knowledge</strong></td>
<td>Process</td>
<td>6</td>
<td>0.87~0.89</td>
<td>0.67~0.76</td>
<td>0.90</td>
</tr>
<tr>
<td></td>
<td>Employee</td>
<td>6</td>
<td>0.81~0.85</td>
<td>0.58~0.78</td>
<td>0.86</td>
</tr>
<tr>
<td></td>
<td>Supplier</td>
<td>4</td>
<td>0.72~0.80</td>
<td>0.52~0.69</td>
<td>0.81</td>
</tr>
<tr>
<td></td>
<td>Customer</td>
<td>5</td>
<td>0.80 ~ 0.84</td>
<td>0.57~0.69</td>
<td>0.84</td>
</tr>
</tbody>
</table>

Table 5-5: Scale Reliability
5.7.2 Descriptive Statistics

Descriptive statistics of the four nominal questions, namely, participant’s role in the organisation, size of the organisation, years in business, and the industry code are discussed below.

Role: Literature survey identified ten different roles of knowledge workers (Awad & Ghaziri, 2004; Rao, 2005): knowledge manager, knowledge broker, knowledge consumer, knowledge creator, knowledge editor, knowledge expert, knowledge leader, senior management involved in knowledge management initiatives, CIO/CKO, and knowledge management consultants. The survey elicited data from all these types of knowledge workers. Moreover, a category ‘other’ was added to the list to include any new roles emerged in the recent past.

Four hundred and eighty two responses were duly filled and twenty eight respondents had not supplied their roles. Two hundred and fifty six knowledge managers accounting for 50.2% overall and 53.1% valid responses, seventy one consultants accounting for 13.9% overall and 14.7% valid responses, thirty six knowledge experts accounting for 7.1% overall and 7.5% valid responses, thirty four senior management personnel accounting for 6.7% overall and 7.1% valid responses, twenty seven knowledge brokers accounting for 5.3% overall and 5.6% valid responses, fifteen knowledge creators accounting for 2.9% over all and 3.1% valid responses, seven knowledge consumers accounting for 1.4% over all and 1.5% valid responses, six knowledge editors accounting for 1.2% overall and valid responses and three Chief Information Officer (CIO)/Chief Knowledge
Officers (CKO) participated in the survey, accounting for 0.6% overall valid responses participated in the survey.

Two new roles of the knowledge workers namely knowledge management business analyst and knowledge specialist were identified through the ‘other’ category: Twelve of the survey participants identified themselves as 'knowledge management business analysts’ and eight identified as 'knowledge specialists’, under the 'other’ category. Table 5-6 describes and Figure 5-1 pictorially presents the types of knowledge workers and their frequencies.

<table>
<thead>
<tr>
<th>Role</th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valid Knowledge Manager</td>
<td>256</td>
<td>50.2</td>
<td>53.1</td>
<td>53.1</td>
</tr>
<tr>
<td>Consultant</td>
<td>71</td>
<td>13.9</td>
<td>14.7</td>
<td>67.8</td>
</tr>
<tr>
<td>Knowledge Expert</td>
<td>36</td>
<td>7.1</td>
<td>7.5</td>
<td>75.3</td>
</tr>
<tr>
<td>Senior Management</td>
<td>34</td>
<td>6.7</td>
<td>7.1</td>
<td>82.4</td>
</tr>
<tr>
<td>Knowledge Broker</td>
<td>27</td>
<td>5.3</td>
<td>5.6</td>
<td>88.0</td>
</tr>
<tr>
<td>Other</td>
<td>27</td>
<td>5.3</td>
<td>5.6</td>
<td>93.6</td>
</tr>
<tr>
<td>Knowledge Creator</td>
<td>15</td>
<td>2.9</td>
<td>3.1</td>
<td>96.7</td>
</tr>
<tr>
<td>Knowledge Consumer</td>
<td>7</td>
<td>1.4</td>
<td>1.5</td>
<td>98.1</td>
</tr>
<tr>
<td>Knowledge Editor</td>
<td>6</td>
<td>1.2</td>
<td>1.2</td>
<td>99.4</td>
</tr>
<tr>
<td>CIO/CKO</td>
<td>3</td>
<td>.6</td>
<td>.6</td>
<td>100.0</td>
</tr>
<tr>
<td>Total</td>
<td>482</td>
<td>94.5</td>
<td>100.0</td>
<td></td>
</tr>
<tr>
<td>Missing System</td>
<td>28</td>
<td>5.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>510</td>
<td>100.0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 5-6: Participant’s Role Frequency
Size: Australian Bureau of Statistics (2005, p. 5) classifies organisations into three categories based on the employee numbers: small organisations with less than 20 employees; medium organisations with employees between 20 and 199 and large organisations with employees more than or equal to 200. The questionnaire though targeted at international audience, adopted the same standard in classifying the participating organisations.

Out of the four hundred and ninety four responses that were duly filled, two hundred and ninety three large organisations accounting for 57.5% total and 59.3% valid responses, one hundred and fifty medium organisations accounting for 29.4% total and 30.4% valid responses and fifty one small organisations accounting for 10.0% total and 10.3% valid responses participated in the survey.
Sixteen of the participants accounting for 3.1% of the total responses had not answered this question. Table 5-7 describes and Figure 5-2 pictorially represents the frequencies of the small, medium and large organisations participated in the survey.

<table>
<thead>
<tr>
<th>Size of the Organisation</th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valid</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Large</td>
<td>293</td>
<td>57.5</td>
<td>59.3</td>
<td>59.3</td>
</tr>
<tr>
<td>Medium</td>
<td>150</td>
<td>29.4</td>
<td>30.4</td>
<td>89.7</td>
</tr>
<tr>
<td>Small</td>
<td>51</td>
<td>10.0</td>
<td>10.3</td>
<td>100.0</td>
</tr>
<tr>
<td>Total</td>
<td>494</td>
<td>96.9</td>
<td>100.0</td>
<td></td>
</tr>
<tr>
<td>Missing System</td>
<td>16</td>
<td>3.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>510</td>
<td>100.0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 5-7: Participating Organisation’s Size

[Bar graph showing frequency of small, medium, and large organisations]

**Figure 5-2: Size of the Participating Organisations**

**Years in business:** Organisations were classified into four categories based on their age. The four categories namely, less than one year, one to three years, three to ten years, and more than ten years, were chosen as the scale. Out of the four hundred and eighty nine responses that were duly filled, fifty seven organisations were in the group of age less than one year, accounting for 11.2% total and 11.7%
valid responses, twenty four organisations accounting for 4.7% total and 4.9% valid responses, were in the group of age between one to three years. Two hundred and fifteen organisations, accounting for 42.2% total and 44% valid responses, were in the group of age between three and ten years. One hundred and ninety three organisations were in the group of age more than ten years accounting for 37.8% total and 39.5% valid responses have responded to the survey. Twenty one participants, accounting for 4.1% of total responses, had not answered this question. Table 5-8 describes and Figure 5-3 pictorially presents distribution of the participating organisations.

<table>
<thead>
<tr>
<th>Years in Business</th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valid 3-10 Years</td>
<td>215</td>
<td>42.2</td>
<td>44.0</td>
<td>44.0</td>
</tr>
<tr>
<td>More than 10 Years</td>
<td>193</td>
<td>37.8</td>
<td>39.5</td>
<td>83.4</td>
</tr>
<tr>
<td>Less than 1 Year</td>
<td>57</td>
<td>11.2</td>
<td>11.7</td>
<td>95.1</td>
</tr>
<tr>
<td>1-3 Years</td>
<td>24</td>
<td>4.7</td>
<td>4.9</td>
<td>100.0</td>
</tr>
<tr>
<td>Total</td>
<td>489</td>
<td>95.9</td>
<td>100.0</td>
<td></td>
</tr>
<tr>
<td>Missing System</td>
<td>21</td>
<td>4.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>510</td>
<td>100.0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 5-8: Participating Organisation's Age

Figure 5-3: Participating Organisation's Age
Industry code: Australian Bureau of Statistics (1993) classifies Australian and New Zealand organisations into seventeen categories. These categories were adopted for classifying the participating organisations. Moreover, another category “other” was provided to accommodate the international audience.

Australian Bureau of Statistics (2006, p. 41) provides a slightly different classification of nineteen categories. The latest classification was ignored due to the time limitations posed on this research study. However, the variable industry code was only used for the sake of future research and thus not crucial for this research study.

Out of the four hundred and ninety four responses that were duly filled, eighty four organisations belonging to the agriculture, forestry and fishing industry accounting for 16.5% total and 17% valid responses, eighty one organisations belonging to the government administration and defence accounting for 15.9% total and 16.4% valid responses, fifty two organisations belonging to the finance and insurance sector accounting for 10.2% total and 10.5% valid responses, thirty three organisations belonging to the communication services sector accounting for 6.5% total and 6.7% valid responses, twenty nine organisations belonging to the education sector accounting for 5.7% total and 5.9% valid responses, twenty four organisations belonging to construction sector accounting for 4.7% total and 4.9% valid responses, twenty one organisations belonging to the electricity, gas and water supply sector accounting for 4.1% total and 4.3% valid responses, fifteen organisations belonging to the accommodation, cafes and restaurants sector accounting for 2.9% total and 3.0% valid responses, nine organisations each from
sectors mining, manufacturing, wholesale trade, transport and storage, and personal and other services accounting for 1.8% total and valid responses and three organisations each from property and business, and health and community services sectors accounting for 0.6% total and valid responses responded to the survey.

One hundred and four organisations identified themselves as belonging to “other” category accounting for 20.4% total and 21.1% valid responses. This could be due to the new classification of the Australian Bureau of Statistics (2006, p. 41) or due to the international participation. Table 5-9 describes Figure 5-4 presents the frequency distribution of participating organisations.
### Table 5-9: Frequencies of Participating Industries as per ABS Classification

<table>
<thead>
<tr>
<th>Industry Code</th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valid Other</td>
<td>104</td>
<td>20.4%</td>
<td>21.1%</td>
<td>21.1%</td>
</tr>
<tr>
<td>Agriculture, Forestry and Fishing</td>
<td>84</td>
<td>16.5%</td>
<td>17.0%</td>
<td>38.1%</td>
</tr>
<tr>
<td>Government Administration and Defence</td>
<td>81</td>
<td>15.9%</td>
<td>16.4%</td>
<td>54.5%</td>
</tr>
<tr>
<td>Finance and Insurance</td>
<td>52</td>
<td>10.2%</td>
<td>10.5%</td>
<td>65.0%</td>
</tr>
<tr>
<td>Communication Services</td>
<td>33</td>
<td>6.5%</td>
<td>6.7%</td>
<td>71.7%</td>
</tr>
<tr>
<td>Education</td>
<td>29</td>
<td>5.7%</td>
<td>5.9%</td>
<td>77.5%</td>
</tr>
<tr>
<td>Construction</td>
<td>24</td>
<td>4.7%</td>
<td>4.9%</td>
<td>82.4%</td>
</tr>
<tr>
<td>Electricity, Gas and Water Supply</td>
<td>21</td>
<td>4.1%</td>
<td>4.3%</td>
<td>86.6%</td>
</tr>
<tr>
<td>Accommodation, Cafes and Restaurants</td>
<td>15</td>
<td>2.9%</td>
<td>3.0%</td>
<td>89.7%</td>
</tr>
<tr>
<td>Mining</td>
<td>9</td>
<td>1.8%</td>
<td>1.8%</td>
<td>91.5%</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>9</td>
<td>1.8%</td>
<td>1.8%</td>
<td>93.3%</td>
</tr>
<tr>
<td>Wholesale Trade</td>
<td>9</td>
<td>1.8%</td>
<td>1.8%</td>
<td>95.1%</td>
</tr>
<tr>
<td>Transport and Storage</td>
<td>9</td>
<td>1.8%</td>
<td>1.8%</td>
<td>97.0%</td>
</tr>
<tr>
<td>Personal and Other Services</td>
<td>9</td>
<td>1.8%</td>
<td>1.8%</td>
<td>98.8%</td>
</tr>
<tr>
<td>Property and Business Services</td>
<td>3</td>
<td>0.6%</td>
<td>0.6%</td>
<td>99.4%</td>
</tr>
<tr>
<td>Health and Community Services</td>
<td>3</td>
<td>0.6%</td>
<td>0.6%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Total</td>
<td>494</td>
<td>96.9%</td>
<td>100.0%</td>
<td></td>
</tr>
<tr>
<td>Missing System</td>
<td>16</td>
<td>3.1%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>510</td>
<td>100.0%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 5-4: Frequencies of Participating Industries
5.7.3 Cluster Formation

One of the survey aims was measurement of the gap between a typical organisation and a Learning Organisation. The Knowledge Synchronisation Model (KSM) measures the gap in terms of missing constructs, such as Awareness, Environment, Leadership, Empowerment, Personal Mastery, Shared Vision, Team Learning, and Systems Thinking. According to Knowledge Synchronisation Model these missing constructs are due to knowledge synchronisation problems arising from an unbalanced combination of organisation’s Subjective Knowledge and Knowledge Management Systems. Knowledge synchronisation in organisations allows the instillation or enhancement of any missing construct. Following this discussion, organisations were classified into following four clusters:

- Learning Organisations;
- organisations leaning towards Knowledge Management Systems development;
- organisations leaning towards Subjective Knowledge development; and
- organisations with no proper direction.

The Knowledge Synchronisation Model (KSM) being unique and the scale developed for this study being new, unsupervised clustering techniques were adopted for data classification. An unsupervised clustering technique, namely, K-means algorithm was adopted for clustering purpose.

The statistical techniques available for unsupervised clustering were partition-based clustering and hierarchical clustering. Partition based clustering focuses on
clustering data into specified number of clusters based on its characteristics. K-means algorithm and soft K-means algorithm are the two most popular unsupervised clustering algorithms. Hierarchical clustering gradually merges the data samples based on their characteristics, thereby creating as many clusters as possible. Agglomerative methods and divisive methods are used in hierarchical clustering (Hand, Mannila, & Smyth, 2001, pp. 293-326). After reviewing these clustering techniques, a partition-based clustering technique namely, K-means algorithm was chosen for the purpose of data classification. The following is a brief description of the K-means algorithm.

K-Means Algorithm

K-means clustering algorithm, initially proposed by MacQueen (1967), is a simple statistical technique used to create clusters based on similar characteristics. Hartigan (1975), Hartigan and Wong (1979), Kanungo et al.,(2002), Alsabti, Ranka and Singh (1998), and Lloyd (1982) are the variants of K-means algorithm used in statistical packages nowadays. This study used intelligent Data Analyser (iDA) and Statistical Package for Social Sciences (SPSS) for data analysis. Lloyd (1982) was adopted by iDA and Hartigan (1975) was adopted by SPSS.

Hartigan (1975), K-means algorithm consists of the following three steps:

- Select the initial cluster centres;
- Update initial cluster centres; and
- Assign cases to the nearest cluster

The above process is repeated until required numbers of clusters are formed.
Participating organisations were classified into four clusters using SPSS classify option, depending on their responses to the Learning Organisation characteristics. The data analysis presented in Table 5-12 shows that all eight constructs play a vital role in differentiating the cases into clusters.

Table 5-10 portrays the four clusters and presence of the constructs. Construct value ‘1’ means that the organisation agrees to the existence of that construct. Construct value ‘2’ means that the organisation neither agree nor disagree to the existence of such construct. Construct value ‘3’ means that the organisation denies existence of the construct.

Organisational awareness for example, was present in organisations belonging to cluster two. Organisations in cluster one and four had a neutral view over the existence of awareness within their organisations. Organisations in cluster three completely denied existence of awareness within them.

Organisations in cluster two agreed that all the eight constructs of Learning Organisations were present within them, hence were Learning Organisations. Organisations in cluster one and four agreed that some of the constructs were present within them and had a neutral view on the presence of the rest. Organisations in cluster three denied presence of many of the constructs and had a neutral view on some of the constructs. Organisations in cluster one, three, and four thus demonstrate knowledge gaps or knowledge synchronisation problems.
According to the Knowledge Synchronisation Model (KSM), the above mentioned knowledge gaps were due to the integration of Subjective Knowledge and Knowledge Management Systems within those organisations. High integration of Knowledge Management Systems and Subjective Knowledge lead to the formation of cluster two. A combination of high or low Knowledge Management Systems and high or low Subjective Knowledge lead to the formation of clusters one and four and finally, a low and low integration of Knowledge Management Systems and Subjective Knowledge lead to the formation of cluster three. Section 5.8 validates the hypotheses to substantiate this argument.
Table 5-10: Participating Organisations Classified into Clusters

<table>
<thead>
<tr>
<th>Cluster</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Awareness - LO 1</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Environment- LO 2</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Leadership- LO 3</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Empowerment- LO 4</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Personal Mastery- LO 5</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Shared Vision- LO 6</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Team Learning- LO 7</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Systems Thinking- LO 8</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>2</td>
</tr>
</tbody>
</table>

Table 5-11: Number of Organisations in each Cluster

<table>
<thead>
<tr>
<th>Cluster</th>
<th>Valid</th>
<th>Missing</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>87.000</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>227.000</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>78.000</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>78.000</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>470.000</td>
<td></td>
</tr>
</tbody>
</table>

Table 5-12: Learning Organisations Construct Significance

<table>
<thead>
<tr>
<th>Cluster</th>
<th>Mean Square</th>
<th>df</th>
<th>Mean Square</th>
<th>df</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Awareness - LO 1</td>
<td>13.662</td>
<td>3</td>
<td>.146</td>
<td>466</td>
<td>94.286</td>
<td>.000</td>
</tr>
<tr>
<td>Environment- LO 2</td>
<td>10.562</td>
<td>3</td>
<td>.108</td>
<td>466</td>
<td>97.647</td>
<td>.000</td>
</tr>
<tr>
<td>Leadership- LO 3</td>
<td>8.731</td>
<td>3</td>
<td>.144</td>
<td>466</td>
<td>60.778</td>
<td>.000</td>
</tr>
<tr>
<td>Empowerment- LO 4</td>
<td>17.329</td>
<td>3</td>
<td>.087</td>
<td>466</td>
<td>198.431</td>
<td>.000</td>
</tr>
<tr>
<td>Personal Mastery- LO 5</td>
<td>19.945</td>
<td>3</td>
<td>.038</td>
<td>466</td>
<td>524.230</td>
<td>.000</td>
</tr>
<tr>
<td>Shared Vision- LO 6</td>
<td>10.608</td>
<td>3</td>
<td>.150</td>
<td>466</td>
<td>70.677</td>
<td>.000</td>
</tr>
<tr>
<td>Team Learning- LO 7</td>
<td>15.977</td>
<td>3</td>
<td>.135</td>
<td>466</td>
<td>118.376</td>
<td>.000</td>
</tr>
<tr>
<td>Systems Thinking- LO 8</td>
<td>27.176</td>
<td>3</td>
<td>.052</td>
<td>466</td>
<td>520.704</td>
<td>.000</td>
</tr>
</tbody>
</table>
5.8 Hypotheses Validation

As discussed in Chapter 4, the Knowledge Synchronisation Model was constructed using eight hypotheses. Multiple regression technique was used to validate these hypotheses. The following sections describe individual hypothesis validation.

5.8.1 Hypothesis 1

Awareness of Learning Organisations is strongly associated with employee Subjective Knowledge and Combination Systems.

As evident from Table 5-10, the organisations in cluster two agreed to the presence of high organisational awareness and thus they could be termed Learning Organisations. Organisations in cluster one and four subscribed to neutral view, whereas organisations in cluster three indicated absence of organisational awareness within them.

According to the Knowledge Synchronisation Model (KSM), organisational awareness is due to the integration of employee Subjective Knowledge and Combination Systems within that organisation. High awareness can be achieved by the synchronisation of high employee Subjective Knowledge and sophisticated Combination Systems such as expert locators (Maybury et al., 2002), and question answer systems (Iske, 2005). Organisations leaning towards development of high Subjective Knowledge or high Combination Systems, ignoring the other construct would result in knowledge gaps and consequently knowledge synchronisation problems within them.
The above argument was tested using the survey data. The correlation between organisation’s awareness and the integration of its employee Subjective Knowledge and Combination Systems was tested. The following sections describe data analysis in all four clusters using multiple regression technique. Awareness was the dependent variable; employee Subjective Knowledge and Combination Systems were independent variables.

Cluster 1:

All the eighty seven cases in cluster one were considered for data analysis. The total correlation between independent and dependent variables (R) was 81%, and the model could predict 66% of the cases as shown in Table 5-13. The model was significant, F= 82.54 at P <0.001, as shown in Table 5-14.

<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.814(^a)</td>
<td>.663</td>
<td>.655</td>
<td>.089</td>
</tr>
</tbody>
</table>

\(^a\) Predictors: (Constant), KMS 4, SK 1

Table 5-13: Hypothesis 1 – Cluster 1 – Model Summary

‘Organisational Awareness = 0.653 + 0.116 (employee Subjective Knowledge) + 0.665 (Combination Systems)’ was the multiple regression equation generated from Table 5-15. The equation made it evident that the variable ’Combination Systems’ was the significant factor and the variable ’employee Subjective Knowledge’ was least significant in creating this model. Hence, it was concluded
that the neutrality of organisational awareness in cluster 1 was due to high technology contribution and low/nil Subjective Knowledge contribution.

**ANOVA\(^{a,b,c}\)**

<table>
<thead>
<tr>
<th>Model</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression</td>
<td>1.295</td>
<td>2</td>
<td>.648</td>
<td>82.544</td>
<td>.000*</td>
</tr>
<tr>
<td>Residual</td>
<td>.659</td>
<td>84</td>
<td>.008</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>1.954</td>
<td>86</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\(^{a}\) Predictors: (Constant), KMS 4, SK 1  
\(^{b}\) Dependent Variable: Awareness - LO 1  
\(^{c}\) Selecting only cases for which Cluster Number of Case = 1

**Table 5-14: Hypothesis 1 – Cluster 1 – Model Significance**

**Coefficients\(^{a,b}\)**

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
<th>t</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>Std. Error</td>
<td>Beta</td>
<td></td>
</tr>
<tr>
<td>1 (Constant)</td>
<td>.653</td>
<td>.104</td>
<td>6.298</td>
<td>.000</td>
</tr>
<tr>
<td>SK 1</td>
<td>.116</td>
<td>.012</td>
<td>.063</td>
<td>9.642</td>
</tr>
<tr>
<td>KMS 4</td>
<td>.665</td>
<td>.052</td>
<td>.810</td>
<td>12.772</td>
</tr>
</tbody>
</table>

\(^{a}\) Dependent Variable: Awareness - LO 1  
\(^{b}\) Selecting only cases for which Cluster Number of Case = 1

**Table 5-15: Hypothesis 1 – Cluster 1 – Regression Equation Coefficients**

**Cluster 2:**

All the two hundred and twenty seven cases from cluster two were considered for data analysis. The total correlation between independent variables and the dependent variable (R) was 96%, and the model could predict 92% of the cases in the cluster as shown in Table 5-16. The model was significant, F= 1362.117 at P <0.001, as shown in Table 5-17.
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Table 5-16: Hypothesis 1 – Cluster 2 – Model Summary

<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cluster Number of Case = 2 (Selected)</td>
<td>.961 a</td>
<td>.924</td>
<td>.132</td>
</tr>
</tbody>
</table>

a. Predictors: (Constant), KMS 4, SK 1

Table 5-17: Hypothesis 1 – Cluster 2 – Model Significance

<table>
<thead>
<tr>
<th>Model</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression</td>
<td>47.308</td>
<td>2</td>
<td>23.654</td>
<td>1362.117</td>
<td>.000 a</td>
</tr>
<tr>
<td>Residual</td>
<td>3.890</td>
<td>224</td>
<td>.017</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>51.198</td>
<td>226</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a. Predictors: (Constant), KMS 4, SK 1
b. Dependent Variable: Awareness - LO 1
c. Selecting only cases for which Cluster Number of Case = 2

Table 5-18: Hypothesis 1 – Cluster 2 – Regression Equation Coefficients

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
<th>t</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>Std. Error</td>
<td>Beta</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>(Constant)</td>
<td>4.500E-02</td>
<td>.030</td>
<td>1.505</td>
</tr>
<tr>
<td>SK 1</td>
<td>.864</td>
<td>.059</td>
<td>.850</td>
<td>14.645</td>
</tr>
<tr>
<td>KMS 4</td>
<td>.973</td>
<td>.049</td>
<td>.960</td>
<td>19.857</td>
</tr>
</tbody>
</table>

a. Dependent Variable: Awareness - LO 1
b. Selecting only cases for which Cluster Number of Case = 2

‘Organisational Awareness = 0.864 (employee Subjective Knowledge) + 0.973 (Combination Systems) + 0.045’ was the multiple regression equation generated from Table 5-18. The equation makes it evident that the variables ‘Combination Systems’ and ‘employee Subjective Knowledge’ both were significant in creating
this model. Hence, it was concluded that the organisational awareness in cluster two was due to high technology and high Subjective Knowledge integration.

**Cluster 3:**

All the seventy eight cases from cluster three were considered for data analysis. A correlation does not exist between the dependent variable and independent variables as shown in Table 5-19. Hence, it was concluded that the lack of organisational awareness in cluster three was due to the integration of low technology and low Subjective Knowledge.

**Warnings**

The dependent variable Awareness - LO 1 has been deleted. Statistics cannot be computed.

| Table 5-19: Hypothesis 1– Cluster 3 – SPSS Output |

**Cluster 4:**

All the seventy eight cases from cluster four were considered for data analysis. The total correlation between independent variables and the dependent variable (R) was 80%, and the model could predict 64% of the cases in cluster four as shown in Table 5-20. The model was significant, F= 69.152 at P <0.001, as shown in Table 5-21.

<table>
<thead>
<tr>
<th>Model</th>
<th>R Cluster Number of Case = 4 (Selected)</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.805&lt;sup&gt;a&lt;/sup&gt;</td>
<td>.648</td>
<td>.639</td>
<td>.260</td>
</tr>
</tbody>
</table>

<sup>a</sup> Predictors: (Constant), KMS- Combination- KMS 4, Employee Capital- SK 1

| Table 5-20: Hypothesis 1 – Cluster 4 – Model Summary |
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ANOVA\textsuperscript{b,c}

<table>
<thead>
<tr>
<th>Model</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression</td>
<td>9.319</td>
<td>2</td>
<td>4.659</td>
<td>69.152</td>
<td>.000\textsuperscript{a}</td>
</tr>
<tr>
<td>Residual</td>
<td>5.053</td>
<td>75</td>
<td>.067</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>14.372</td>
<td>77</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\textsuperscript{a} Predictors: (Constant), KMS 4, SK 1
\textsuperscript{b} Dependent Variable: Awareness - LO 1
\textsuperscript{c} Selecting only cases for which Cluster Number of Case = 4

Table 5-21: Hypothesis 1 – Cluster 4 – Model Significance

‘Organisational Awareness = 0.486 + 0.726 (employee Subjective Knowledge) + 0.033 (Combination Systems)’ was the multiple regression equation generated from Table 5-22. The equation makes it evident that the variable ‘employee Subjective Knowledge’ was the most significant factor and the variable ‘Combination Systems’ was insignificant in creating this model. Hence, it was concluded that the neutral view about awareness by the organisations in cluster four was due to high Subjective Knowledge development and low technology development.

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
<th>t</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>Std. Error</td>
<td>Beta</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>(Constant)</td>
<td>.486</td>
<td>.121</td>
<td>.798</td>
</tr>
<tr>
<td>SK 1</td>
<td>.726</td>
<td>.063</td>
<td>.960</td>
<td>11.618</td>
</tr>
<tr>
<td>KMS 4</td>
<td>3.296E-02</td>
<td>.034</td>
<td>.066</td>
<td>.960</td>
</tr>
</tbody>
</table>

\textsuperscript{a} Dependent Variable: Awareness - LO 1
\textsuperscript{b} Selecting only cases for which Cluster Number of Case = 4

Table 5-22: Hypothesis 1 – Cluster 4 – Regression Equation Coefficients

Effect of Knowledge Synchronisation on Awareness

The effect of knowledge synchronisation on the construct awareness was clearly demonstrated by this survey data analysis as detailed below:
• Organisations in cluster one developed Combination Systems to create awareness within them and paid little attention to the development of employee Subjective Knowledge. This created a knowledge gap which resulted in their neutral view to the characteristic of organisational awareness.

• Organisations in cluster two developed Combination Systems as well as employee Subjective Knowledge resulting in high organisational awareness. This knowledge synchronisation resulted in their agreement to the existence of the construct awareness.

• It is safe to say that the organisations in cluster three developed low technology and low employee Subjective Knowledge towards the creation of awareness. This created a knowledge gap which resulted in the absence of the construct awareness.

• The organisations in cluster four developed employee Subjective Knowledge and paid little attention to the development of technology towards the creation of awareness. This created a knowledge gap which resulted in their neutral view towards the construct awareness.

5.8.2 Hypothesis 2

‘Environment’ of Learning Organisations is strongly associated with process Subjective Knowledge, employee Subjective Knowledge, Information Systems and Socialisation Systems.
As evident from Table 5-10 the organisations in clusters one, two and four agreed to the presence of the construct ‘environment’ within them. Organisations in cluster 3 reported neutral view towards the construct ‘environment’.

According to the Knowledge Synchronisation Model (KSM), environment depends on the integration of employee Subjective Knowledge, process Subjective Knowledge, Information Systems and Socialisation Systems. ‘Environment’ necessary to create and maintain a Learning Organisation can be created in any organisation with well informed employees following industry best practices and using latest technology to share information or knowledge.

The above argument was tested using the survey data. The correlation between organisation’s environment and the integration of its technology (Socialisation Systems and Information Systems) and the Subjective Knowledge (employee and process) was tested. The following sections describe data analysis in all four clusters using multiple regression technique. Environment was the dependent variable; employee Subjective Knowledge, process Subjective Knowledge, Information Systems and Socialisation Systems were independent variables.

**Cluster 1:**

All the eighty seven cases, in cluster one, were considered for data analysis. The total correlation between the independent and dependent variables (R) was 43%, and the model could only predict 18% of the cases as shown in Table 5-23. The model was also not significant as F= 4.655 at P <0.002 and also the sum of squares of residual was greater than that of regression as shown in Table 5-24.
This makes the model not suitable for further analysis. Hence, it was concluded that the right organisational environment present in organisations belonging to cluster one was due to some other constructs which were not considered.

<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.430(^a)</td>
<td>.185</td>
<td>.145</td>
<td>.253</td>
</tr>
</tbody>
</table>

\(^a\) Predictors: (Constant), KMS 2, SK 1, SK2, KMS 1

Table 5-23: Hypothesis 2 – Cluster 1 – Model Summary

<table>
<thead>
<tr>
<th>Model</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression</td>
<td>1.191</td>
<td>4</td>
<td>.298</td>
<td>4.655</td>
<td>.002(^a)</td>
</tr>
<tr>
<td>Residual</td>
<td>5.246</td>
<td>82</td>
<td>.064</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>6.437</td>
<td>86</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\(^a\) Predictors: (Constant), KMS 2, SK 1, SK2, KMS 1  
\(^b\) Dependent Variable: LO 2  
\(^c\) Selecting only cases for which Cluster Number of Case = 1

Table 5-24: Hypothesis 2 – Cluster 1 – Model Significance

Cluster 2:

All the two hundred and twenty seven cases in cluster two were considered for data analysis. The total correlation between independent variables and the dependent variable (R) was 29%, and the model could only predict 8% of the cases in cluster two as shown in Table 5-25.
Table 5-25: Hypothesis 2 – Cluster 2 – Model Summary

<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.295&lt;sup&gt;a&lt;/sup&gt;</td>
<td>.087</td>
<td>.232</td>
</tr>
</tbody>
</table>

a. Predictors: (Constant), KMS 2, SK 1, SK2, KMS 1

Table 5-26: Hypothesis 2 – Cluster 2 – Model Significance

<table>
<thead>
<tr>
<th>Model</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Regression</td>
<td>1.140</td>
<td>4</td>
<td>.285</td>
<td>5.276</td>
</tr>
<tr>
<td></td>
<td>Residual</td>
<td>11.996</td>
<td>222</td>
<td>.054</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>13.137</td>
<td>226</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a. Predictors: (Constant), KMS 2, SK 1, SK2, KMS 1
b. Dependent Variable: LO 2
c. Selecting only cases for which Cluster Number of Case = 2

The model was also not significant as F= 5.276 at P <0.001 and also the sum of squares of regression is less than that of residual as shown in Table 5-26. This makes the model not suitable for further analysis. Hence, it was concluded that the right organisational environment present in organisations belonging to cluster two was due to some other constructs which were not considered.

Cluster 3:

All the seventy eight cases in cluster three were considered for data analysis. The total correlation between independent variables and the dependent variable (R) was 82%, and the model could predict 67% of the cases as shown in Table 5-27. The model was significant with F= 37.905 at P <0.001 as shown in Table 5-28.
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**Table 5-27: Hypothesis 2 – Cluster 3 – Model Summary**

<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cluster Number of Case = 3 (Selected)</td>
<td>.822°a</td>
<td>.675</td>
<td>.657</td>
</tr>
<tr>
<td>1</td>
<td>.822°a</td>
<td>.675</td>
<td>.657</td>
</tr>
</tbody>
</table>

a. Predictors: (Constant), KMS 2, SK2, SK 1, KMS 1

**Table 5-28: Hypothesis 2 – Cluster 3 – Model Significance**

<table>
<thead>
<tr>
<th>Model</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression</td>
<td>9.346</td>
<td>4</td>
<td>2.337</td>
<td>37.905</td>
<td>.000°a</td>
</tr>
<tr>
<td>Residual</td>
<td>4.500</td>
<td>73</td>
<td>.062</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>13.846</td>
<td>77</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a. Predictors: (Constant), KMS 2, SK2, SK 1, KMS 1
b. Dependent Variable: LO 2
c. Selecting only cases for which Cluster Number of Case = 3

'Environment = 0.016+ 0.192 (employee Subjective Knowledge) + 0.549 (process Subjective Knowledge) - 0.070 (Information Systems) + 0.417 (Socialisation Systems)' was the multiple regression equation from Table 5-29. The equation makes it evident that the variables 'process Subjective Knowledge’ and ‘Socialisation Systems’ were significant factors and variables ‘employee Subjective Knowledge’ and ‘Information Systems’ were least significant in creating this model. Hence, it was concluded that the neutral view of organisations in cluster three towards the construct ‘environment’ was due to lack of Information Systems and also due to poor employee Subjective Knowledge.
Cluster 4:

All the seventy eight cases in cluster four were considered for data analysis. The total correlation between independent variables and the dependent variable (R) was 60%, and the model could only predict 36% of the cases in the cluster as shown in Table 5-30. The model was not significant as F= 10.499 at P <0.001 and also the sum of squares of residual is greater than that of regression, as shown in Table 5-31. This makes the model unsuitable for further investigation. Hence, it was concluded that the right organisational environment present in organisations belonging to cluster four was due to some other constructs which were not considered.
Effect of Knowledge Synchronisation on Environment

The effect of knowledge synchronisation on the construct environment was not established by this survey data analysis.

The organisations in clusters one, two, and four agreed to the existence of ‘environment’ within them. Empirical analysis of the survey data failed to establish any relationship between the dependent variable, organisational environment, and independent variables, subjective Knowledge (employee, process) and Knowledge Management Systems (information and socialisation). This means that further investigations are required for identification of Subjective Knowledge and Knowledge Management System constructs which facilitate the creation of ‘environment’ suitable for a Learning Organisation.

Interestingly, the neutral view about the environment reported by organisations in cluster three was justified by the lack of Information Systems and employee Subjective Knowledge. This suggests that there could be some relationship between independent variables and the dependent variable. Knowledge

<table>
<thead>
<tr>
<th>Model</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression</td>
<td>6.204</td>
<td>4</td>
<td>1.551</td>
<td>10.499</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Residual</td>
<td>10.783</td>
<td>73</td>
<td>.148</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>16.987</td>
<td>77</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a. Predictors: (Constant), KMS 2, SK 1, KMS 1, SK2
b. Dependent Variable: LO 2
c. Selecting only cases for which Cluster Number of Case = 4

Table 5-31: Hypothesis 2 – Cluster 4 – Model Significance
Synchronising Subjective Knowledge and Knowledge Management Systems in Organisations

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Synchronisation Model can be used as the basis for further investigations for this reason.

5.8.3 Hypothesis 3

Leadership of Learning Organisations is strongly associated with customer Subjective Knowledge, Supplier Subjective Knowledge, Information Systems and Combination Systems.

As evident from Table 5-10, organisations in clusters two and four agreed to the presence of the construct 'leadership' within them. Organisations in cluster one subscribed to a neutral view, whereas organisations in cluster three indicated absence of the construct leadership.

According to the Knowledge Synchronisation Model (KSM), organisational leadership is due to the integration of customer Subjective Knowledge, supplier Subjective Knowledge, information systems and Combination Systems. This means that a constructive and innovative leadership is only possible if the management team is well aware of the customer requirements as well as the supplier capabilities. Moreover, the leaders of the organisation require strong assistance from Information Systems and Combination Systems.

The above argument was tested using the survey data. The correlation between organisation’s leadership, and the integration of its Subjective Knowledge (customer, supplier) and Knowledge Management Systems (combination,
information) was tested. The following sections describe data analysis in all the four clusters using multiple regression technique. Leadership was the dependent variable; supplier Subjective Knowledge, customer Subjective Knowledge, Information Systems and Combination Systems were independent variables.

**Cluster 1:**

All the eighty seven cases, in cluster one, were considered for data analysis. The total correlation between independent variables and the dependent variable (R) was 29% and the model could only predict 8% of the cases as shown in Table 5-32. The model was also not significant as F= 1.947 at P <0.110 and also the sum of squares of the residual was greater than that of regression, as shown in Table 5-33. This makes the model not suitable for further analysis.

<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.295</td>
<td>.087</td>
<td>.042</td>
<td>.487</td>
</tr>
</tbody>
</table>

Cluster Number of Case = 1 (Selected)

**Table 5-32: Hypothesis 3 – Cluster 1 – Model Summary**

<table>
<thead>
<tr>
<th>Model</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Regression</td>
<td>1.844</td>
<td>4</td>
<td>.461</td>
<td>1.947</td>
</tr>
<tr>
<td></td>
<td>Residual</td>
<td>19.420</td>
<td>82</td>
<td>.237</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>21.264</td>
<td>86</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a. Predictors: (Constant), KMS 4, SK3, KMS 1, SK 4
b. Dependent Variable: LO 3
c. Selecting only cases for which Cluster Number of Case = 1

**Table 5-33: Hypothesis 3 – Cluster 1 – Model Significance**
Hence, it was concluded that the neutral view about the construct ‘leadership’ by organisations in cluster one was due to the constructs which were not considered.

Cluster 2:

All the two hundred and twenty seven cases in cluster two were considered for data analysis. The total correlation between independent variables and the dependent variable (R) was 30%, and the model can only predict 9% of the cases in cluster two as shown in Table 5-34.

<table>
<thead>
<tr>
<th>Model</th>
<th>R Cluster Number of Case = 2 (Selected)</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.306a</td>
<td>.094</td>
<td>.078</td>
<td>.188</td>
</tr>
</tbody>
</table>

a. Predictors: (Constant), KMS 4, KMS 1, SK 4, SK3

Table 5-34: Hypothesis 3 – Cluster 2 – Model Summary

<table>
<thead>
<tr>
<th>Model</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Regression</td>
<td>.812</td>
<td>4</td>
<td>.203</td>
<td>5.754</td>
</tr>
<tr>
<td></td>
<td>Residual</td>
<td>7.831</td>
<td>222</td>
<td>.035</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>8.643</td>
<td>226</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a. Predictors: (Constant), KMS 4, KMS 1, SK 4, SK3

The model was also not significant as F = 5.754 at P<0.001 and also the sum of squares of residual was greater than that of regression, as shown in Table 5-35. This makes the model not suitable for further analysis. Hence, it was concluded
that the presence of the characteristic ‘leadership’ in organisations belonging to cluster two was due to the factors which were not considered.

**Cluster 3:**

All the seventy eight cases in cluster three were considered for data analysis. The total correlation between independent variables and the dependent variable (R) was 76% and the model could predict 57% of the cases in cluster three as shown in Table 5-36. The model is significant, \( F = 25.047 \) at \( P < 0.001 \), as shown in Table 5-37.

<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cluster Number of Case = 3 (Selected)</td>
<td>.761*</td>
<td>.578</td>
<td>.555</td>
<td>.335</td>
</tr>
</tbody>
</table>

a. Predictors: (Constant), KMS 4, SK 4, SK3, KMS 1

Table 5-36: Hypothesis 3 – Cluster 3 – Model Summary

<table>
<thead>
<tr>
<th>Model</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression</td>
<td>11.214</td>
<td>4</td>
<td>2.803</td>
<td>25.047</td>
<td>.000*</td>
</tr>
<tr>
<td>Residual</td>
<td>8.171</td>
<td>73</td>
<td>.112</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>19.385</td>
<td>77</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a. Predictors: (Constant), KMS 4, SK 4, SK3, KMS 1

b. Dependent Variable: LO 3

c. Selecting only cases for which Cluster Number of Case = 3

Table 5-37: Hypothesis 3 – Cluster 3 – Model Significance

\[ \text{Leadership} = 0.338 \text{ (customer Subjective Knowledge)} + 0.479 \text{ (supplier Subjective Knowledge)} + 0.470 \text{ (Information Systems)} + 0.387 \text{ (Combination Systems)} \]

was the multiple regression equation generated from Table 5-38. The
equation makes it evident that all the constructs played a role in creating this model. The organisations in cluster three denied any presence of the construct ‘leadership’ within their organisations. This result further substantiates the role of unidentified constructs which play a vital role in creating leadership.

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
<th>t</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (Constant)</td>
<td>-929</td>
<td>.254</td>
<td>-3.662</td>
<td>.000</td>
</tr>
<tr>
<td>SK3</td>
<td>.338</td>
<td>.077</td>
<td>.335</td>
<td>4.391</td>
</tr>
<tr>
<td>SK 4</td>
<td>.479</td>
<td>.076</td>
<td>.480</td>
<td>6.277</td>
</tr>
<tr>
<td>KMS 1</td>
<td>.470</td>
<td>.078</td>
<td>.468</td>
<td>6.010</td>
</tr>
<tr>
<td>KMS 4</td>
<td>.387</td>
<td>.078</td>
<td>.386</td>
<td>4.960</td>
</tr>
</tbody>
</table>

a. Dependent Variable: LO 3
b. Selecting only cases for which Cluster Number of Case = 3

Table 5-38: Hypothesis 3 – Cluster 3 – Regression Equation Coefficients

Cluster 4:

All the seventy eight cases in cluster four were considered for data analysis. The total correlation between independent variables and the dependent variable (R) was 28% and the model could only predict 8% of the cases in the cluster as shown in Table 5-39.

<table>
<thead>
<tr>
<th>Model</th>
<th>Cluster Number of Case = 4 (Selected)</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td>.288</td>
<td>.083</td>
<td>.033</td>
</tr>
</tbody>
</table>

a. Predictors: (Constant), KMS 4, KMS 1, SK3, SK 4

Table 5-39: Hypothesis 3 – Cluster 4 – Model Summary
The model was not significant as $F= 1.652$ and $P > 0.001$ and also the sum of squares of the residual was greater than that of regression, as shown in Table 5-40. This makes the model not suitable for further investigation. Hence, it was concluded that the presence of the construct ‘leadership’ in organisations belonging to cluster four was due to the factors which were not considered.

**Effect of Knowledge Synchronisation on Leadership**

The effect of knowledge synchronisation on the construct leadership was not established by this survey data analysis.

The organisations in clusters two and four agreed to the existence of the construct ‘leadership’ within them. Organisations in cluster one had reported neutral to existence of the construct. Empirical analysis of the data failed to establish any relationship between the dependent variable organisational ‘leadership’ and the independent variables, ‘Subjective Knowledge (customer, supplier)’ and ‘Knowledge Management Systems (information and combination)’. Further investigations are required to establish a correlation between the dependent and independent variables.
Interestingly, organisations in cluster three denied any existence of the construct ‘leadership’. Empirical analysis of cluster three data revealed existence of such a relationship between the dependent variable and the independent variables. This further supports the need for investigations into this hypothesis.

### 5.8.4 Hypothesis 4

**Empowerment of Learning Organisations is strongly associated with employee Subjective Knowledge, process Subjective Knowledge, Externalisation Systems and Internalisation Systems.**

As evident from Table 5-10, organisations in clusters one and two agreed to the presence of the construct “empowerment” within them. Organisations in cluster three indicated absence of “empowerment” within them and organisations in cluster four subscribed to a neutral view.

According to the Knowledge Synchronisation Model (KSM), empowerment is due to the integration of employee Subjective Knowledge, process Subjective Knowledge, Externalisation Systems and Internalisation Systems. This was tested using the survey data. The correlation between empowerment, and the integration of its Subjective Knowledge (employee, process) and Knowledge Management Systems (externalisation, internalisation) was tested. The following sections describe data analysis in all the four clusters using multiple regression technique. Empowerment was the dependent variable; employee Subjective Knowledge,
process Subjective Knowledge, Externalisation Systems and Internalisation Systems were the independent variables.

**Cluster 1:**

All the eighty seven cases, in cluster one, were considered for data analysis. The total correlation between independent variables and the dependent variable (R) was 32% and the model could only predict 10% of the cases as shown in Table 5-41. The model was not significant at $F= 2.461$ at $P > 0.001$ and also the sum of squares of residual was greater than that of regression as shown in Table 5-42. This makes the model not suitable for further analysis.

<table>
<thead>
<tr>
<th>Model</th>
<th>$R$</th>
<th>Cluster Number of Case = 1 (Selected)</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.327</td>
<td></td>
<td>.107</td>
<td>.064</td>
<td>.429</td>
</tr>
</tbody>
</table>

Table 5-41: Hypothesis 4 – Cluster 1 – Model Summary

<table>
<thead>
<tr>
<th>Model</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Regression</td>
<td>1.814</td>
<td>4</td>
<td>.453</td>
<td>2.461</td>
<td>.052</td>
</tr>
<tr>
<td>Residual</td>
<td>15.106</td>
<td>82</td>
<td>.184</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>16.920</td>
<td>86</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 5-42: Hypothesis 4 – Cluster 1 – Model Significance
Hence, it was concluded that the presence of the construct ‘empowerment’ in organisations belonging to cluster one was due to the factors which were not considered.

**Cluster 2:**

All the two hundred and twenty seven cases in cluster 2 were considered for data analysis. The total correlation between independent variables and the dependent variable (R) was 32% and the model could only predict 10% of the cases in the cluster as shown in Table 5-43. The model was also not significant as F= 6.542 at P > 0.001 and also the sum of squares of residual was greater than that of regression, as shown in Table 5-44. This makes the model not suitable for further investigation.

```
<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.325a</td>
<td>.105</td>
<td>.089</td>
<td>.271</td>
</tr>
</tbody>
</table>
```

a. Predictors: (Constant), KMS 5, SK2, KMS 3, SK 1

**Table 5-43: Hypothesis 4 – Cluster 2 – Model Summary**

```
<table>
<thead>
<tr>
<th>Model</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression</td>
<td>1.923</td>
<td>4</td>
<td>.481</td>
<td>6.542</td>
<td>.000a</td>
</tr>
<tr>
<td>Residual</td>
<td>16.315</td>
<td>222</td>
<td>.073</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>18.238</td>
<td>226</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
```

a. Predictors: (Constant), KMS 5, SK2, KMS 3, SK 1
b. Dependent Variable: LO 4
c. Selecting only cases for which Cluster Number of Case = 2

**Table 5-44: Hypothesis 4 – Cluster 2 – Model Significance**
Hence, it was concluded that the existence of the construct ‘empowerment’ in organisations belonging to cluster two was due to factors which were not considered.

**Cluster 3:**

All the seventy eight cases from cluster three were considered for data analysis. A correlation does not exist between the dependent variable and independent variables as shown in Table 5-45. Hence, it was concluded that the lack of empowerment in organisations belonging to cluster three was due to the technology and Subjective Knowledge constructs responsible for creating empowerment in clusters one and two.

**Warnings**

The dependent variable LO 4 has been deleted. Statistics cannot be computed.

Table 5-45: Hypothesis 4 – Cluster 3 – SPSS Output

**Cluster 4:**

All the seventy eight cases in cluster four were considered for data analysis. The total correlation between independent variables and the dependent variable (R) was 33% and the model could only predict 11% of the cases in cluster four as shown in Table 5-46. The model was not significant as F= 2.299 at P >0.001 and the sum of squares of the residual was greater than that of regression, as shown in Table 5-47. This makes the model unsuitable for further analysis.
Hence, it was concluded that the existence of the construct “empowerment” in organisations belonging to cluster four was due to the constructs which were not considered.

**Effect of Knowledge Synchronisation on Empowerment**

The effect of knowledge synchronisation on empowerment was not established by this survey data analysis.

Empowerment in conclusion requires further investigation. The analysis of data belonging to clusters one, two, and four could not establish any relationship between the dependent variable, employee empowerment, and the independent variables, Subjective Knowledge (employee and process) and Knowledge Management Systems.
Management Systems (externalisation and internalisation). However, the organisations in those clusters agree to the presence of empowerment. This means that the presence of empowerment is due to some other constructs which were not identified earlier. Further investigations will be required for the identification of Subjective Knowledge and Knowledge Management Systems constructs which facilitate the creation of empowerment.

5.8.5 Hypothesis 5


As evident from Table 5-10, the organisations in clusters two and four agreed to the presence of the construct “personal mastery” within them. The organisations in clusters one and three subscribed to a neutral view.

According to the Knowledge Synchronisation Model (KSM), personal mastery is due to the integration of employee Subjective Knowledge, Information Systems, Socialisation Systems, Externalisation Systems, and Internalisation Systems. This was tested using the survey data. The correlation between personal mastery, and the integration of its employee Subjective Knowledge and Knowledge Management Systems (information, socialisation, externalisation, and internalisation) was tested.
The following sections describe the data analysis in all the four clusters using multiple regression technique. Personal mastery was the dependent variable; employee Subjective Knowledge, Information Systems, Socialisation Systems, Externalisation Systems, and Internalisation Systems were the independent variables.

**Cluster 1:**

All the eighty seven cases, in cluster one, were considered for data analysis. The total correlation between independent variables and the dependent variable (R) was 90% and the model could predict 81% of the cases as shown in Table 5-48. The model was significant as F= 71.196 at P <0.001 as shown in Table 5-49.

<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.903³</td>
<td>.815</td>
<td>.803</td>
<td>.081</td>
</tr>
</tbody>
</table>

Table 5-48: Hypothesis 5 – Cluster 1- Model Summary

<table>
<thead>
<tr>
<th>Model</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Regression</td>
<td>2.360</td>
<td>5</td>
<td>.472</td>
<td>71.196</td>
</tr>
<tr>
<td></td>
<td>Residual</td>
<td>.538</td>
<td>81</td>
<td>.007</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>2.897</td>
<td>86</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 5-49: Hypothesis 5 – Cluster 1 – Model Significance
‘Personal Mastery = 0.138 + 0.377 (employee Subjective Knowledge) + 0.664 (Information Systems) + 0.837 (Socialisation Systems) + 0.614 (Externalisation Systems) + 0.527 (Internalisation Systems)’ was the multiple regression equation generated from Table 5-50. The equation makes it evident that the Knowledge Management Systems (information, socialisation, externalisation and internalisation) were significant factors and employee Subjective Knowledge was less significant in creating this model.

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
<th>t</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (Constant)</td>
<td>.138</td>
<td>.014</td>
<td>10.616</td>
<td>.000</td>
</tr>
<tr>
<td>SK 1</td>
<td>.377</td>
<td>.024</td>
<td>.489</td>
<td>15.709</td>
</tr>
<tr>
<td>KMS 1</td>
<td>.664</td>
<td>.045</td>
<td>.755</td>
<td>14.756</td>
</tr>
<tr>
<td>KMS 2</td>
<td>.837</td>
<td>.047</td>
<td>.923</td>
<td>17.809</td>
</tr>
<tr>
<td>KMS 3</td>
<td>.614</td>
<td>.043</td>
<td>.634</td>
<td>14.256</td>
</tr>
<tr>
<td>KMS 5</td>
<td>.527</td>
<td>.043</td>
<td>.497</td>
<td>12.256</td>
</tr>
</tbody>
</table>

a. Dependent Variable: LO 5  
b. Selecting only cases for which Cluster Number of Case = 1

Table 5-50: Hypothesis 5 – Cluster 1 – Regression Equation Coefficients

Hence, it was concluded that the neutral view about the construct ‘personal mastery’ by organisations in cluster one was due to high technology contribution and low employee Subjective Knowledge contribution.

Cluster 2:

All the two hundred and twenty seven cases in cluster two were considered for data analysis. The total correlation between independent variables and the dependent variable (R) was 99% and the model could predict 98% of cases in cluster two as shown in Table 5-51. The model was significant as F= 2311.612 at P <0.001 as shown in Table 5-52.
Table 5-51: Hypothesis 5 – Cluster 2 – Model Summary

<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.991</td>
<td>.981</td>
<td>.981</td>
<td>.139</td>
</tr>
</tbody>
</table>

a. Predictors: (Constant), KMS 5, KMS 1, SK 1, KMS 3, KMS 2

Table 5-52: Hypothesis 5 – Cluster 2 – Model Significance

<table>
<thead>
<tr>
<th>Model</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression</td>
<td>222.700</td>
<td>5</td>
<td>44.548</td>
<td>2311.612</td>
<td>.000a</td>
</tr>
<tr>
<td>Residual</td>
<td>4.260</td>
<td>221</td>
<td>.019</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>226.960</td>
<td>226</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a. Predictors: (Constant), KMS 5, KMS 1, SK 1, KMS 3, KMS 2

b. Dependent Variable: LO 5
c. Selecting only cases for which Cluster Number of Case = 2

'Personal Mastery = 0.743 (employee Subjective Knowledge) + 0.618 (Information Systems) +0.719 (Socialisation Systems) + 0.863 (Externalisation Systems) + 0.810 (Internalisation Systems)' was the multiple regression equation generated from Table 5-53. The equation makes it evident that all the independent variables were significant in creating this model. Hence, it was concluded that personal mastery in cluster two was due to high technology contribution and high Subjective Knowledge contribution.
Cluster 3:

All the seventy eight cases in cluster three were considered for data analysis. The total correlation between independent variables and the dependent variable (R) was 84% and the model could predict 72% of the cases as shown in Table 5-54. The model was significant as F= 37.167 at P <0.001 as shown in Table 5-55.
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ANOVA\(^{a,b,c}\)

<table>
<thead>
<tr>
<th>Model</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression</td>
<td>8.964</td>
<td>5</td>
<td>1.793</td>
<td>37.167</td>
<td>.000</td>
</tr>
<tr>
<td>Residual</td>
<td>3.473</td>
<td>72</td>
<td>.048</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>12.437</td>
<td>77</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\(^{a}\) Predictors: (Constant), KMS 5, SK 1, KMS 2, KMS 1, KMS 3
\(^{b}\) Dependent Variable: LO 5
\(^{c}\) Selecting only cases for which Cluster Number of Case = 3

Table 5-55: Hypothesis 5 – Cluster 3 – Model Significance

'Personal Mastery = 0.201 + 0.889 (employee Subjective Knowledge) + 0.416 (Information Systems) + 0.313 (Socialisation Systems) + 0.413 (Externalisation Systems) + 0.347 (Internalisation Systems)' was the multiple regression equation generated from Table 5-56. This equation makes it evident that the variable 'employee Subjective Knowledge' was significant and the Knowledge Management Systems (information, socialisation, externalisation, and internalisation) were less significant in creating this model.

Coefficients\(^{a,b}\)

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
<th>t</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>Std. Error</td>
<td>Beta</td>
<td>.32</td>
</tr>
<tr>
<td>(Constant)</td>
<td>.201</td>
<td>.034</td>
<td>.32</td>
<td>5.912</td>
</tr>
<tr>
<td>SK 1</td>
<td>.889</td>
<td>.069</td>
<td>.914</td>
<td>12.884</td>
</tr>
<tr>
<td>KMS 1</td>
<td>.416</td>
<td>.052</td>
<td>.368</td>
<td>8.000</td>
</tr>
<tr>
<td>KMS 2</td>
<td>.313</td>
<td>.039</td>
<td>.343</td>
<td>8.026</td>
</tr>
<tr>
<td>KMS 3</td>
<td>.413</td>
<td>.088</td>
<td>.457</td>
<td>4.693</td>
</tr>
<tr>
<td>KMS 5</td>
<td>.347</td>
<td>.045</td>
<td>.319</td>
<td>7.711</td>
</tr>
</tbody>
</table>

\(^{a}\) Dependent Variable: LO 5
\(^{b}\) Selecting only cases for which Cluster Number of Case = 3

Table 5-56: Hypothesis 5 – Cluster 3 – Regression Equation Coefficients
Hence, it was concluded that the neutral view about the construct 'personal mastery' by organisations in cluster three was due to low technology development and high employee Subjective Knowledge development.

**Cluster 4:**

All the seventy eight cases in cluster four were considered for data analysis. The total correlation between independent variables and the dependent variable (R) was 82% and the model could predict 67% of the cases in cluster four as shown in Table 5-57. The model was significant as F= 29.625 at P <0.001 as shown in Table 5-58.

<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.820&lt;sup&gt;a&lt;/sup&gt;</td>
<td>.673</td>
<td>.650</td>
<td>.251</td>
</tr>
</tbody>
</table>

<sup>a</sup> Predictors: (Constant), KMS 5, SK 1, KMS 2, KMS 1, KMS 3

**Table 5-57: Hypothesis 5 – Cluster 4 – Model Summary**

<table>
<thead>
<tr>
<th>Model</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Regression</td>
<td>9.317</td>
<td>5</td>
<td>1.863</td>
<td>29.625</td>
</tr>
<tr>
<td></td>
<td>Residual</td>
<td>4.529</td>
<td>72</td>
<td>.063</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>13.846</td>
<td>77</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<sup>a</sup> Predictors: (Constant), KMS 5, SK 1, KMS 2, KMS 1, KMS 3  
<sup>b</sup> Dependent Variable: LO 5  
<sup>c</sup> Selecting only cases for which Cluster Number of Case = 4

**Table 5-58: Hypothesis 5 – Cluster 4 – Model Significance**
Table 5-59: Hypothesis 5 – Cluster 4 – Regression Equation Coefficients

![Table 5-59](image)

'Personal Mastery = 0.271 + 0.842 (employee Subjective Knowledge) + 0.647 (Information Systems) + 0.647 (Socialisation Systems) + 0.982 (Externalisation Systems) + 0.720 (Internalisation Systems)' was the multiple regression equation generated from Table 5-59. This equation makes it evident that all independent variables were significant in creating this model. Hence, it was concluded that the presence of the construct ‘personal mastery’ in cluster four organisations was due to high technology development and high Subjective Knowledge development.

**Effect of Knowledge Synchronisation on Personal Mastery**

The effect of knowledge synchronisation on personal mastery was clearly demonstrated by this survey data analysis as detailed below:

- Organisations in cluster one developed Knowledge Management Systems (information, socialisation, externalisation, and internalisation) to instil personal mastery within their organisation and ignored employee Subjective Knowledge. This created a knowledge gap that resulted in their neutral view to the construct ‘personal mastery’.
• Organisations in clusters two and four developed Knowledge Management Systems (information, socialisation, externalisation, and internalisation) as well as the employee Subjective Knowledge. This resulted in high personal mastery within them.

• Organisations in cluster three developed employee Subjective Knowledge and paid little attention to the development of Knowledge Management Systems (information, socialisation, externalisation, and internalisation). This created a knowledge gap which resulted in their neutral view towards the construct ‘personal mastery’.

5.8.6 Hypothesis 6

*Shared Vision of Learning Organisations is strongly associated with employee Subjective Knowledge, Information Systems and Externalisation Systems.*

As evident from Table 5-10, organisations in clusters one and two agreed to the presence of ‘shared vision’ within them. Organisations in clusters three and four subscribed to neutral view.

According to the Knowledge Synchronisation Model (KSM), shared vision is due to the integration of employee Subjective Knowledge, Information Systems, and Externalisation Systems. This was tested using the survey data. The correlation between the construct shared vision, and the integration of organisation’s employee Subjective Knowledge, Information Systems and Externalisation Systems was tested.
The following sections describe data analysis in all the four clusters using multiple regression technique. Shared vision was the dependent variable; employee Subjective Knowledge, Information Systems and Externalisation Systems were the independent variables.

**Cluster 1:**

All the eighty seven cases in cluster one were considered for data analysis. The total correlation between the independent variables and the dependent variables (R) was 77% and the model could predict 60% of the cases as shown in Table 5-60. The model was significant as F= 40.54 at P <0.001 as shown in Table 5-61.

<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.772a</td>
<td>.596</td>
<td>.581</td>
<td>.291</td>
</tr>
</tbody>
</table>

*a. Predictors: (Constant), KMS 3, SK 1, KMS 1

**Table 5-60: Hypothesis 6 – Cluster 1 – Model Summary**

<table>
<thead>
<tr>
<th>Model</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Regression</td>
<td>10.371</td>
<td>3</td>
<td>3.457</td>
<td>40.773</td>
</tr>
<tr>
<td></td>
<td>Residual</td>
<td>7.038</td>
<td>83</td>
<td>.085</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>17.416</td>
<td>86</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*a. Predictors: (Constant), KMS 3, SK 1, KMS 1
b. Dependent Variable: LO 6
c. Selecting only cases for which Cluster Number of Case = 1

**Table 5-61: Hypothesis 6 – Cluster 1 – Model Significance**


\[ \text{Shared Vision} = 0.532 + 0.935 \text{ (employee Subjective Knowledge)} + 0.505 \text{ (Information Systems)} + 0.862 \text{ (Externalisation Systems)} \]

was the multiple regression equation generated from Table 5-62. This equation makes it evident that all independent variables were significant in creating this model. Hence, it was concluded that the shared vision in cluster one was due to high technology contribution and high Subjective Knowledge contribution.

**Cluster 2:**

All the two hundred and twenty seven cases in cluster two were considered for data analysis. The total correlation between independent variables and the dependent variable (R) was 77% and the model could predict 59% of the cases in the cluster as shown in Table 5-63. The model was significant as F= 109.546 at P < 0.001 as shown in Table 5-64.

---

**Table 5-62: Hypothesis 6 – Cluster 1 – Regression Equation Coefficients**

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
<th>t</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>Std. Error</td>
<td>Beta</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>(Constant)</td>
<td>.532</td>
<td>.047</td>
<td>11.319</td>
</tr>
<tr>
<td>SK 1</td>
<td>.935</td>
<td>.015</td>
<td>.960</td>
<td>62.334</td>
</tr>
<tr>
<td>KMS 1</td>
<td>.505</td>
<td>.031</td>
<td>.638</td>
<td>16.291</td>
</tr>
<tr>
<td>KMS 3</td>
<td>.862</td>
<td>.031</td>
<td>.824</td>
<td>28.734</td>
</tr>
</tbody>
</table>

a. Dependent Variable: LO 6
b. Selecting only cases for which Cluster Number of Case = 1
Synchronising Subjective Knowledge and Knowledge Management Systems in Organisations  
Chapter 5: Validating the Knowledge Synchronisation Model through Survey

<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>Cluster Number of Case = 2 (Selected)</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.772a</td>
<td></td>
<td>.596</td>
<td>.590</td>
<td>.178</td>
</tr>
</tbody>
</table>

a. Predictors: (Constant), KMS 3, SK 1, KMS 1

Table 5-63: Hypothesis 6 – Cluster 2 – Model Summary

**ANOVA**

<table>
<thead>
<tr>
<th>Model</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Regression</td>
<td>3</td>
<td>3.457</td>
<td>109.546</td>
<td>.000a</td>
</tr>
<tr>
<td></td>
<td>Residual</td>
<td>223</td>
<td>.032</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>17.410</td>
<td>226</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a. Predictors: (Constant), KMS 3, SK 1, KMS 1  
b. Dependent Variable: LO 6  
c. Selecting only cases for which Cluster Number of Case = 2

Table 5-64: Hypothesis 6 – Cluster 2 – Model Significance

'Shared Vision = 0.253 + 0710 (employee Subjective Knowledge) + 0.905 (Information Systems) + 0.858 (Externalisation Systems)’ was the multiple regression equation generated from Table 5-65. This equation makes it evident that all the independent variables were significant in creating this model. Hence, it was concluded that the presence of the construct “shared vision” in cluster two was due to high technology contribution and high Subjective Knowledge contribution.
Cluster 3:

All the seventy eight cases in cluster three were considered for data analysis. The total correlation between the independent variables and the dependent variable (R) was 84% and the model could predict 70% of the cases in the cluster as shown in Table 5-66. The model was significant as F = 58.983 at P < 0.001 as shown in Table 5-67.
"Shared Vision = 0.159 + 0.820 (employee Subjective Knowledge) + 0.382 (Information Systems) + 0.398 (Externalisation Systems)" was the multiple regression equation generated from Table 5-68. This equation makes it evident that the variable ‘employee Subjective Knowledge’ was most significant and the Knowledge Management Systems (information, externalisation) were less significant factors in creating this model. Hence, it was concluded that the neutral view about ‘shared vision’ by organisations in cluster three was due to low technology contribution and high Subjective Knowledge contribution.
Cluster 4:

All the seventy eight cases in cluster four were considered for data analysis. The total correlation between the independent variables and the dependent variable (R) was 79% and the model could predict 62% of the cases in the cluster as shown in Table 5-69. The model was significant as \( F = 40.870 \) at \( P < 0.001 \) as shown in Table 5-70.

\[
\text{Model} \quad \begin{array}{|c|c|c|c|}
\hline
\text{Cluster Number of Case} = 4 & \text{R Square} & \text{Adjusted R Square} & \text{Std. Error of the Estimate} \\
\hline
1 & .790^a & .624 & .608 & .311 \\
\hline
\end{array}
\]

\( ^a \) Predictors: (Constant), KMS 3, KMS 1, SK 1

Table 5-69: Hypothesis 6 – Cluster 4 – Model Summary

\[
\text{ANOVA}^{b,c}
\]

\[
\begin{array}{|c|c|c|c|c|}
\hline
\text{Model} & \text{Sum of Squares} & \text{df} & \text{Mean Square} & \text{F} & \text{Sig.} \\
\hline
1 & \text{Regression} & 11.873 & 3 & 3.958 & 40.870 & .000^a \\
 & \text{Residual} & 7.166 & 74 & .097 & \\
 & \text{Total} & 19.038 & 77 & & \\
\hline
\end{array}
\]

\( ^a \) Predictors: (Constant), KMS 3, KMS 1, SK 1
\( ^b \) Dependent Variable: LO 6
\( ^c \) Selecting only cases for which Cluster Number of Case = 4

Table 5-70: Hypothesis 6 – Cluster 4 – Model Significance

\[
\text{Shared Vision} = 0.198 + 0.215 \text{ (employee Subjective Knowledge)} + 0.539 \text{ (Information Systems)} + 0.639 \text{ (Externalisation Systems)}
\]

\'Shared Vision = 0.198 + 0.215 (employee Subjective Knowledge) + 0.539 (Information Systems) + 0.639 (Externalisation Systems)’ was the multiple regression equation generated from Table 5-71. This equation makes it evident that the Knowledge Management Systems (information, externalisation) were most significant factors and the employee Subjective Knowledge was less
significant in creating this model. Hence, it was concluded that the neutral view about ‘shared vision’ reported by organisations in cluster four was due to the high technology contribution and low Subjective Knowledge contribution.

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
<th>t</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>Std. Error</td>
<td>Beta</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>(Constant)</td>
<td>.198</td>
<td>.025</td>
<td>7.921</td>
</tr>
<tr>
<td>SK 1</td>
<td>.215</td>
<td>.024</td>
<td>.831</td>
<td>8.958</td>
</tr>
<tr>
<td>KMS 1</td>
<td>.539</td>
<td>.031</td>
<td>.365</td>
<td>17.387</td>
</tr>
<tr>
<td>KMS 3</td>
<td>.639</td>
<td>.078</td>
<td>.641</td>
<td>8.193</td>
</tr>
</tbody>
</table>

a. Dependent Variable: LO 6
b. Selecting only cases for which Cluster Number of Case = 4

Table 5-71: Hypothesis 6 – Cluster 4 – Regression Equation Coefficients

**Effect of Knowledge Synchronisation on Shared Vision**

The effect of knowledge synchronisation on shared vision was clearly demonstrated by this survey data analysis as detailed below:

- Organisations in clusters one and two developed Knowledge Management Systems (information, externalisation) as well as employee Subjective Knowledge. This resulted in high shared vision within the organisation.

- Organisations in cluster three developed Knowledge Management Systems (information and externalisation) to instil shared vision within them and paid little attention to the development of employee Subjective Knowledge. This created a knowledge gap which resulted in their neutral view towards the existence of ‘shared vision’.
• Organisations in cluster four developed employee Subjective Knowledge and paid little attention to the development of Knowledge Management Systems (information and externalisation). This created a knowledge gap which resulted in their neutral view towards the existence of ‘shared vision’.

5.8.7 Hypothesis 7

*Team Learning of Learning Organisations is strongly associated with employee Subjective Knowledge, Externalisation Systems and Internalisation Systems.*

As evident from Table 5-10, organisations in clusters two and four agreed to the presence of ‘team learning’ within them. Organisations in cluster one had a neutral view towards the presence of the construct. Organisations in cluster three indicated the absence of ‘team learning’.

According to the Knowledge Synchronisation Model (KSM) team learning is due to the integration of employee Subjective Knowledge and the Knowledge Management Systems (externalisation, internalisation). This was tested using the survey data. The correlation between the construct ‘team learning’ and the integration of organisation’s employee Subjective Knowledge and Knowledge Management Systems (externalisation and internalisation) was tested.

The following sections describe data analysis in all four clusters using multiple regression technique. Team learning was the dependent variable; employee
Subjective Knowledge, Externalisation Systems and Internalisation Systems were the independent variables.

**Cluster 1:**

All the eighty seven cases, in cluster one, were considered for data analysis. The total correlation between independent variables and the dependent variable (R) was 88% and the model could predict 78% of the cases as shown in Table 5-72. The model was significant as F= 102.711 at P <0.001, as shown in Table 5-73.

![Table 5-72: Hypothesis 7 – Cluster 1 – Model Summary](image)

<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>Cluster Number of Case = 1 (Selected)</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.888a</td>
<td>.788</td>
<td>.780</td>
<td>.232</td>
<td></td>
</tr>
</tbody>
</table>

Note: a. Predictors: (Constant), KMS 5, KMS 3, SK 1

![Table 5-73: Hypothesis 7 – Cluster 1 – Model Significance](image)

<table>
<thead>
<tr>
<th>Model</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Regression</td>
<td>16.625</td>
<td>3</td>
<td>5.542</td>
<td>102.711</td>
</tr>
<tr>
<td></td>
<td>Residual</td>
<td>4.478</td>
<td>83</td>
<td>.054</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>21.103</td>
<td>86</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: a. Predictors: (Constant), KMS 5, KMS 3, SK 1

'\( \text{Team Learning} = 0.125 + 0.759 (\text{employee Subjective Knowledge}) + 0.378 (\text{Externalisation Systems}) + 0.287 (\text{Internalisation Systems}) \)' was the multiple regression equation generated from Table 5-74. This equation makes it evident that the employee Subjective Knowledge was significant and the Knowledge
Management Systems (externalisation, internalisation) were less significant factors in creating this model. Hence, it was concluded that the neutral view towards ‘team learning’ by organisation in cluster one was due to low technology contribution and high Subjective Knowledge contribution.

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
<th>t</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (Constant)</td>
<td>.125</td>
<td>.021</td>
<td>5.952</td>
<td>.000</td>
</tr>
<tr>
<td>SK 1</td>
<td>.759</td>
<td>.032</td>
<td>.654</td>
<td>23.688</td>
</tr>
<tr>
<td>KMS 3</td>
<td>.378</td>
<td>.057</td>
<td>.439</td>
<td>6.632</td>
</tr>
<tr>
<td>KMS 5</td>
<td>.287</td>
<td>.038</td>
<td>.631</td>
<td>7.553</td>
</tr>
</tbody>
</table>

a. Dependent Variable: LO 7
b. Selecting only cases for which Cluster Number of Case = 1

Table 5-74: Hypothesis 7 – Cluster 1 – Regression Equation Coefficients

Cluster 2:

All the two hundred and twenty seven cases in cluster two were considered for data analysis. The total correlation between independent variables and the dependent variable (R) was 76% and the model could predict 58% of the cases in cluster two as shown in Table 5-75. The model was significant as F= 102.253 at P <0.001 as shown in Table 5-76.

<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (Selected)</td>
<td>.761(^a)</td>
<td>.579</td>
<td>.573</td>
<td>.244</td>
</tr>
</tbody>
</table>

a. Predictors: (Constant), KMS 5, SK 1, KMS 3

Table 5-75: Hypothesis 7 – Cluster 2 – Model Summary
Table 5-76: Hypothesis 7 – Cluster 2 – Model Significance

<table>
<thead>
<tr>
<th>Model</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression</td>
<td>18.321</td>
<td>3</td>
<td>6.107</td>
<td>102.253</td>
<td>.000</td>
</tr>
<tr>
<td>Residual</td>
<td>13.318</td>
<td>223</td>
<td>.060</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>31.639</td>
<td>226</td>
<td>223</td>
<td>223</td>
<td></td>
</tr>
</tbody>
</table>

a. Predictors: (Constant), KMS 5, SK 1, KMS 3 
b. Dependent Variable: LO 7 
c. Selecting only cases for which Cluster Number of Case = 2

'Team Learning = 0.057 + 0.750 (employee Subjective Knowledge) + 0.864 (Externalisation Systems) + 0.883 (Internalisation Systems)’ was the multiple regression equation generated from Table 5-77. This equation makes it evident that all the independent variables were significant factors in creating this model.

The presence of the construct ‘team learning’ in the organisations belonging to cluster two was due to high technology and high Subjective Knowledge contribution.

Table 5-77: Hypothesis 7 – Cluster 2 – Regression Equation Coefficients

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
<th>t</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>Std. Error</td>
<td>Beta</td>
<td></td>
</tr>
<tr>
<td>1 (Constant)</td>
<td>5.732E-02</td>
<td>.018</td>
<td>3.167</td>
<td>.035</td>
</tr>
<tr>
<td>SK 1</td>
<td>.750</td>
<td>.017</td>
<td>.740</td>
<td>44.118</td>
</tr>
<tr>
<td>KMS 3</td>
<td>.864</td>
<td>.033</td>
<td>.798</td>
<td>26.182</td>
</tr>
<tr>
<td>KMS 5</td>
<td>.883</td>
<td>.033</td>
<td>.824</td>
<td>26.758</td>
</tr>
</tbody>
</table>

a. Dependent Variable: LO 7 
b. Selecting only cases for which Cluster Number of Case = 2

Cluster 3:
All the seventy eight cases in cluster three were considered for data analysis. A correlation does not exist between the dependent variable and the independent variables as shown Table 5-78. Hence, it was concluded that the lack of team learning in cluster three was due to low technology and low Subjective Knowledge.

Warnings

The dependent variable LO 7 has been deleted. Statistics cannot be computed.

Table 5-78: Hypothesis 7 – Cluster 3 – SPSS Output

Cluster 4:

All the seventy eight cases in cluster four were considered for data analysis. The total correlation between independent variables and the dependent variable (R) was 81% and the model could predict 66% of the cases in cluster four as shown in Table 5-79. The model was significant as F= 47.181 at P < 0.001 as shown in Table 5-80.

<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.810a</td>
<td>.657</td>
<td>.643</td>
<td>.217</td>
</tr>
</tbody>
</table>

a. Predictors: (Constant), KMS 5, SK 1, KMS 3

Table 5-79: Hypothesis 7 – Cluster 4 – Model Summary
Synchronising Subjective Knowledge and Knowledge Management Systems in Organisations
Chapter 5: Validating the Knowledge Synchronisation Model through Survey

ANOVA\(^{a,c}\)

<table>
<thead>
<tr>
<th>Model</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression</td>
<td>6.668</td>
<td>3</td>
<td>2.223</td>
<td>47.181</td>
<td>.000(^a)</td>
</tr>
<tr>
<td>Residual</td>
<td>3.486</td>
<td>74</td>
<td>.047</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>10.154</td>
<td>77</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\(^a\) Predictors: (Constant), KMS 5, SK 1, KMS 3
\(^b\) Dependent Variable: LO 7
\(^c\) Selecting only cases for which Cluster Number of Case = 4

Table 5-80: Hypothesis 7 – Cluster 4 – Model Significance

'Team Learning = 0.177 + 0.921 (employee Subjective Knowledge) + 0.821 (Externalisation Systems) + 0.642 (Internalisation Systems)' was the multiple regression equation generated from Table 5-81. This equation makes it evident that all the independent variables were significant in creating this model. The presence of 'team learning' within the organisations in cluster two was due to high technology and high Subjective Knowledge contribution.

Coefficients\(^{a,b}\)

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
<th>t</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>Std. Error</td>
<td>Beta</td>
<td></td>
</tr>
<tr>
<td>(Constant)</td>
<td>.177</td>
<td>.017</td>
<td>.906</td>
<td>.000</td>
</tr>
<tr>
<td>SK 1</td>
<td>.921</td>
<td>.030</td>
<td>.846</td>
<td>.000</td>
</tr>
<tr>
<td>KMS 3</td>
<td>.821</td>
<td>.052</td>
<td>.583</td>
<td>.000</td>
</tr>
<tr>
<td>KMS 5</td>
<td>.642</td>
<td>.025</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\(^a\) Dependent Variable: LO 7
\(^b\) Selecting only cases for which Cluster Number of Case = 4

Table 5-81: Hypothesis 7 – Cluster 4 – Regression Equation Coefficients

Effect of Knowledge Synchronisation on Team Learning

The effect of knowledge synchronisation on team learning was clearly demonstrated by this survey data analysis as detailed below:
• Organisations in cluster one had developed employee Subjective Knowledge to instil team learning and paid little attention to the development of Knowledge Management Systems (externalisation and internalisation). This created a knowledge gap which resulted in the neutral view towards the construct ‘team learning’.

• Organisations in clusters two and four had developed Knowledge Management Systems (externalisation and internalisation) and also employee Subjective Knowledge to instil ‘team learning’ within them. This knowledge synchronisation resulted in ‘team learning’.

• It is safe to say that the organisations in cluster three had developed low Knowledge Management Systems (externalisation and internalisation) and low employee Subjective Knowledge towards inculcation of team learning.

5.8.8 Hypothesis 8

*Systems thinking of Learning Organisations is strongly associated with employee Subjective Knowledge, Information Systems, Socialisation Systems and Externalisation Systems.*

As evident from Table 5-10, organisations in clusters one and two agreed to the presence of the construct ‘systems thinking’ within them. Organisations in cluster four had a neutral view towards ‘systems thinking’. Organisations in cluster three indicated the absence of ‘systems thinking’ within them.
According to the Knowledge Synchronisation Model, ‘systems thinking’ is due to the integration of employee Subjective Knowledge, Information Systems, Socialisation Systems and Externalisation Systems. This was tested using the survey data. The correlation between ‘systems thinking’, and the integration of its employee Subjective Knowledge and Knowledge Management Systems (information, socialisation, and externalisation) was tested.

The following sections describe data analysis in all four clusters using multiple regression technique. ‘systems thinking’ was the dependent variable; employee Subjective Knowledge, Information Systems, Socialisation Systems, and Externalisation Systems were independent variables.

**Cluster 1:**

All the eighty seven cases, in cluster one, were considered for data analysis. The total correlation between independent variables and the dependent variable (R) was 73% and the model could predict 55% of the cases as shown in Table 5-82. The model was significant as F= 24.345 at P <0.001 as shown in Table 5-83.

<table>
<thead>
<tr>
<th>Model</th>
<th>R Cluster Number of Case = 1 (Selected)</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.737a</td>
<td>.543</td>
<td>.521</td>
<td>.230</td>
</tr>
</tbody>
</table>

*Predictors: (Constant), KMS 3, SK 1, KMS 2, KMS 1*

**Table 5-82: Hypothesis 8 – Cluster 1 – Model Summary**
Synchronising Subjective Knowledge and Knowledge Management Systems in Organisations
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**ANOVA**

<table>
<thead>
<tr>
<th>Model</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression</td>
<td>5.129</td>
<td>4</td>
<td>1.282</td>
<td>24.345</td>
<td>.000a</td>
</tr>
<tr>
<td>Residual</td>
<td>4.319</td>
<td>82</td>
<td>.053</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>9.449</td>
<td>86</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a. Predictors: (Constant), KMS 3, SK 1, KMS 2, KMS 1  
b. Dependent Variable: LO 8  
c. Selecting only cases for which Cluster Number of Case = 1

Table 5-83: Hypothesis 8 – Cluster 1 – Model Significance

'Systems Thinking = 0.182 + 0.519 (employee Subjective Knowledge) + 0.722 (Information Systems) + 0.742 (Socialisation Systems) + 0.825 (Externalisation Systems)' was the multiple regression equation generated from Table 5-84. This equation makes it evident that all the independent variables were significant in creating this model.

**Coefficients**

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
<th>t</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>Std. Error</td>
<td>Beta</td>
<td></td>
</tr>
<tr>
<td>Regression</td>
<td>.182</td>
<td>.059</td>
<td>.627</td>
<td>3.085</td>
</tr>
<tr>
<td>SK 1</td>
<td>.519</td>
<td>.022</td>
<td>.644</td>
<td>23.636</td>
</tr>
<tr>
<td>KMS 1</td>
<td>.722</td>
<td>.026</td>
<td>.782</td>
<td>46.375</td>
</tr>
<tr>
<td>KMS 2</td>
<td>.742</td>
<td>.016</td>
<td>.755</td>
<td>31.731</td>
</tr>
<tr>
<td>KMS 3</td>
<td>.825</td>
<td>.026</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a. Dependent Variable: LO 8  
b. Selecting only cases for which Cluster Number of Case = 1

Table 5-84: Hypothesis 8 – Cluster 1 – Regression Equation Coefficients

The presence of the construct ‘systems thinking’ within the organisations in cluster one was due to high technology and high Subjective Knowledge integration.
Cluster 2:

All the two hundred and twenty seven cases in cluster two were considered for data analysis. The total correlation between independent and dependent variables (R) was 79% and the model could predict 62% of the cases in the cluster as shown in Table 5-85. The model was significant as F= 92.103 at P <0.001 as shown in Table 5-86.

![Table 5-85: Hypothesis 8 – Cluster 2 – Model Summary](image)

![Table 5-86: Hypothesis 8 – Cluster 2 – Model Significance](image)

'Systems Thinking = 0.105 + 0.910 (employee Subjective Knowledge) + 0.842 (Information Systems) + 0.602 (Socialisation Systems) + 0.766 (Externalisation Systems)' was the multiple regression equation generated from Table 5-87. This equation makes it evident that all independent variables were significant in creating the model. Hence, it was concluded that the presence of the construct...
‘systems thinking’ in cluster two organisations was due to high technology and high Subjective Knowledge contribution.

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
<th>t</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>(Constant)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SK 1</td>
<td>.105</td>
<td>.072</td>
<td>1.479</td>
<td>.000</td>
</tr>
<tr>
<td>KMS 1</td>
<td>.910</td>
<td>.014</td>
<td>.873</td>
<td>65.000</td>
</tr>
<tr>
<td>KMS 2</td>
<td>.842</td>
<td>.030</td>
<td>.764</td>
<td>28.067</td>
</tr>
<tr>
<td>KMS 3</td>
<td>.602</td>
<td>.030</td>
<td>.582</td>
<td>20.068</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>.766</td>
<td>26.414</td>
</tr>
</tbody>
</table>

a. Dependent Variable: LO 8
b. Selecting only cases for which Cluster Number of Case = 2

Table 5-87: Hypothesis 8 – Cluster 2 – Regression Equation Coefficients

Cluster 3:
All the seventy eight cases from cluster three were considered for data analysis. A correlation between the dependent variable and independent variables does not exist as shown in Table 5-88. The denial of presence of ’systems thinking’ within them by the organisations in cluster three was because of the low technology and less Subjective Knowledge integration.

Warnings
The dependent variable LO 8 has been deleted. Statistics cannot be computed.

Table 5-88: Hypothesis 8 – Cluster 3 – SPSS Output

Cluster 4:
All the seventy eight cases in cluster four were considered for data analysis. The total correlation between the independent variable and the dependent variable (R) was 93%, and the model could predict 87% of the cases in cluster four as shown

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in Table 5-89. The model was significant as $F= 125.564$ at $P <0.001$ as shown in Table 5-90.

\[
\begin{array}{|c|c|c|c|}
\hline
\text{Model} & \text{R} & \text{R Square} & \text{Adjusted R Square} & \text{Std. Error of the Estimate} \\
\hline
1 & .934^{a} & .873 & .866 & .100 \\
\hline
\end{array}
\]

a. Predictors: (Constant), KMS 3, KMS 2, KMS 1, SK 1

**Table 5-89: Hypothesis 8 – Cluster 4 – Model Summary**

\[
\begin{array}{|c|c|c|c|c|}
\hline
\text{Model} & \text{Sum of Squares} & \text{df} & \text{Mean Square} & \text{F} & \text{Sig.} \\
\hline
\text{Regression} & 4.988 & 4 & 1.247 & 125.564 & .000^{a} \\
\text{Residual} & .073 & 73 & .010 \\
\text{Total} & 5.713 & 77 & & \\
\hline
\end{array}
\]

a. Predictors: (Constant), KMS 3, KMS 2, KMS 1, SK 1
b. Dependent Variable: LO 8
c. Selecting only cases for which Cluster Number of Case = 4

**Table 5-90: Hypothesis 8 – Cluster 4 – Model Significance**

’Systems Thinking = 0.313 + 0.264 (employee Subjective Knowledge) + 0.530 (Information Systems) + 0.583 (Socialisation Systems) + 0.521 (Externalisation Systems)’ was the multiple regression equation generated from Table 5-91. This equation makes it evident that the Knowledge Management Systems (information, socialisation, and externalisation) were most significant and employee Subjective Knowledge was less significant in creating the model.
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The neutral view about ‘systems thinking’ reported by organisations in cluster four was due to high technology contribution and low Subjective Knowledge contribution.

Effect of Knowledge Synchronisation on Systems Thinking

The effect of knowledge synchronisation on systems thinking was clearly demonstrated by this survey data analysis as detailed below:

- Organisations in clusters one and two had developed Knowledge Management Systems (information and externalisation) and also the employee Subjective Knowledge to instil the construct ‘systems thinking’ within them. This synchronised knowledge resulted in high systems thinking.

- It is safe to say that the organisations in cluster 3 had less effective Knowledge Management Systems (information and externalisation) and low employee Subjective Knowledge development towards inculcation.
of ‘systems thinking’. This created a knowledge gap which resulted in the absence of systems thinking within them.

- The organisations in cluster four had developed Knowledge Management Systems (information and externalisation) and paid little attention to the development of employee Subjective Knowledge. This created a knowledge gap that resulted in their neutral view towards ‘systems thinking’.

5.9 Summary

A web-based survey was conducted to validate the Knowledge Synchronisation Model (KSM) proposed in Chapter 4. The survey was conducted in two stages. The preliminary questionnaire adopted for survey was corroborated by the members of the New South Wales Knowledge Management Forum for its validity and relevancy in the first stage. Fifteen hundred organisations were contacted using snowball sampling technique for data collection. Five hundred and ten responses were received, out of which four hundred and seventy were usable for final analysis. After collecting the survey data, a number of statistical analysis methods were employed to determine the findings. Unsupervised clustering technique ‘K-means algorithm’ was applied for classifying the participating organisations into four clusters. Regression analysis was applied to individual clusters to validate the hypotheses. Five out of the eight hypotheses were substantiated by the data. The remaining three hypotheses could not be validated.
The survey and data analysis did not attempt to identify new relationships between the constructs discussed in Chapter 4, which was a limitation to this research study.

Two organisations from the survey participants were selected for further analysis and for knowledge synchronisation. The following chapter, Chapter 6, describes two action research studies conducted in those two organisations.
Chapter 6: Validating the Knowledge Synchronisation Model through Action Research Studies

6.1 Overview

This chapter describes two action research studies carried out in order to validate the Knowledge Synchronisation Model (KSM) developed by this study. The validation is undertaken through the synchronisation of Subjective Knowledge and Knowledge Management Systems in two specific organisations selected from the organisations that participated in the survey discussed in Chapter 5. The details of these two organisations are discussed under individual action research studies in Sections 6.3 and 6.4.

As discussed earlier, the process of knowledge synchronisation is divided into three major sub processes:

- **Knowledge gap identification**, using KSM as discussed in chapter 4 and the survey instrument as discussed in Chapter 5;

- **Organisational transformation**, using the tools and techniques as discussed in Chapter 3; and finally

- **Measuring** the effectiveness of the new organisation, again using KSM and the survey instrument as discussed in Chapters 4 and 5.

The survey instrument discussed in Chapter 5 aims to identify the knowledge gap in organisations. Survey data analysis indicated deficiencies in some of these
organisations such as lack of awareness, systems thinking and personal mastery. Two such organisations that demonstrated the aforementioned deficiencies were finally selected for the action research study. These deficiencies in those two organisations are due to the organisations’ inclination towards either technology development or people development.

The existence of aforementioned deficiencies in these two selected organisations was further supported by a survey and onsite observations conducted during the look stage of respective action research study. Organisational transformation and measuring its effectiveness were carried out during the think and act stages.

Action research process suggested by Stringer (2007, p. 8) is adopted for both the action research studies. The action research process is discussed in Section 6.2. Section 6.3 describes the action research study conducted in the first organisation while Section 6.4 describes the action research study conducted in the second organisation. Section 6.5 discusses the knowledge synchronisation in both organisations and Section 6.6 summarises this chapter.

6.2 Action Research Process

The process of action research was briefly described in Chapter 2. However, due to the importance of action research methodology in this chapter this section describes action research process in detail.
An action research study consists of many cycles of action research processes. Each action research process consists of three stages: Look, Think and Act as explained in the following sub sections.

**Look** (Stringer, 2007, p. 93) stage of an action research process enables the researcher to gather information from a variety of sources. The researcher then builds a picture, using the information so gathered, to clarify the research problem.

The process of gathering information includes qualitative research methods, such as onsite observations and interviews and quantitative research methods, such as questionnaires, as discussed in Chapter 2. Once the researcher gets a clear understanding of the problem, the purpose of the look stage is to assist the stakeholders in understanding how and what events occur.

Stringer (2007, p. 84) says that a researcher can gain extensive understanding by applying one of the following three frameworks:

- creating collaborative descriptive accounts through Ethnography,
- answering six questions – Why, What, How, Who, Where and When, and
- creating organisational profile.

Information pertaining to a research problem, at the end of the Look stage, will take the form of deliverables, such as current business process flows, business requirements, and problem definitions.
Organisation profiles are created during the look stage of both the action research studies. Business process flows are documented using Unified Modelling Language (UML) 2.0 (Unhelkar, 2005, p. 23) notation. Look stage of the action research study 1 is explained in Section 6.4.2.

Think stage of an action research process starts after the look stage. The deliverables of the look stage are the inputs for think stage. Think stage enables the researcher to analyse the information gathered, thereby gaining knowledge about that particular organisation or the research domain. Think stage also enables the researcher to create taxonomies or clusters with respect to the research problem. Finally, Think stage enables the researcher to formulate a solution to the research problem.

The purpose of Think stage is to use the interpretive processes to distil the information gathered, identify key features and elements of people’s experience, and enable participants to understand more clearly the way the research problem affects the organisational processes (Stringer, 2007, p. 124). The reporting framework of the think stage generally takes one of the following four forms says Stringer (2007, p. 102):

- interpretive questions (Why, What, How, Who, Where, and When),
- organisational review,
- concept mapping, and
- problem analysis.
Deliverables of the Think stage include possible solutions to the research problems, and refined business process workflows based on proposed solutions.

Organisational reviews and problem analysis are adopted as the reporting frameworks for both the action research studies. The Think stage of both the action research studies uses the Knowledge Synchronisation Model (KSM), to analyse the information gathered in respective look stages. Think stage and the deliverables of action research study one are discussed in Section 6.3.3 while those of action research study two are discussed in 6.4.3.

Act stage of an action research process starts after the think stage. The deliverables of the think stage will become inputs for act stage. Act stage enables the researcher to discuss the research problem and proposed solution with action research study stakeholders. The solution obtained by consensus will then be applied, in the research domain. Action plans will be used to apply the solution. Once the action plans have been made and executed, there will be a period of observation. The observation period will help the researcher to observe changes in the organisation or problem domain with respect to the research problem. Final report will be generated if the proposed solution solves the research problem or a new action research cycle initiated.

The purpose of act stage is planning and implementing practical solutions to the research problems. Act stage can be divided into four sub stages: planning, implementing, reviewing and evaluating.
The stage of planning includes identification of priorities and developing action plans for implementation. Stringer (2007, p. 144) says that any action plan needs to incorporate:

- **goals**: the actions required to resolve issues,
- **objectives**: specific activities required to resolve issues,
- **tasks**: the sequence of tasks required to accomplish each activity,
- **persons**: those who will carry out the tasks,
- **time**: the time frame within which each task will have to be completed; and
- **resources**: materials, equipment, and funds required to complete tasks.

*Implementation* stage starts with review of the detailed action plans. The tasks described in the action plans will be executed in the implementation stage. Stakeholders need to be connected through mutually supportive networks. The task of these networks is to nurture, reflect, assist and link stakeholders.

The *review and evaluation* stages run parallel to the entire action research study. The stakeholders need to meet on a regular basis to review the progress. The review process should focus on the following aspects: reviewing the plan, reporting the progress, modifications to the action plans as needed, and finally celebrating the success (Stringer, 2007, p. 140). Act stage of the action research study 1 is discussed in Section 6.3.4. The act stage of action research study 2 is discussed in Section 6.4.4.
UML 2.0 and Activity Diagrams

The current and proposed business process flows are documented using Unified Modelling Language (UML) 2.0 notation as discussed above. UML activity diagrams are used throughout this chapter to depict the process flows.

Unhelkar (2005, p. 23) says that UML emerged in 1995 as a combination of three modelling methodologies that were most popular at that time and evolved into the current state of the art UML 2.0 in 2004. UML models assist in creating new systems by facilitating communication, discussion and consideration of a number of ‘what-if’ scenarios (Unhelkar, 2005, p. 14).

UML 2.0 has 13 official diagrams and Activity diagrams are one of them. Activity diagrams represent the flow within the system or a specific business process from user’s point of view. Therefore, they are like flowcharts. Activity diagrams also help in mapping the activities to the actors (Unhelkar, 2005, p. 29). Activity diagrams are used in the look and think stages of these two action research studies. The purpose of the activity diagrams in the look stage is to effectively document the existing business process flows. This will enable the researcher in identifying missing links within the process flows and between the process flows and the actors. The activity diagrams in the think stage will enable the researcher to create and merge links between the business processes to achieve optimum solution with less number of actors involved.

The following sections describe two action research studies conducted in order to synchronise knowledge in two different organisations. The first organisation,
Biotec Solutions Australia Private Limited (Biotec Australia), has been providing sales and services to pharmaceutical and food industry since mid 90’s. The second organisation, a Certified Practicing Accountant (CPA) practice, has been providing tax and accounting services since early 2000. The name of the CPA firm is withheld from this thesis upon mutual agreement between the researchers and the CPA practice. The information on both the organisations presented in this thesis is not complete, due to the critical nature of the research problems addressed. However, sufficient information is provided to understand the knowledge synchronisation problem and the solution provided using Knowledge Synchronisation Model.

6.3 Action Research Study at Biotec Australia (ARS 1)

6.3.1 ARS1 - Introduction to Biotec

Biotec is a small enterprise with a turnover of about 20 million Australian dollars and offices in 3 countries: India, Australia and New Zealand. Biotec specialises in the supply of machinery and speciality material to the Pharmaceutical and Food industries. Biotec’s revenue originates from three departments: consultancy services, sales department and service department.

Consultancy services provided by Biotec include, but not limited to, the following areas:

- Development of quality assurance systems for Good Manufacturing Practice (GMP), and Hazard Analysis and Critical Control Points (HACCP) to the food and pharmaceutical industries. Besides, Biotec also offers technical training sessions in GMP and HACCP.
• Product Development: Biotec assists new entrepreneurs in developing new products.

• Qualifications (IQ & OQ) & Validations: Biotec offers complete Installation Qualification (IQ) and Operational Qualification (OQ) through logbooks. These logbooks contain complete history of the plant and the machinery.

• Food Label Compliance Checks: Biotec assists food exporters by verifying specifications of the label of the food packing to meet the standing of the destination country.

• Project Management: Biotec assists entrepreneurs with turn key projects in the areas of pharmaceutical and food industries.

The consultancy services offered by Biotec solutions require expertise in different areas such as biotechnology and extensive knowledge of the international standards for pharmaceuticals. The consultancy services department is based in New Zealand and consists of four consultants.

The sales department supplies wide array of products, to the pharmaceutical and food industry ranging from simple tablet and capsule counters through custom built walk-in humidity chambers to sophisticated research and development tools. The sales department currently is employing twenty personnel: four in Australia, four in New Zealand and the rest in India.

The service department looks after machine installations, repairs, training client staff, and preparation of technical bids. The service department is currently
employing sixteen personnel: three each in Australia and New Zealand, and the rest in India. The service department of Biotec is so branched out as to minimise the travel time for the service personnel. The three service personnel in Australia are trained in servicing a specific set of machines that are popular in Australia. Their counterparts in New Zealand are trained in servicing another set of machines that are popular in New Zealand. Similarly personnel in India are trained in servicing machines manufactured in India. The service personnel travel between these countries as required.

The head of the country operations is Operations Manager”. Biotec currently employs three operations managers, one each in Australia, New Zealand and India. The operations managers, with the help of the front desk, coordinate Biotec’s country operations. These operations include sales and service coordination, warehouse management, and liaising with other country offices and suppliers to fulfil operational needs. The organisational structure of Biotec is shown in Figure 6-1.
Chapter 6: Validating the Knowledge Synchronisation Model through Action Research

Figure 6-1: Biotec Solutions Organisational Diagram

Biotec Solutions
Board of Directors

Biotec Australia
Operations Manager
Specialises in Pharmaceutical industry

Sales
Four sales personnel

Service
Three service personnel. Well trained in servicing machines originating from a region.

Consulting
Four consultants

Biotec New Zealand
Operations Manager
Specialises in Food Processing

Sales
Four sales personnel

Service
Three service personnel. Well trained in servicing machines originating from a region.

Biotec India
Operations Manager

Sales
Four sales personnel

Service
Three service personnel. Well trained in servicing machines originating from a region.

Figure 6-1: Biotec Solutions Organisational Diagram
Biotec’s Australian operations manager participated in the survey discussed in Chapter 5. The survey data analysis discussed in Chapter 5 identified Biotec Australia as a ‘Subjective Knowledge high’ and ‘technology low’ organisation. Biotec Australia lacks Awareness and Systems Thinking as a consequence. The principle researcher of this study and his principle supervisor with the consent of Biotec conducted action research in their Australian office based in Villawood. The focal points of this action research study are the Australian sales and service departments based in Villawood. The consultancy division was excluded from the study due to time limitations. Sections 0 to 6.3.4 describe the Look, Think and Act stages of the action research study at Biotec Australia.

6.3.2 ARS 1 - Look Stage at Biotec

Biotec Australia located in Villawood currently employs three service personnel in the service department and four sales personnel in the sales department under the directions of an Australian operations manager. Approximately one hundred Australian manufacturers from around Australia form the customer base of Biotec Australia, which explains the niche of Biotec’s products and expertise. Only a few organisations in Australia can be compared with Biotec Australia in terms of range of available products.

Technologically, Biotec Australia has a Local Area Network (LAN) within their Villawood office. All the sales and service personnel are equipped with mobile phones and laptops. Biotec Australia has a static website (http://www.biotecsolution.com.au) portraying their business calibre. The connection between Australian operations and operations in New Zealand and
India is through traditional communication channels such as email, phone and fax.

The front desk of the company, on receipt of customer calls, forwards them to respective departments, either sales or service. The following paragraphs describe the current state of sales and service departments at Biotec Australia.

**The service department**

The service department of Biotec Australia comprises three service technicians. Activity diagram to address a typical client’s service request is shown in Figure 6-2.
Synchronising Subjective Knowledge and Knowledge Management Systems in Organisations
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Figure 6-2: Current Service Business Process at Biotec
A service request as shown in Figure 6-2 received by the front desk goes through the service process. A service request is received by front desk in either through traditional communication channels, such as fax, phone and email or through the sales personnel’s visit logs. Once the service process is initiated, the front desk with the help of the operations manager assesses whether the service can be provided by the Villawood office or not. All service calls, as mentioned earlier, cannot be served by the service personnel in the Villawood office. The service calls which require foreign expertise goes through another process involving the operations manager of Australia and of the respective country. The customers are notified about the delay. These situations arise only occasionally.

The sales and service departments at Villawood are in a position to handle about 98% of the sales and service calls. The operations manager assesses whether the service call can be attended to by the local technicians and allocates a service technician to address the service call. The service technician assesses the problem severity and whether physical presence is required to resolve it.

Most of the service calls do not require physical presence of the service technicians. For example, customer’s complaints relating to the rattling sounds from a machine can be resolved over the phone. Alternatively, the service technician prepares a solution plan and forwards it to the customer. A typical such solution involves technical manuals pertinent to the machine and a document explaining step by step directions to address the service request. An example of such a service call could be a Darwin customer’s request for change of a simple spare. The solution involves a relevant spare part along with a 'how-to' document...
prepared by a technician sent via speed post. Some of the service calls are more complex and require physical presence. The activity diagram for onsite service process is shown in Figure 6-3.

**Figure 6-3: Current Onsite Service Business Process**
Onsite service process, as shown in Figure 6-3, starts with the service person’s request for travel arrangements. The front office handles relevant logistics such as flight tickets and accommodation and then informs the client about the service technician’s visit. The service technician downloads information relating to the client’s plant and collects necessary spares from the warehouse. The service technician visits the plant and performs the required service as pre schedule. The service technician receives feedback from the client and then moves on to another job. A service trip generally includes visits to a number of clients.

The customer who requests a service receives either an onsite service or an off-site service based on the nature of the service call. Customers submit their feedback to the system, which is evaluated before disarming the service request.

The service processes described in Figure 6-2 and in Figure 6-3 are developed when the customer base was less than fifty. However, there are only three service technicians covering the whole of Australia and now the customer base exceeds hundred. One service technician needs to be in the office to provide off site services. This reduces the number of service technicians available to provide onsite service to two. Moreover, it is observed that when the service technician visits a client, the client presents a list of other services required by the machinery. These unforeseen and unplanned for requests require additional information, spare parts and time. Service technicians request clients to make a fresh service booking. Additional service bookings require clients to pay service charges besides some wait in period. Most of the clients did not seem to understand the
rationale behind their additional bookings and they start complaining to the operations manager about the service technicians.

**The sales department**

The sales department of Biotec Australia consists of four sales personnel who are always on their toes. The job of a sales person includes generating and following sales leads, participating in exhibitions, and touching base with existing clients. A sale is classified into two types: machinery sale and accessory sale. Accessories, such as empty capsules and tablet coatings, account for major share of the income from the existing customer base. Accessory sales require more of warehouse involvement than that of the sales personnel. However, accessory sales are the key in generating machinery sales. Machinery sales are relatively low in volume and generate substantial revenue. The sales personnel focus on machine sales as well as accessory sales for that reason. A typical itinerary of a sales person covers the entire state and spans over ten days. Activity diagram for a sales person’s travel is shown in Figure 6-4.
Figure 6-4: Existing Sales Personnel Tour Process
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The tour plan of a sales person as shown in Figure 6-4 starts with his announcement of availability to the system. The front desk in consultation with the sales person prepares a travel plan. For example, the front desk received expression of interests from a number of new and existing clients from Victoria and Biotec Australia made plans to participate in an exhibition in Melbourne. The Operations Manager typically decides to send the first available sales person to Victoria. The sales person with the help of the front desk prepares a travel plan so that he can cover all the clients and then join the sales team at the Melbourne exhibition. The front desk takes care of the travel arrangements and accommodation, and then forwards the same to the Operations Manager for his approval. Operations manager verifies the plan; either approves it or suggests some alterations.

Once the plan is approved and the arrangements are made, the sales person downloads information, such as the latest catalogue, customer details, quotations to be submitted and power point presentations to be made, from the Local Area Network (LAN) into his laptop. The sales person then starts visiting clients according to the travel plan.

A sales person generally submits a quotation and discusses it in detail with new clients who expressed interest in purchasing products from Biotec Australia. Warehouse visits and working demonstrations of the machines of interest are offered to new clients at the expense of Biotec Australia. The purpose of the sales person’s visit to an existing client can be either to take orders for accessories, or to discuss proposals of new machines, or just courtesy calls. The sales person
updates the system about customer visits at the end of the day. These updates typically contain information about new supply orders, service requests, requests for quotations/proposals and site visit requests.

The requests forwarded by sales personnel are acted upon by the front desk or by other sales personnel. However, it is observed that the sales person who obtained the sale orders fulfils them after his return, which generally occurs after ten or even more days. Some requests of type ‘send 10 cartons of empty capsules to customer XYZ’ cannot wait for that long as the delay in the supply might cause total closure of the client’s plant for a couple of days and the customer will turn to other supplier to avoid such inconvenience.

A survey, using the survey questionnaire presented in Appendix-B, was organised within the Biotec Australia. The survey data analysis pointed out that the sales and service departments lack Awareness, and Systems Thinking due to the lack of proper technology and process support.

**The look stage report for Biotec**

A detailed report is presented to Biotec Australia’s Operations Manager at the end of the second week of the action research study. The report discusses the organisational profile, current business process flows and the underlying problems. The business process models are shown in Figure 6-1, Figure 6-2, and in Figure 6-3. The problems associated with those business process models are identified as follows:
The problems with current service business flow include the following:

- Service personnel are not able to complete the service task due to the customer’s inability to summarise service requirements.
- Service personnel are not able to access information away from the office premises.
- Time and financial constraints involved in arranging specialist’s visits from overseas. Moreover, it has been observed that some of the overseas experts’ visits were in vain due to the nature of the service requests.
- Inability of the service personnel to adhere to their schedules.

The problems with the current sales process flow include the following:

- Sales personnel are not able to access the information while on run, which prevents them to complete sale on the run.
- Front desk is not able to serve the requests if none of the sales personnel are physically available, which is putting pressure on the Operations Manager for he has to serve these requests himself, akin to fighting fires instead of focusing on future development strategy.
- Sales personnel are not able to perform simple service tasks. This is adding financial burden to Biotec Australia and makes service departments agenda more complicated.

The Operations Manager agreed with the report and enriched the understanding of the researcher by throwing more light on financial, operational and technical
constraints pertinent to the problems identified. However that discussion is excluded from this thesis due to its operational sensitivity.

### 6.3.3 ARS 1 - Think Stage at Biotec

The survey data analysis pointed out that the sales and service departments lacked ‘Awareness’, and ‘Systems Thinking’ for want of proper technology and process support.

The problems arising from this situation are as follows:

The sales personnel are not able to

- Generate quotations on the run, due to lack of access to the technical manuals on line;
- Close a sale on the run, due to lack of access to the up to date stock details;
- Access the latest catalogue; and
- Perform simple service tasks, due to the rigid partition between the sales and service departments and also due to the “minding my own business” style of thinking.

The service personnel are not able to

- Answer simple sales related questions, due to lack of accurate price details;
- Service all kinds of machines sold by their organisation; due to lack of training, peculiar organisational structure, and again ’minding my own business’ style of thinking.
• Adhere to their schedule, due to unforeseen situations at the clients’ place; and
• Complete the service requests in one single service call.

The front desk is not able to
• Serve all the requests in a timely manner;
• Handle the sales if all the sales personnel are on run; and
• Manage the warehouse effectively.

The Operations Manager, due to the above mentioned reasons, has to done the roles of a service technician, sales person and the front desk operator at times, thus limiting his ability to focus on business critical issues. The problems mentioned above confirm the survey results that Biotec Australia lacks Awareness and Systems Thinking.

According to the Knowledge Synchronisation Model, as explained in Chapter 4,
• ‘Awareness’ can be instilled into an organisation by developing employee Subjective Knowledge and Combination Systems; and
• 'Systems Thinking’ can be instilled into an organisation by developing Information Systems, Externalisation Systems, Socialisation Systems and employee Subjective Knowledge;

The sales and service departments of Biotec Australia require development of employee Subjective Knowledge and some new technology to address these operational issues. Following solutions are contemplated:
Appointing more staff, Biotec Australia can do with more staff. Increase in the number of service personnel would help reduce the load on each service person. Increase in the number of sales personnel and making one constantly available at headquarters would reduce the load on the front desk.

Problems such as sales personnel not being able to perform simple service tasks and their inability to close the sale on the run will remain the same. Moreover, the question ‘how many new employees are needed?’ will become hard to answer and adds financial burden to the organisation.

Training existing staff members, Biotec Australia currently employs three service technicians and four sales personnel. All of them are mostly on run and communicate with the clients regularly. Biotec Australia can train the sales personnel in performing simple service tasks and the service personnel in simple sales tasks. This will enable Biotec to operate with seven sales and service technicians, four specialising in sales and three in service. The training would also allow Biotec Australia to change the thinking style of ‘Minding my own business’ of its employees. The survey identified that the sales and service personnel are willing to share their knowledge with their colleagues. Personal discussions with the sales and service departments indicated that they need some time and space to share their knowledge.

Implementing new technology, Biotec Australia can implement new technology. The Local Area Network (LAN) can be extended with current technologies such as intranet, extranet and knowledge portal. Intranet can help Biotec Australia to
standardise most of its business processes and will allow the sales and service personnel to share information seamlessly. Extranets will allow Biotec Australia to communicate with the suppliers and other branch offices. Finally, a knowledge portal would allow Biotec Australia to share knowledge with their customers, suppliers and the employees.

**Solution Proposed in the Think Stage**

Investments in new technology and in training existing employees, rather than hiring new, are proposed as a result of the think stage. A knowledge portal was suggested as a technological solution. A Community of Practice (CoP) was suggested for employee Subjective Knowledge development. New processes and roles were developed based on the proposed solution.

The following characteristics of the knowledge portal were suggested:

- Knowledge base of all the technical manuals (searchable);
- Customer database;
- Frequently Asked Questions;
- Standard business document templates;
- Online purchase facilities for accessories; and
- Expert locator.

A new role, sales and service manager was suggested to ease the burden on Operations Manager, with the following key functions:

- Office based position, no travelling required;
• Portal maintenance;
• Sales and service coordination;
• Championing the Community of Practice (CoP); and
• Warehouse management.

The organisational structure of Biotec Australia, after organisational transformation, is as depicted in Figure 6-5.

![Figure 6-5: Biotec Australia Organisational Structure after Organisational Transformation](image)

Activity diagram for the proposed service process with the sales and service manager, knowledge portal and a Community of Practice (CoP) in place is shown in Figure 6-6.
Figure 6-6: Biotec Australia’s proposed Service Process with Application of KSM
As shown in Figure 6-6, Customers have to request service through the knowledge portal. The customer will be guided to the Frequently Asked Questions (FAQ) section of the knowledge portal, which is also open to the general public. The FAQ section answers typical questions such as ‘What type of tablet sizes can be made with machine type XYZ?’ Or ‘what colour coatings suit specific type of tablets?’

Requests relating to the machines and also of more technical type will take the customer to the knowledge base. The customers need to logon to the knowledge base using their username and password. The knowledge base consists of all the technical documentation of the machines being supplied by Biotec Australia. A typical question such as ‘machine type XYZ is turning off after working for an hour, what I should do?’, will be answered by guiding the customer through the operational manual for taking necessary precautions, such as changing the control panel settings, or ensuring sufficient airflow to the machine XYZ.

A customer who is not satisfied with the knowledge base or a customer whose problem has not been resolved by the knowledge base, fills in a service request document on the portal. The service request document allows the customer to upload related voice, picture, or video.

The knowledge portal initiates a service process after receiving the service request. The service request will be forwarded to the sales and service manager, who assesses the request by inspecting the audio visual attachments. The manager will then decide whether the local team can provide the service. Service requests
requiring overseas expertise will be forwarded to appropriate office. Service requests that can be served by the local team will be further assessed as to the need for physical presence to solve the problem. The service requests which do not require physical presence will be answered by the manager himself within a working day. The services which do require physical presence will be further assessed and added to a technician’s schedule. The technician will visit the client’s place and perform the required service. The client will then provide feedback to the sales and service manager. The manager will then update the FAQ section and the knowledge base as required, and close the service request with his comments. The portal will then inform the Operations Manager about the closure of the service request process.

The advantages of this process over the existing process include the following:

- Phone calls received by the front desk are minimised;
- Off site requests are served within one working day;
- Purchase orders are processed within a short period;
- Customers do not need to pay any service fee to access the knowledge portal;
- Six technicians can always be outdoors, performing sales tasks as well as service tasks with some limitations, though these technicians are specialists in either sales or service;
- The limitations mentioned above will be overcome as the technicians will acquire the skills required with the help of the Community of Practice (CoP).
The involvement of the Operations Manager is minimised in the day to day sales, service, and warehouse operations. The Operations Manager will have more time to address the development strategy as a consequence.

Activity diagram for a technician’s site visit process is shown in Figure 6-7. A technician announces his availability for travel and on receipt of approval from the sales and service manager visits a client as planned and discusses the matter with the client. Sales related matters, such as request for quotations, will be fulfilled by the technician instantly with the help of the knowledge portal. The technician logs on to the knowledge portal and prepares instant quotations with the help of standard templates. Special sales matters, such as quotations for custom made machines can also be fulfilled in a matter of hours. The technician logs on to the knowledge portal and contacts the sales and service manager with the request. The manager furnishes a quotation and the relevant material, after negotiating with the manufacturers, in an hour’s time. The technician will use this quotation to receive an expression of interest from the client. Service related issues will also be dealt with similarly. The technician assesses the client’s service requests with the help of the knowledge portal. The service requests that can be served immediately will be handled by the technician. The service requests that cannot be served immediately are reported to the manager by the technician through the knowledge portal. The manager assesses the service request immediately and gives out a confirmed service date before the current service technician leaves the client’s premises.
### Figure 6-7: Technician’s Onsite Visit with Application of KSM

<table>
<thead>
<tr>
<th>Customer</th>
<th>Technician</th>
<th>Knowledge portal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Request onsite service</td>
<td>Visit Customer</td>
<td>Supply instant quotations and stock details</td>
</tr>
<tr>
<td></td>
<td>Discussions with customer</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Discussion type</td>
<td>Initiate sales process</td>
</tr>
<tr>
<td></td>
<td>Sales Service</td>
<td></td>
</tr>
<tr>
<td>Evaluate Quotation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>Process purchase order</td>
<td></td>
</tr>
<tr>
<td>Buy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>Can I do it?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>No</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Initiate purchase process</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Provide service</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Initiate service request</td>
</tr>
<tr>
<td>Receive onsite service</td>
<td></td>
<td>Confirm service date</td>
</tr>
<tr>
<td>Receive service date</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The advantages of this process model include:

- The number of technicians available. There will be six technicians available and hence more clients can be supported;
- The transparency in the sale process will allow the Operations Manager to plan his inventory well in advance; and
- A technician can close a sale on the run.

However, the above mentioned advantages can be delivered only by developing and deploying a specific knowledge portal that suits Biotec Australia’s needs. Further, a Community of Practice (CoP) has to be initiated, to train the sales personnel in service related issues and the service personnel in sales related issues.

**The think stage report for Biotec**

The Operations Manager is briefed at the end of week four of the research study with the proposed solution. The report consisted of the discussions with the sales and service personnel, proposed organisational changes, knowledge portal technologies and process of initiating and nurturing a Community of Practice (CoP).

The Operations Manager agreed to implement those proposals. He requested the researchers to come up with a one year action plan to implement the solution which was readily prepared. The following section describes the action plan and the actions taken during the remaining eight weeks of the study period.
6.3.4 ARS 1 - Act Stage at Biotec

Act stage of the study at Biotec Australia started in week five of the action research study. The sales and service team was assembled and were appraised of the issues identified in look and think stages. The Operations Manager also explained the need for organisational transformation and his vision for the future of Biotec Australia. A senior service technician was selected as temporary sales and service coordinator, for his working experience in all the three offices. The researchers with the help of operations manager and the coordinator prepared action plans. The highest level action plan, in parts, is shown Table 6-1. The actual action plan is prepared for a twelve month period. However, due to the time limitations, this act stage only reports the final eight weeks study at Biotec Australia.

The sales and service coordinator, owing to his experience in all the three offices of Biotec, quickly understood the need for and advantages of the proposed solution and took upon himself to champion the project. The coordinator’s travel duties were delegated to other service personnel and he was made stationary for the durations of the study of nearly eight weeks.

The Local Area Network (LAN) administrator created a work space for the sales and service coordinator. The coordinator managed to get hold of the master product catalogue which existed in the main office in New Zealand and consolidated all technical manuals into one directory. The manuals were in text, Portable Document Format (PDF), or Microsoft word formats. All the manuals were transferred into PDF format. A customer database was created. A
Frequently Asked Questions (FAQ) information base was initiated by the end of week eight of the action research study.

<table>
<thead>
<tr>
<th>Objective</th>
<th>Tasks</th>
<th>Persons</th>
</tr>
</thead>
</table>
| Creation of a Knowledge Portal | 1. Consolidate and create a knowledge base of technical manuals.  
2. Consolidate and create a complete product catalogue.  
3. Create a customer data base.  
4. Create a FAQ information base.  
5. Identify suitable Knowledge Portal product vendors.  
6. Purchase and commission the portal | All the sales and service team under the guidance of sales and service coordinator.  
Operations manager and the researchers as observers. |
| Community of Practice (CoP) | 1. Allocate 2 working hours a week as get together time.  
2. Plan the discussion issues in consultation with all the members.  
3. Devise a “recognise and reward” scheme. | Sales and service coordinator.  
Operations manager and the researchers as consultants. |

Table 6-1: Biotec Australia - Transformation Action Plan

The first get together session, to create a Community of Practice (CoP) was held on Friday of week 6 of the action research study. The operations manager ensured that all the employees in the Villawood office attended that session. The operations manager unfolded the entire exercise of Community of Practice (CoP) and explained the rationale. The sales and service personnel, who knew bits and pieces about the study, due to their interactions with the researcher, understood the importance of this study. They realised that by application of the Knowledge
Synchronisation Model (KSM), many of their problems can be solved. Moreover, they realised that their marketability would increase if they gain more skills by following new business processes and by sharing their knowledge with their colleagues. The same is also true for the organisation. This understanding created a win-win situation. The Operations Manager wanted to implement the new business process model for making the organisation more efficient and the sales and service personnel supported it for increasing their marketability.

The coordinator later explained the ‘reward and recognise’ system. Employees will be recognised and rewarded for their contribution towards the development of the knowledge portal and other employee development plans. Employees are required to do the following:

- Fill in the FAQ information base;
- Take initiative on performing the other side of tasks, for sales personnel it is simple service related tasks and vice versa, at clients place; and
- The team members have to help each other.

The sales and service coordinator also assured the team members that he will be always at hand to help them if needed. The staff of Biotec Australia started having get together sessions every Friday after work, beginning Friday of the week six of this research study, sharing their work experiences and other information. The team, by the end of week ten is willing to follow the new business processes. The sales and service coordinator managed to update the laptops of the sales and service personnel with images of the new knowledge bases and basic templates for sales and service quotations. The sales and service personnel, by week ten
were equipped with all the required gadgets to discuss with clients about both sales and service related issues.

The researcher during the last two weeks of the study participated in these Friday evening sessions. The discussions with the sales and service team revealed that they were trying to talk about the other side issues with clients, which it self is a big achievement according to the Operations Manager. The researcher explained the proposed solution, a knowledge portal to the sales and service team. The researcher asked the sales and service technicians to fill in the questionnaire, shown in Appendix-B considering the full solution been implemented. The survey data analysis showed that Biotec Australia will become a Subjective Knowledge high and technology high organisation once the proposed solution is implemented and will achieve Awareness and Systems Thinking.

6.4 Action Research Study at a CPA Firm (ARS - 2)

The second action research study is conducted at a Certified Practising Accountant’s (CPA) firm located in Parramatta Central Business District (CBD). The name of the CPA practice is withheld owing to an agreement between the researchers and the CPA practice partners. The duration of the study is twelve weeks similar to the action research study 1 discussed in Section 6.3. Details of the action research study to synchronise knowledge in the CPA practice are discussed in the following sub sections.
6.4.1 ARS 2 - Introduction to the CPA Firm

The CPA practice has two offices with the Head Office in Parramatta and a branch office in Melbourne. The CPA practice provides services to four types of clients: *individuals, companies, partnerships and trusts*.

The services on offer to the *individuals* include the following:

- Accounts maintenance and finalisation;
- Business Activity Statement (BAS) preparation and lodgement;
- Tax returns preparation and lodgement;
- Fringe Benefit Tax (FBT) calculation and lodgement of FBT returns; and
- Superannuation calculation and lodgement of superannuation returns.

The services on offer to the *companies, partnerships and trusts* include the following:

- Company formation;
- Account maintenance and lodgement of income tax returns;
- Payroll maintenance;
- Business Activity Statement (BAS) preparation and lodgement;
- Company returns preparation and submission to Australian Securities and Investments Commission (ASIC);
- FBT calculation and lodgement of FBT returns;
- Trust income tax returns preparation and lodgement; and
• Beneficiaries and trustee’s income tax return preparation and lodgement.

The CPA practice employs four full time staff members and above casuals during the end of the financial year, July to October. The required number of casual staff depends on the work load of the full timers. Four casual staff members are appointed to help the CPA practise with 2006-2007 tax returns during the year 2007. Three of them are stationed in the Parramatta office and one in Melbourne office.

The principal consultant of the CPA practice has participated in the survey discussed in Chapter 5. The survey data analysis discussed in Chapter 5 indicated that the CPA practice lacks ‘Personal Mastery’. The CPA practice was approached by the researchers for further study during the tax return season of 2007. The partners of the CPA practice agreed to allow the researcher to study the process of ‘individual tax return preparation and lodgement’ for further investigation. The focal point of this action research study (ARS-2) was the process of individual tax return at the Parramatta office.

6.4.2 ARS 2 - Look Stage at the CPA Firm

The CPA practice’s Parramatta office employed two fulltime and three casual staff members during the tax return period of year 2007. The principal consultant above participated in tax return lodgements whenever time permitted. The office has submitted more than twelve hundred individual tax returns during that period. The CPA practice has an intranet and all the employees are equipped with a
desktop computer connected to the intranet. The intranet is connected to the Australian Taxation Office (ATO) through a secure line. Employees lodge e-tax returns using a specific software package supplied by a leading software development house in Australia. Activity diagram for the process of an individual tax return lodgement is shown in Figure 6-8.
Figure 6-8: Individual Tax Return Lodgement Process
The process of individual tax return lodgement as shown in Figure 6-8 starts with a client’s request for an appointment either through a fax message, or a phone call or an e-mail. The front desk allocates a suitable time and then forwards a tax pack and appointment details to the client. The tax pack consists of a set of standard forms and a list of supporting documents necessary to process the tax return claims.

The client fills in the forms and collates required documents before visiting the tax consultant. The client visits the CPA practice for the appointment with the tax pack and supporting documents. A consultant reviews the documentation with a view to maximising the legally allowed tax returns to the client. The tax consultant finally prepares the tax return document using the software package. The software package can identify technical defects in the application. However, it cannot suggest options for maximising client’s tax return amount. Once the software accepts all the inputs from the tax consultant, he will print the tax return document and discusses it with the client. The client reviews and if satisfied signs the tax return document. The tax consultant will forward the signed tax return document to his supervisors for lodgement.

Full time staff members act as supervisors to casual staff members under the overall supervision of the principal consultant. The supervisors being more experienced are able to optimise the benefits to clients. The supervisors review and make changes to the tax return documents if needed. The supervisors generally submit the final tax return document to the Australian Taxation Office (ATO) using specific software.
The problems with the current ‘prepare tax return’ process were identified as follows:

- Casual staff members, being naïve and theory oriented, are taking much longer than the allocated 45 minutes time to complete an individual tax return;
- The tax returns are received to be modified by the supervisors regularly, thus adding more pressure on the supervisors, as individual consultants and reviewers;
- Some of the tax returns are being delayed for weeks as they require special attention by the principal consultant.

These problems point out the knowledge gaps between the casual staff members and full timers, and the full timers and the principal consultant. In view of this knowledge gap all the clients started seeking appointments with the principal consultant. The effects of this knowledge gap and the problems with the tax return preparation surfaced during the review tax return process.

The owner of the review process is a supervisor. As mentioned earlier, senior staff members act as supervisors to the causal staff and the principal consultant to the senior staff. The review tax return process is shown in Figure 6-9.
Figure 6-9: Review Tax Return Process
Three people are functioning as supervisors every day and are responsible for review and lodgement of the tax return forms. As shown in Figure 6-9, the review process starts with the receipt of a duly signed tax return form. The client generally would have left the CPA practice before the start of this process. The supervisors review the tax return document to check the eligibility and validity of the claim. As mentioned earlier the technical defects of the application are taken care of by the software package. Supervisors generally look at the client’s previous tax return lodgements and other possible deductions which can be made by the client to maximise their refund. Supervisors lodge the application with the ATO if the application signed by the client is appropriate and needs no corrections.

Supervisors, some times, find options to improve the refund to the client. Additional documentation from the client or changes to the tax return application may be required to maximise the refund to the client. The client will be contacted by the front desk and a new appointment will be made for consultation. Concerned tax consultant will be notified of the required changes and an amendment process will be initiated. Neither the new appointments nor the amendments process are paid for by the client.

The review process at the CPA practice has considered two hundred such requests for amendments or re-appointments during the tax return season of 2007. This is nearly fifteen percent of the total submissions and is not chargeable.
A survey, using the questionnaire presented in Appendix-B, was organised within the CPA practice. The survey data analysis confirmed the principal consultant’s opinion that the employees in the organisation lack ‘Personal Mastery’. This explains the staggering amount of requests for amendments and re-appointments at the CPA practice.

The look stage report for the CPA practice

A report was presented to the principal consultant at the end week two of the study. The report consisted of the organisational profile, current tax return lodgement process, tax return assessment process and the survey data analysis. The report also indicated the problems with the current tax return lodgement process as explained above. The number of amendments required also supported the findings of this stage.

6.4.3 ARS 2 - Think Stage at the CPA Firm

As stated above, the survey data analysis confirmed the principal consultant’s opinion that the employees in the organisation lack ‘Personal Mastery’. The lack of Personal Mastery could be because of the naïve casual employees or lack of technology to help employees in gaining personal mastery. Moreover, the standard templates in the CPA’s tax pack were created by the principal consultant quite sometime ago and need updating.

The problems arising from current tax return lodgement process model in the CPA practice are summarised as follows:

The tax consultants are not able to
Complete and lodge a tax return in the planned 45 minutes’ due to either

- The tax consultant’s inexperience; or
- Client’s inability to provide required documentation; or
- The supervisor’s tight schedule, deterring them from reviewing the filled applications.

Access the relevant documents from the ATO’s website. This is due to

- The sheer volume of the information available on the ATO’s website. Tax consultants are found to be spending too much time surfing the ATO’s website with little success.
- The lack of necessary documentation. Tax consultants are calling the tax office helpline to confirm the deductions.

Learn from their mistakes. This is due to lack of standard procedures for training the staff and sharing the knowledge.

Communicate with the clients. Some of the clients are with the CPA practice since its inception and expect cosiness. Casual staff members, who do not have access to the clients’ history, are not in a position to offer it to the deserved clients. This situation is creating discomfort to the principal consultant.

The clients are not able to

- Get the best tax advice.
- Get the recognition they deserve.
- Complete their tax returns in scheduled time.

The front desk is not able to manage the appointments schedule, due to the above mentioned constraints.
According to the Knowledge Synchronisation Model, as explained in Chapter 4, ‘Personal Mastery’ can be instilled into an organisation by developing employee Subjective Knowledge, Socialisation systems, Externalisation Systems and Internalisation Systems. Along these lines, the following solutions were contemplated:

New Technology: The CPA practice uses software from one of the leading financial software vendors to file tax returns. The software has limited functionality in solving current problems. A knowledge based application is suggested to the CPA practice. The following characteristics of the application are suggested.

- **Client database:** created in such a way that the consultant can access current and prior years’ tax returns of the client. The database also has to mention the client’s relationship with the practice so that the client can be treated appropriately;

- **Knowledge base:** which include the comprehensive library of tax returns and ATO schedules;

- **Appointment scheduler:**

- **Frequently Asked Questions (FAQ) section:** and

- **Document management system:** to manage proprietary templates.

Community of Practice (CoP): A Community of Practice (CoP) is also suggested to the CPA practice to develop employee Subjective Knowledge. Community of Practice (CoP) also provides a base for socialisation,
externalisation and internalisation. The Community of Practice (CoP) sessions are
to take place in the morning over a cup of tea for discussing the mistakes made by
the consultants and the corrections made to them by the supervisors on the
previous day. This will help the novice tax consultants.

**One supervisor:** The principal consultant and two full time staff members are
acting as supervisors and tax consultants every day. This is putting much pressure
on them. One dedicated supervisor per day is suggested. This means that one of
the three experienced staff members’ two full timers and the principle consultant
acts as supervisor for a whole day. The dedicated supervisor will only review
applications filed on that day and does not consult. This will reduce the work load
on the other two experienced consultants and allow them to focus on tax return
filing. The supervisor, while reviewing the tax returns, will prepare a list of errors
made by the others. This error list consists of four columns: the name of the
consultant who made the error, the error and the corrective action taken/suggested,
and respective documentary reference. The supervisor, at the end of the day,
summarises the error list and updates the FAQ section of the knowledge base for
future reference. The supervisor will chair the next day’s morning tea (CoP)
session and will discuss the list in detail. The consultants will gain knowledge this
way. Present day’s supervisor will take charge after commencement of the
business.

**Think stage report for the CPA practice**

The recommendations were presented to the principal consultant at the end of
week four. The principal consultant agreed to look at the possibility of purchasing
a new software package or upgrading existing one in the coming year. The principal consultant agreed to try the Community of Practice (CoP) or morning tea sessions and one supervisor for the day for the rest of the study duration, which was nearly eight weeks. The decision of the principal consultant to continue with the existing software package and try changes to the organisational structure has compelled the researchers to come up with an alternative solution. The supervisor was asked to socialise with the waiting clients, when not busy with the review process. The supervisor, with his experience, can easily identify the clients and can help the casual staff to locate the documents pertinent to the clients. This might reduce client’s discomfort.

6.4.4 ARS 2 - Act Stage at the CPA Firm

The researcher has briefed the staff at the CPA practice about the suggested operational changes. Error logging templates were created and the work flows were defined in week five of the research study. The principal consultant and the two full time staff were trained in the new process. The new process model was implemented in Week six of the research study. The staff including the principal consultant started attending the morning tea sessions to review the previous day’s work.

Researcher’s discussions with the staff members revealed that the persons acting as supervisors were hesitant to point out the mistakes made by the principal consultant. Moreover, the principal consultant was trying to act as supervisor more often, than planned.
Researcher’s interim report on the effects of new process gently pointed out these two points to the principal consultant and indicated the problems in such an approach. The problems of this approach included the staff’s inability to complete the process while the principal consultant was away. The principal consultant acknowledged the issues and continued further discussions with the researchers. Those discussions related to the concept of “trust” and are not discussed in this thesis.

The researchers as well as the CPA practice have observed that the average time for completing a tax return is continuing to take more than 45 minutes. The morning tea sessions started working effectively, as can be seen from the decreased number of amendment requests and client’s complaints. A survey conducted at the end of the study indicated that the employees have made learning an ongoing process.

6.5 Knowledge Synchronisation Model Validated

Knowledge Synchronisation Model is proven valid in both the action research studies.

Two constructs namely, awareness and systems thinking, were identified as missing in Biotec Australia. The effects of these missing constructs were identified and documented in the look stage of corresponding action research study. Biotec Australia has been transformed using Knowledge Synchronisation Model in the think stage and the organisational transformation has been implemented in the act stage of the respective action research study. The
organisational transformation includes development of employee Subjective Knowledge and a knowledge portal. Some process reengineering has also happened. An exit survey indicates that Biotec Australia has instilled the missing constructs namely, awareness and systems thinking, after the action research study. The validity and usefulness of knowledge synchronisation at Biotec Australia is reflected in the reduction of travel cost and increase in customer satisfaction.

One construct - personal mastery, was identified as missing in the CPA practice. The survey questionnaire was used for identification of this missing construct. The effects of this missing construct were identified and documented in the look stage of respective action research study. This missing construct is instilled into the CPA practice by organisational transformation in the think and act stages of respective action research study. The organisation transformation includes initiation of a Community of Practice for employee Subjective Knowledge development and a knowledge base for externalisation and internalisation. Some process reengineering has also taken place during this action research study. However the CPA practice has only implemented partial solution and postponed the decision on technology. Implementation of the Community of Practice (CoP) has proved the worthiness of proposed solution by reducing the errors in tax return lodgement process through continued employee education. An exit survey indicated that the construct 'personal mastery' has been instilled into the CPA practice during the action research study.
6.6 Summary

This chapter examined the validity of the Knowledge Synchronisation Model (KSM) through action research studies in two organisations. The action research studies were conducted over a period of twelve weeks each in these two organisations.

Look stage was carried out for a period of two weeks. Think stage was carried out for two weeks and the act stage for the rest eight weeks. A report at the end of each stage was presented to the concerned authority. The three stages of knowledge synchronisation namely, knowledge gap identification, organisational transformation and measuring the effectiveness were aligned to the three stages namely, Look, Think and Act, of the action research process to facilitate the knowledge synchronisation.

Three hypotheses, pertinent to the constructs-‘Awareness’, ‘Systems Thinking’ and ‘Personal Mastery’ from the Knowledge Synchronisation Model- have been validated due to these two action research studies. This is in accordance with the action research principle that all the constructs cannot be validated using one action research study. A number of action research studies are required to validate Knowledge Synchronisation Model in its entirety. These aforementioned action research studies are planned at post-doctoral level by this researcher with promised sponsorship of the study by other organisations participated in the survey explained in Chapter 5. The Following chapter concludes this thesis by
indicating the research significance, its findings and implications on research and management.
Chapter 7 : Conclusion and Future Directions

7.1 Overview

This chapter summarises the research described in this thesis. This chapter also outlines future areas of research opened up by this research. The research aim and objectives were discussed briefly in Chapter 1. The research methodology adapted to achieve the research aim was discussed in Chapter 2. The literature review pertinent to this research study was discussed in Chapter 3. The Knowledge Synchronisation Model was discussed in Chapter 4. Chapter 5 describes a web-based survey and Chapter 6 describes two action research studies conducted to validate the Knowledge Synchronisation Model.

This chapter discusses the result of this research. Section 7.3 discusses the challenges faced by the researcher during this research. Section 7.4 discusses the implications of this research over research and management paradigms. This chapter concludes finally in Section 7.5 with possible extensions and related future directions of this research.

7.2 What Has Been Achieved?

The aim and objectives of the research outlined in Section 1.3 have been achieved by this research study. A judicious combination of research methodologies has been adapted to create the framework for this research study. However, there are some expected limitations to the achievement of the research aim, including time
constraints. The challenges faced by the researcher while conducting this research are discussed in Section 7.3.

This research study, like most, was conducted in two stages: theory development and theory validation.

The theory development stage used research methods such as literature review and content analysis to generate the proposed Knowledge Synchronisation Model. The Knowledge Synchronisation Model stemmed from the ideas of past and present researchers who worked in the areas of Organisational Theory, Intellectual Capital and Knowledge Management.

The theory has been developed in the following four steps:

1. Investigation of Organisational Characteristics;
2. Investigation of Subjective Knowledge Characteristics;
3. Investigation of Knowledge Management Systems; and
4. Development of the Knowledge Synchronisation Model.

Theory validation has been performed in two steps:

1. A web-based survey to assess the validity of the Knowledge Synchronisation Model in practice
2. Action research studies to synchronise organisational knowledge using the Knowledge Synchronisation Model.
The steps involved in theory development and validation are revisited in a summary format in the following sections.

### 7.2.1 Investigation of Organisational Characteristics

The aim of the research, *Synchronising Subjective Knowledge and Knowledge Management Systems in Organisations*, thereby creating and maintaining *Learning Organisations*, from a management perspective can be viewed as *inculcating necessary characteristics into an ordinary organisation, through knowledge synchronisation, to transform it into a Learning Organisation.* Logically, the first step in theory generation is the investigation of organisational characteristics. The investigation focussed on identification of the organisational characteristics, which are essential for organisational survival and for developing upon, to become a Learning Organisation. Chapter 2 discussed numerous organisational characteristics identified by a number of researchers. Chapter 4 discussed eight characteristics of organisations which, if instilled, will transform typical organisations into Learning Organisations. These eight characteristics are Awareness, Empowerment, Leadership, Environment, Personal Mastery, Shared Vision, Team Learning, and Systems Thinking.

### 7.2.2 Investigation of Subjective Knowledge Characteristics

The second step in theory generation is the investigation of Subjective Knowledge characteristics. The reasoning is that the development of human beings and organisational processes is identified as a way to transform a typical organisation into a Learning Organisation. Investigations into the area of Intellectual Capital led to the development of the constructs for Subjective Knowledge. Subjective
Knowledge as per Knowledge Synchronisation Model is collectively constituted by organisational processes, employees, suppliers and customers.

### 7.2.3 Investigation of Knowledge Management Systems

The third step in theory generation is the investigation of Knowledge Management Systems. The reasoning is that the development of Knowledge Management Systems is identified as way to transform organisations into Learning Organisations. Chapter 2 discussed three generations of Knowledge Management and the Knowledge Management Systems developed in those generations. Chapter 4 discussed the Knowledge Management Systems namely, Information, Socialisation, Externalisation, Internalisation, and Combination Systems, which, as per the Knowledge Synchronisation Model, will help the managements in inculcating required characteristics to transform organisations into Learning Organisations.

### 7.2.4 Development of the Knowledge Synchronisation Model

The final step in theory generation is the development of the Knowledge Synchronisation Model. Chapter 4 discussed the inter-relationships between organisational characteristics those transform a typical organisation into a Learning Organisation. Each organisational characteristic is explained in terms of the integration between Subjective Knowledge and Knowledge Management Systems. Awareness for example can be inculcated by training the employees and by putting Combination Systems in place. Eight such hypotheses are developed based on the eight characteristics of a Learning Organisation. These eight hypothesis are combined to create the Knowledge Synchronisation Model.
The Knowledge Synchronisation Model was validated using both qualitative and quantitative methods, employing a web-based survey. Action research studies were conducted in two organisations to validate the model and to synchronise knowledge. The following sections describe the theory validation.

### 7.2.5 Generalisation of the Knowledge Synchronisation Model

A web-based survey was conducted to assess the validity of the Knowledge Synchronisation Model in practice. The snowball sampling technique was adapted to collect the required number of responses. Four hundred and seventy usable responses were analysed. The data analysis validated five out of eight proposed hypotheses to be true and the rest three could not be validated. Chapter 5 discusses those details.

### 7.2.6 Application of the Knowledge Synchronisation Model

Two organisations from the survey participants were chosen for knowledge synchronisation through action research studies. The action research studies are described in Chapter 6. The following is a brief synopsis of those studies.

The first organisation lacked the characteristics of Awareness and Systems Thinking. Participative action research, over a period of twelve weeks, resulted in knowledge synchronisation by means of the development of a knowledge portal and initiation of a Community of Practice (CoP). An exit survey proved that the organisation instilled the characteristics of Awareness and Systems Thinking through knowledge synchronisation thus, validating the Knowledge Synchronisation Model.
The second organisation lacked the characteristic of Personal Mastery. Participative action research over a period of twelve weeks resulted in the development of a knowledge base and initiation of a Community of Practice (CoP) for knowledge synchronisation. An exit survey proved that the organisation is trying to instil the missing characteristic, thus validating the Knowledge Synchronisation Model.

### 7.3 Challenges in Conducting This Research Study

This research study, like all others, has encountered a number of hurdles. This section describes some of those hurdles and the measures taken by the researcher to overcome them.

- *Identifying sample group for the survey:* The areas of Knowledge Management and Intellectual Capital, though widely discussed in academia and adapted by fortune 500 organisations, are scant in small and medium organisations. This can be attributed to the enormous amounts of resources required for a Knowledge Management initiative. Moreover, a number of organisations have been found to be performing Knowledge Management tasks under different names. Identification of the sample group has become an issue for that reason. The researcher, to overcome this hurdle, adapted the snowball sampling technique to achieve the required number of responses. The members of the New South Wales-Knowledge Management-Forum were invited to participate in the survey. The participants were asked to forward the request for participation to their peers and colleagues in other organisations.
• **Identification of Action Research participants:** The survey participants’ role frequencies discussed in Section 5.7.2 indicate that there are thirty four participants from the senior management category and only three participants from Chief Information Officer (CIO) or Chief Knowledge Officer (CKO) category. Therefore, only thirty seven participants are in a position to champion the organisational transformation processes required by the Knowledge Synchronisation Model. Moreover, the affordability of travelling to distinct places to conduct action research has become another constraint. The researcher, keeping these issues in mind, managed to identify two organisations which were in close proximity to the researcher’s location. The first organisation, Biotec Australia, was located within a twenty minute travelling distance by car. Furthermore, the primary contact person being the chief of Australian operations was in a position to champion the project. The second organisation, the Certified Practicing Accountant (CPA) practice, was located within a ten minute travelling distance by car to the researcher’s location. The contact person being the principal partner of the practice was also in a position to champion the project.

• **Implementation of proposed solution:** The solution proposed to both the organisations has two components: technology component and process component. The technology component being the knowledge portal for the first organisation and a knowledge base for the second organisation requires investments in the form of money, resources and also in the form of employee contribution. The Frequently Asked Questions
(FAQ) section of the knowledge portal, for example, will never achieve completeness until and unless updated by the employees on a regular basis. Similarly the other sections of the knowledge portal do require continuous input from the employees. The process component of the solution, a Community of Practice (CoP), requires human characteristics, such as respect, trust and open communication, for it to be successful. Characteristics such as trust and respect require a long time to be built. The real success of a Community of Practice (CoP) or a knowledge based product can only be measured over a period of time.

Biotec Australia has expressed a willingness to implement the proposed solution over a period of twelve months which is far beyond the proposed twelve week study period. The implementation of the solution has been initiated. However, Biotec Australia has seen positive results from the partial implementation of the proposed solution and has been on-track for full implementation of the knowledge portal.

The CPA practice has agreed to investigate the proposed solution in the coming year, again which is far beyond the proposed twelve week study period. However, the process component, Community of Practice (CoP), has been initiated and nurtured during the action research study period.
7.4 Implications for Research and Management

The effect of this research on organisational management is two fold: knowledge gap identification and knowledge synchronisation. The survey questionnaire can be adapted by any organisation to identify the knowledge gap within it. The knowledge gap generally presents itself as a missing characteristic of a Learning Organisation. The same questionnaire will help the management to identify required measures for inculcation of that missing characteristic. This characteristic development will happen in the form of either developing Subjective Knowledge or building new Knowledge Management Systems. The action research study at Biotec Australia, for example, has demonstrated that a missing organisational characteristic such as Awareness can be inculcated by installing a knowledge portal and by initiating a Community of Practice (CoP).

The theory of the Knowledge Synchronisation Model can serve as a basis for future studies and development of theories. Future researchers are recommended to use the outcome of this research to investigate the missing links among organisational characteristics. Examples of such missing links are Environment, Leadership, and Empowerment. Such research might result in the development of a fourth generation Knowledge Management model.

7.5 Future Directions

Future directions for research include, but are not limited to, the following:

- **Identification of missing links to complete the Knowledge Synchronisation Model**: The survey could not relate the constructs of Subjective Knowledge and Knowledge Management Systems to the
constructs Environment, Leadership or Empowerment. These missing links have to be identified to complete the Knowledge Synchronisation Model. One reason for this fallacy could be the assumption about mental models being a part of Subjective Knowledge. The influence of mental models on creation and maintenance of Learning Organisations has to be explored. The effect of mental models as a stand-alone organisational characteristic on organisational knowledge and its Knowledge Management Systems require further investigation.

- **Effect of organisational framework on Knowledge Synchronisation Model:** The literature review in Section 3.3.1 presented organisational frameworks identified by Morgan (1986) and Robbins and Barnwell (2002) which were adopted by many organisations. The framework adopted by organisations influence the development of processes, technologies and the people linked to those organisations. Therefore organisations following a framework might experience similar kinds of knowledge synchronisation problems.

The relationship between the organisational framework and the kind of knowledge synchronisation problems became evident when this researcher carried out action research studies as explained in Chapter 6.

Biotec Solutions Private Limited in which the first action research study took place has adopted the loosely coupled systems framework as explained by Robbins and Barnwell (2002). Biotec is made up of three
relatively independent units in India, Australia, and New Zealand. Biotec Australia exhibited lack of Awareness and Systems Thinking which was mostly due to this operational independence.

The CPA practice in which the second action research study took place has adapted the information processing unit framework (Robbins & Barnwell, 2002). The CPA practice especially the investigated business process ‘Individual tax return submission’ requires the tax consultants to understand the Australian Taxation Office regulations and apply them to individual clients. The information and knowledge travels horizontally, amongst colleagues, as well as vertically, to the peers for inspection. Trust played major role in controlling the knowledge flow and thus in creating lack of Personal Mastery.

The action research studies conducted by this researcher have led him to believe that organisational framework adopted by organisations gives rise to some knowledge synchronisation problems within them. This observation has to be fully investigated to finetune the Knowledge Synchronisation Model. Future investigations into ‘knowledge synchronisation issues in loosely coupled organisations’ and ‘knowledge synchronisation issues in information processing organisations’ will address the requirements to test the observation.

• *Effect of Web 2.0 on Knowledge Synchronisation*: The second phase in Web’s evaluation, Web 2.0, is equipping organisations with new tools
for knowledge synchronisation. Web 2.0 technologies such as Blogs, Wiki engines, Meshup tools, Really Simple Syndication (RSS) are revolutionising the area of Knowledge Management Systems. Blog, short-hand for a Web log, is a website that facilitates socialisation irrespective of time and space. RSS readers are text abstraction and classification systems which help users in obtaining the latest information. Wiki engines facilitate web based collaboration and Meshup tools will help users to combine information from multiple websites. Further investigations are required to understand the effect of Web 2.0 on knowledge synchronisation.

- **Use of Folksonomy rather than Taxonomy:** Folksonomy often referred to as social tagging is a way of classifying data. The major difference between taxonomy and folksonomy is that in taxonomy the classification framework exists even before the data is collected. Folksonomy creates the classification framework from the collected data thus is user centric.

This research adopted taxonomies. Organisational characteristics were contemplated and taxonomy (set of constructs) was created. Subjective Knowledge was contemplated and taxonomy was created. Similarly, Knowledge Management Systems were contemplated and taxonomy was created. The set of constructs were further supported by a set of items (questions). A survey was conducted using those set of questions.
This process was theoretically proven by many survey researchers to be sound in nature.

The action research studies, especially the discussions with respective organisational management, have identified that the items (questions) constituting a construct may vary from one organisation to another. Moreover, it has been identified that the items can be customised for individual organisations. These observations lead to the idea of using folksonomy instead of taxonomy. Folksonomy is, in effect, user centric taxonomy and can be used to generate taxonomies specific to organisations. The items generated using the sense making approach (Kurtz & Snowden, 2003) in an organisation will be more relevant to the constructs of that organisation. Consequently, a survey conducted using those items will achieve more accurate results. The only downside of such an approach would be the generalisation of the results. The results of such a survey cannot be generalised. Guba (Stringer, 2007, p. XI) says that one of the objectives of action research is decentralisation and hence the use of folksonomy is justified in action research studies. The survey questionnaire item creation using folksonomy and the sense making approach seemed more precise during the action research process. Action research studies based on the proposed Knowledge Synchronisation Model has to adopt such a technique to measure the knowledge gap succinctly.
• **Effect of mobile technologies on Knowledge Synchronisation:** The role of mobile technologies in knowledge synchronisation has to be investigated. The problems encountered by the technicians of Biotec while at clients places were solved by a knowledge portal as a result of the action research study. These problems could have been effectively solved if mobile technologies were used. For example, had the machines at the client’s place been connected to Biotec’s Villawood office remotely using mobile devices such as PDA’s, handheld devices or smart phones, the technicians would have known the problems and arrived at solutions without leaving the office. This solution of using mobile technologies was implementable but proved expensive. This example however is sufficient to highlight the role of mobile technologies in knowledge synchronisation. Further investigations are required to elicit the effect of mobile technologies on knowledge synchronisation.

### 7.6 Epilogue

This concludes the dissertation titled *Synchronising Subjective Knowledge and Knowledge Management Systems in Organisations*. This research looked at problems faced by organisations while dealing with their knowledge. The difference between this research and similar studies was that this research aimed at knowledge synchronisation rather than Knowledge Management as preached by the three generations of knowledge managers.
An organisation’s knowledge was classified into two groups: Subjective Knowledge and Objective Knowledge. Subjective Knowledge of the organisation lies in people linked to the organisation and the organisational processes. Three types of people are connected to any organisation namely, employees, customers and suppliers. This study acknowledges that most of the knowledge resides in the people linked to the organisation and therefore cannot be articulated. Objective Knowledge of the organisation is contained in Knowledge Management Systems namely, Information Systems, Socialisation Systems, Externalisation Systems, Combination Systems, and Internalisation Systems. Constructs for Subjective Knowledge and Knowledge Management Systems were identified through the literature review and the Knowledge Synchronisation Model was created. The Knowledge Synchronisation Model was validated through a web-based survey and through action research studies. Deficiencies of the present knowledge managers as learnt from the survey and the action research studies were used to identify future directions for this research.
References


Synchronising Subjective Knowledge and Knowledge Management Systems in Organisations

References


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References


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References


Appendix A – Ethics Committee Approval
Appendix - A

27 April 2007

Sai Kiran Lakkaraju
78 Foxwood Avenue
Quakers Hill NSW 2763

Dear Sai

HREC Number 07/024 A comparative study of subjective knowledge and knowledge management systems in learning organisations

The Committee has reviewed and accepted the responses to the outstanding issues for the above mentioned project and has agreed to approve the project.

You are advised that the Committee should be notified of any further change/s to the research methodology should there be any in the future. You will be required to provide a report on the ethical aspects of your project annually and at the completion of this project. The report form is located on the Research Services Ethics Web Page.

The Protocol Number HREC 07/024 should be quoted in all future correspondence about this project. Your approval will expire 30 December 2007. Please contact the Human Ethics Officer, Kay Buckley on tel: 02 47 360 883 if you require any further information.

The Committee wishes you well with your research.

Yours sincerely

Associate Professor Louise O'Brien
Acting Chairperson & Deputy Chairperson
UWS Human Research Ethics Committee
Cc Dr Bhuvan Unhelkar
Appendix B – Survey Questionnaire
A Comparative Study of Subjective Knowledge and Knowledge Management Systems in Learning Organisations

<table>
<thead>
<tr>
<th>Name: ______________________</th>
<th>Organisation: ____________________</th>
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<tbody>
<tr>
<td>Your Role:</td>
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<tr>
<td>[ ] CIO/CKO</td>
<td>[ ] Consultant</td>
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<td>[ ] Knowledge Consumer</td>
<td>[ ] Knowledge Creator</td>
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<td>[ ] Knowledge Expert</td>
<td>[ ] Knowledge Leader</td>
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<td>[ ] Senior Management</td>
<td>[ ] Knowledge Manager</td>
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<td>[ ] Other (Specify): __________</td>
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<td>Company Size:</td>
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<td>[ ] Small (&lt;20 Employees)</td>
<td>[ ] Medium (20-200 Employees)</td>
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<tr>
<td>[ ] Large (&gt;200 Employees)</td>
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<td>Years in Business:</td>
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<td>[ ] Less than 1 year</td>
<td>[ ] 1 - 3 years</td>
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<td>[ ] 3 - 10 years</td>
<td>[ ] More than 10 years</td>
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<td>Industry:</td>
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<td>[ ] Accommodation, Cafes and</td>
<td>[ ] Agriculture, Forestry and</td>
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<td>Restaurants</td>
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<td>[ ] Communication</td>
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<td>[ ] Culture and Recreational</td>
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<td>[ ] Electricity, Gas and Water</td>
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<td>[ ] Government Administration</td>
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<td>and Defense</td>
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<td>[ ] Manufacturing</td>
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<td>[ ] Personal and Other Services</td>
<td>[ ] Property and Business Services</td>
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<td>[ ] Retail Trade</td>
<td>[ ] Transport and Storage</td>
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<td>[ ] Wholesale Trade</td>
<td>[ ] Other ______________</td>
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</tbody>
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Questions in the following section are designed to measure your organisational Subjective Knowledge. On a sliding scale of 1 (Strongly Agree) to 7 (Strongly Disagree), tick the box that best describes your organisation’s Subjective Knowledge.

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<thead>
<tr>
<th>Organisational Subjective Knowledge</th>
<th>1</th>
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<td>Our employees are experienced in their allocated job</td>
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<td>Our employees have educational qualifications commensurate with their job responsibilities</td>
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<td>Our employees are open to new ideas</td>
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<td>Our employees are willing to learn and unlearn as circumstances require</td>
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<td>Our employees are satisfied with our rewards and recognition system</td>
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<td>We have a number of subject matter experts in our organisation</td>
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<td>Most of our employees have worked across various functions in the organisation</td>
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<td>We have a strong organisational culture</td>
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<td>Our employees trust each other</td>
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<td>The management and the employees share a common vision</td>
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<td>Our employees trust the management</td>
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<td>Our management is open to innovation</td>
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<td>We have a dedicated R&amp;D function</td>
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<td>Our employees regularly submit new ideas</td>
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<td>We regularly apply for patents</td>
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<td>Our employees regularly publish scholarly work in journals</td>
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<td>We have a loyal customer base</td>
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<td>We work with our customers in developing new products and services</td>
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<td>Our customers are well aware of our entire product and service range</td>
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<td>We have a strong supplier base</td>
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<td>We work with our suppliers in developing new products and services</td>
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</table>
Questions in the following section are designed to measure the Knowledge Management Systems in your organisation. On a sliding scale of 1 (Strongly Agree) to 7 (Strongly Disagree), tick the box that best describes the technologies exist in your organisation.

<table>
<thead>
<tr>
<th>Knowledge Management Systems</th>
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<tr>
<td>We have the following systems implemented and functioning in our organisation</td>
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<td>Basic word processing systems</td>
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<td>Electronic calendar systems</td>
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<td>E-mail system</td>
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<td>Groupware system</td>
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<td>Helpdesk system</td>
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<td>Instant polling and presentation system</td>
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<td>Chat, messaging, video conferencing systems</td>
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<td>Workflow systems</td>
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<td>Shared services such as Share Point portal</td>
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<td>Business Intelligence system</td>
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<td>Content Management System</td>
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<td>Document Management System</td>
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<td>Corporate yellow pages</td>
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<td>Knowledge Portal</td>
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<td>Data Mining systems</td>
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<td>Text abstraction, classification and clustering systems</td>
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<td>E-learning system</td>
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<td>Knowledge bases</td>
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Questions in the following section are designed to measure your organisation against a Learning Organisation. On a sliding scale of 1 (Strongly Agree) to 7 (Strongly Disagree), tick the box that best describes your organisation.

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<th>Learning Organisation</th>
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<tr>
<td>We have process and technologies in place to notify the people concerned of any regulatory changes that concern our business</td>
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<tr>
<td>We have process and technology in place to notify the people concerned about the new entrants in our line of business</td>
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<td>We have process and technology in place to notify the people concerned about new products and services introduced by our competitors</td>
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<td>Our organisation understands the current and future climate of our industry in relation to the country and the world</td>
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<td>Our key business resource is capital and facilities</td>
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<td>Our competitive advantage comes from the continuous incremental innovation and refinement of variety of ideas</td>
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<td>Our management started at entry level jobs within our organisation</td>
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<td>Our management is able to inspire and motivate employees</td>
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<td>Our management is able to create strategies and contingency plans that allow the organisation to have a competitive advantage</td>
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<td>In our organisation the hierarchy negotiates appropriate level of empowerment on a case by case basis</td>
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<td>In our organisation employee creativity is contributing significantly towards our continued financial success</td>
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<td>In our organisation employee freedom, energy and enthusiasm are highly encouraged.</td>
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<td>Our employees have problem identification skills, problem solving skills and strategic brokerage skills</td>
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<td>In our organisation employees are encouraged to query the way things are done</td>
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<td>Our key business resource is knowledge, information and ideas</td>
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<td>In our organisation employees have opportunities for self assessment</td>
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<td>There is a widespread support and acceptance of our organisation’s mission statement</td>
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<td>In our organisation employees are encouraged to solve problems as a team before discussing it with the management</td>
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<tr>
<td>In our organisation most problem solving groups have employees from a variety of functional areas</td>
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<td>In our organisation employees understand how each section of the business interrelates</td>
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<tr>
<td>In our organisation employees are able to realise the implications of interventions on many parts of the organisation, process or individual</td>
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