KNOWLEDGE MANAGEMENT FRAMEWORK FOR MOBILE TELECOMMUNICATION SECTOR IN SRI LANKA

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Degree of Master of Science

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Thesis/Dissertation submitted in partial fulfilment of the requirements for the degree Master of Science

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Declaration of the candidate & Supervisor

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Dedication

I dedicate this dissertation work to my loving family, including my wife, son, parents, brother, and sister, for their valuable support and encouragement.

Acknowledgement

My heartfelt gratitude is extended to the supervisor of my thesis, Eng. Kithsiri Samarasinghe, for the immense support and encouragement given throughout the project. With great respect, I acknowledge his perfect guidance and strength during the research period. A special thank goes to my MSc coordinator Dr. Chandika Wewagedara for his valuable guidance.

I take this opportunity to thank the engineers and technical officers in the mobile telecommunication industry who provided feedback for the circulated questionnaire, which made this thesis a success.

Abstract

Sri Lankan mobile telecommunication industry is a fiercely competitive market space where five key mobile service companies operate. Most operators provide their services island wide; therefore the coverage footprint is no longer a differentiating factor. On the other hand, knowledge is a tool, which companies can use to provide a better service quality, which is now in demand with customers.

Due to globalization and increasing opportunities for individuals, companies face a challenge to retain best employees within the organization. Now the focus has shifted to keep the knowledge within the organization even with the movement of skilled labor. Therefore, knowledge management systems are necessary than ever before, but a most suitable knowledge management framework is yet to be identified.

The objective of this study was to determine a most appropriate Knowledge Management Framework for Mobile telecommunication sector in Sri Lanka. To realize this goal, initially, a literature survey was performed. The Author analyzed various knowledge management models available and best global practices of knowledge management aspects. It revealed six key concept variables, i.e. socialization, externalization, combination, internalization, knowledge sharing culture, and leadership. Next, an online survey tested these concepts to find the importance and current practices in the mobile telecommunication industry in Sri Lanka. This study identified that all the six concept variables were relevant to Sri Lankan context, while externalization, combination, and internalization practices were at a lower level. Finally, a knowledge management framework suitable for mobile telecommunication industry in Sri Lanka was developed.

Key words:

Knowledge management, Mobile telecommunication, Knowledge sharing culture, Leadership

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List of Abbreviations

Abbreviation	Description
SPSS	Statistical Package for the Social Sciences
ICAS	Intelligent Complex Adaptive Systems
STC	Saudi Telecom Company
CMS	Configuration Management System
CMDB	Configuration Management Data Base
EMA	Enterprise Management Associates
NOC	Network Operating Center
IEEE	Institute of Electrical and Electronics Engineers
CTO	Chief Executive Officer
KM	Knowledge Management
KMS	Knowledge Management System

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1. INTRODUCTION

1.1 Problem Statement/Motivation

In modern context with a dynamic environment, it is crucial to have a proper knowledge management system in the telecommunication field, because Knowledge is the power for the success of many telecommunication area businesses. An increasing scale of complexity of organizations, high competition among organizations, rapid changes in technology development, and globalization, have increased the importance of knowledge management. Many methods are available to document and protect knowledge, especially when classified as an intellectual property and protected by patents, trademarks, or copyrights. Fewer evidences are available as effective knowledge management systems and deal with reservation of tacit knowledge management in telecommunication operation to provide better telecommunication services to their valuable customers.

Under Sri Lankan context, Engineers who pass out from leading universities come up with excellent ideas to improve the performance of telecommunication services, optimize capital expenditure through creative solutions, and develop new business opportunities by combining unrelated technologies. However, they might change their job in telecommunication discipline, migrate to other countries, or upgrade into management field; this will diminish the transfer of tacit knowledge from generation to generation. Leading mobile operators in Sri Lanka have expanded their services island wide; hence, they cannot differentiate their services from their coverage footprint. In future, the only differentiating factor would be the service quality, and tacit knowledge would play a major role in maintaining high quality standards.

It is vital to have a proper tacit knowledge management system to capture and conserve this valuable situational specific knowledge, and share such knowledge with future engineers. It will help to create new technical solutions, enhance robustness of the telecommunication network areas, and improve mobile customer experience.

1.2 Research Objectives

The researcher identified following research objectives to overcome research problems explained in section 1.1:

- Identify tacit knowledge management models
- Identify best practices in the world in knowledge management
- Recommend a suitable knowledge management framework for mobile telecommunication sector in Sri Lanka

1.3 Research Scope

This research study will be cover the following aspects:

- Analyse the existing knowledge management models
- Analyse the existing best practices in the world with respect to tacit knowledge management
- Perform an online survey on tacit knowledge management and obtain feedback from Telecommunication sector employees (views of Engineers and Technical officers)
- Review and analysis of survey data
- Identify the gap between Sri Lankan and world contexts
- Recommend a suitable knowledge management framework for mobile telecommunication sector in Sri Lanka

2. LITERATURE REVIEW

2.1 Mobile Telecommunication industry

This section analyses the mobile telecommunication industry and nature of the telecommunication business, and evaluate industry attractiveness by adopting ***Porter's five-force model*** [1]**.**

2.1.1 An introduction about the industry

Mobile Telecommunication industry is one of the major industries in Sri Lanka, with a high level of dynamism. Mobile communication is so volatile, and a new technological revolution takes place in every five years and thus, all mobile telecommunication companies have to upgrade their networks frequently because of such technological advancement over the years. Hence, a significant capital expenditure is needed to compete with rivals, and thus, the engineering knowledge play a major role in the success of the industry.

Telecommunication companies are forced to update their product portfolios frequently and many researchers admit that tacit knowledge forms the foundation for building a sustainable competitive advantage.

Future internet-based solutions such as machine-to-machine communication, online service request, and remote monitoring, will help to identify new business opportunities in telecommunication. Due to above-explained volatility, the knowledge management is crucial in the mobile telecommunication industry.

2.1.2 Attractiveness of Mobile telecommunication industry

Porter's five forces model identified five competitive forces that shape every industry and every market, and it gives the industry a competitive position and relative attractiveness.

2.1.2.1 Supplier Power

The key players in the telecommunication equipment suppliers in Sri Lanka are Ericsson, Alcatel, Huawei, and ZTE. The persistent high competition among these suppliers results in a low bargaining power towards the telecommunication market. Dominant Chinese vendors have influenced significantly to reduce the price of telecommunication infrastructure equipment, and thus, the supplier power remains at a minimum level.

2.1.2.2 Buyers' power

Mobile users are restricted to one operator network under Sri Lankan context because users are willing to maintain the same mobile contact number for a long time; if the users want to move from one network to another, they have to change the mobile number. Even though user experience is at a very lower level in a specific area, the user will not move from one network to another due to this limitation with the mobile number. Countries such as India, Canada, and USA, have introduced "number portability," where one user can switch from one operator to another while keeping the same number. This reveals that the customer bargaining power in Sri Lanka is at a lower level.

2.1.2.3 Competitive rivalry

There are five mobile operators in Sri Lanka and a high level of competition prevails in the industry. A diverse product differentiation in telecommunication market is observed but the major two operators, Dialog and Mobitel, provide similar technology and features. If one operator introduces a new feature o r a function, the other key player also introduces the same.

2.1.2.4 Threat of substitutes

Voice service is considered as the main product in mobile telecommunication industry. Applications such as Skype, Viber, and Whatsapp can be categorized as substitutes to the traditional circuit-switched voice service. In addition, fixed line telecommunication can also be a substitute. However, mobile communication still dominates due to flexibility of using and

interoperability between different networks, but in future, solely relying on voice revenue could be risky.

2.1.2.5 Threat of new entrants

The existing frequency band limitation and license requirement governed by the telecommunication regulation commission have limited new entries. However, in some other parts of the world, virtual mobile operators do not have any telecommunication infrastructure but they lease or share existing operators' infrastructure and provide services. This type of virtual operators can be considered as potential threats to the existing business operations.

Considering the five forces in porter's model, the overall mobile telecommunication industry attractiveness and profitability aspects are favorable for the business.

2.2 Knowledge management

The business environment of the 21st century is perhaps the most turbulent in history. It is dominated by three powerful influences: globalization, the knowledge and information revolution, and structural changes in organizations. Knowledge is thought to be the only meaningful resource in this knowledge-based economy. The traditional factors of production have become secondary. Organizations have started considering the knowledge as the key resource within organizations and hence, knowledge management has become increasingly important to all organizations.

2.2.1 Tacit knowledge

This is highly personal and hard to formalize, making it difficult to communicate or share with others. Furthermore, tacit knowledge is deeply rooted in actions, competencies, and experiences of each individual, as well as in the ideas, values, beliefs, and emotions they embrace. The subjective and intuitive nature of tacit knowledge makes it difficult to process or transmit the acquired knowledge in any systematic or logical manner. To communicate tacit knowledge, it must be converted into words, models, or numbers, for people to understand.

2.2.2 Explicit knowledge

Explicit knowledge can be expressed in words and numbers, and shared in the form of data, scientific formulae, product specifications, manuals, universal principles, etc. This kind of knowledge can be readily transmitted across individuals, formally and systematically. Also, it can easily be processed by a computer, transmitted electronically, or stored in databases; for example, lecture notes, power point presentations, formulas, equations, and rules.

2.3 Knowledge management models

In this section, it is expected to study the available knowledge management models and use that knowledge to develop a framework suitable for the Sri Lankan telecommunication industry.

2.3.1 The KM Process Model by Botha et al. (2008) [1]

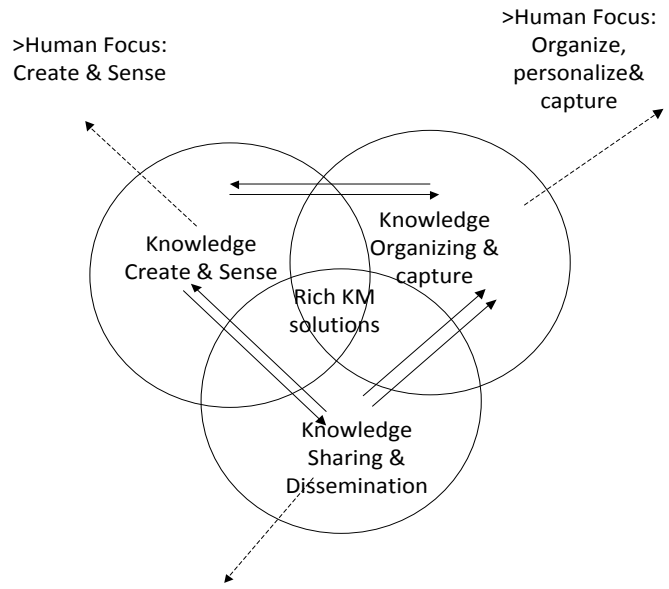


Figure 2.1 KM Process Model by Botha et al. (2008) [1]

KM Process Model by Botha et al. [2] attempts to offer a more realistic overview of the knowledge management process through interaction of three broad categories. This model focus on managerial initiatives, therefore, the strategic focus is omitted. In addition, it includes the creation of new knowledge as a specific knowledge management initiative. This model consists of people oriented and more technology focused categories.

- Knowledge Creation & Sensing

This category is more focused on human side as people create the knowledge initially in the form of tacit knowledge. Knowledge generation can be either event-specific or person-specific.

- Knowledge Organizing & Capture

The organization should next take actions to organize this knowledge through organization and personalization process. Knowledge should be captured from people and stored in a central location for sharing purposes.

- Knowledge Sharing & Dissemination

Knowledge sharing process is highly technology-driven since a proper access media should be available to share and collaborate stored knowledge among different people according to the requirement.

2.3.2 Zack Knowledge Management Model

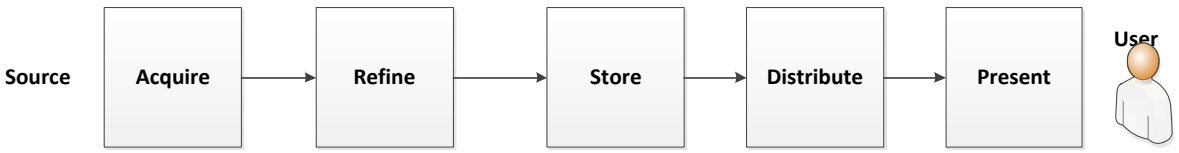


Figure 2.2 The Zack model

The Zack model [3] is originally developed for design and development of information products. Therefore, the stages are acquisition, refinement, storage/retrieval, distribution, and presentation/use, more suitable for similar products. This cycle is also known as the "refinery."

- Acquire

Acquisition deals with issues regarding the origin of raw materials such as scope, breadth, depth, credibility, accuracy, timeliness, relevance, cost, control, and exclusivity. Therefore, the highest quality source data is required.

- Refine

Refinement may be physical or logical. Refining also defines cleaning up or standardizing.

- Storage / Retrieval

Storage or Retrieval forms a bridge between the upstream addition and refinement stages that feed the repository and downstream stages of product generation. Storage can be physical as well as digital (database, knowledge management software).

- Distribute

Distribution defines how the product is delivered to the end-user (i.e. fax, print, email) and encloses not only the medium of delivery, but also its timing, frequency, form, language, etc.

- Present

Context plays an important role in Presentation or Application stage. The performance of each preceding value-added steps is evaluated here – for example, does the user have enough context to be able to make use of this content? If not, the KM cycle has failed to deliver value to the individual, and ultimately, to the company.

The repository and the "refinery" combined, enable the management of valuable knowledge of a firm. In this cycle, there is also an impression of 'having to renew continually,' the repository and the refinery to avoid elimination.

2.3.3 Bukowitz & Williams Model

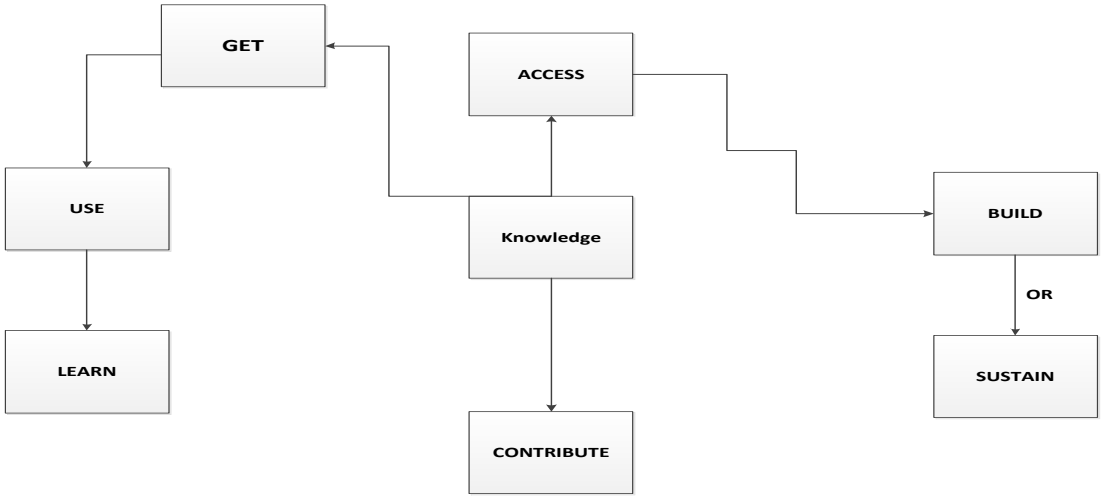


Figure 2.3 Bukowitz & Williams KM Cycle

This knowledge management model [3] has a framework that outlines "how organizations generate, maintain, and expand a strategically correct stock of knowledge to create value." According to this model, knowledge includes knowledge repositories, relationships, information technologies, communications infrastructure, functional skill sets, process know-how, environmental responsiveness, organizational intelligence, and external sources.

- Get

This stage consists of seeking out information required to make decisions, solve problems, or innovate.

- Use

This stage deals with how to combine information in novel and interesting ways to improve organizational innovation. The spotlight is primarily on individuals and then on groups.

- Learn

This stage points to the formal process of learning from experiences as a means of creating competitive gain. Learning in enterprises is important because it serves the transition step between application of ideas and generation of new ones.

- Contribute

This stage of Knowledge Management Cycle deals with encouraging employees to post what they have learnt, to the communal knowledge base. The individual knowledge is made visible only through this way, and available to the entire organization, where and when appropriate.

2.3.4 McElroy Model

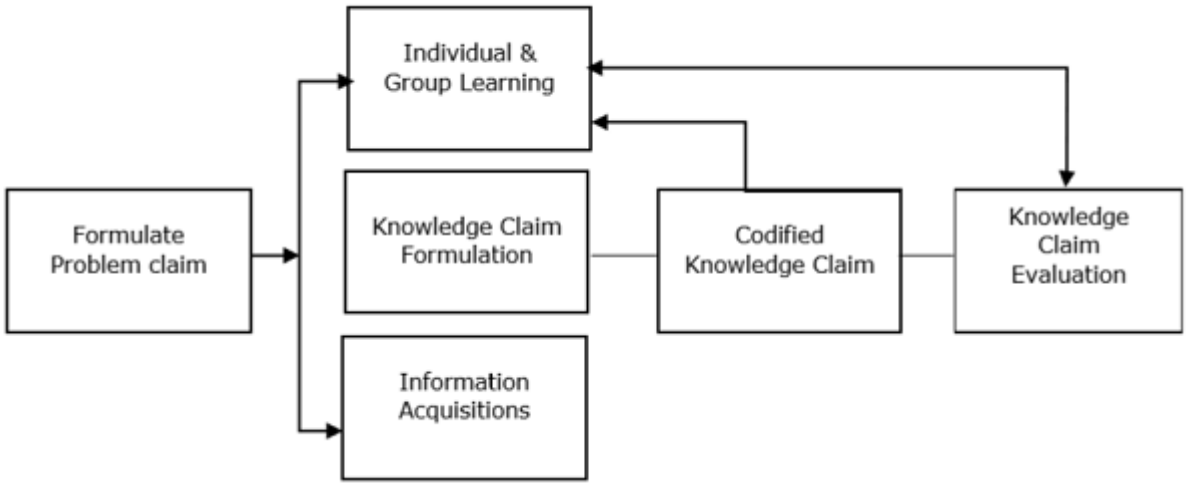


Figure 2.4 McElroy Model

McElroy Model [3] outlines a knowledge life cycle that consists of the processes of knowledge production and knowledge integration. It also has a series of feedback loops to organizational memory, beliefs, claims, and the business-processing environment.

- Knowledge Production

The primary processes are individual and group learning through knowledge claim formulation, information acquisition, codified knowledge claim, and knowledge claim evaluation.

- Problem claim formulation is an attempt to learn and state the specific nature of the detected knowledge gap.
- Knowledge claim formulation acts as a response to approved problem claims via information acquisition and individual and group learning.
- New knowledge claims are tested and examined through knowledge claim evaluation processes.

- Evaluation of knowledge claims result in surviving knowledge claims integrated as new organizational knowledge or falsified/undecided knowledge claims.

Experience gained from the application of knowledge in the organizational knowledge base leads to new claims and resulting beliefs, triggering the cycle to begin all over again.

- Knowledge integration

In this step, an organization announces new knowledge claims to its operating environment and retires old ones. It includes all knowledge transmission techniques such as teaching, knowledge sharing, and other social activities, that either connect an understanding of previously produced organizational knowledge-to-knowledge workers, or accommodate newly minted knowledge.

An advantage of the McElroy cycle is the clear description of how knowledge is examined and the ability of making a conscious decision as to whether or not it need to be included into the organizational memory. The step that performs authorization of knowledge clearly differentiates knowledge management from document management. The KM cycle aims at processes to identify knowledge content that is beneficial to the organization and its employees.

2.3.5 WIIG Model

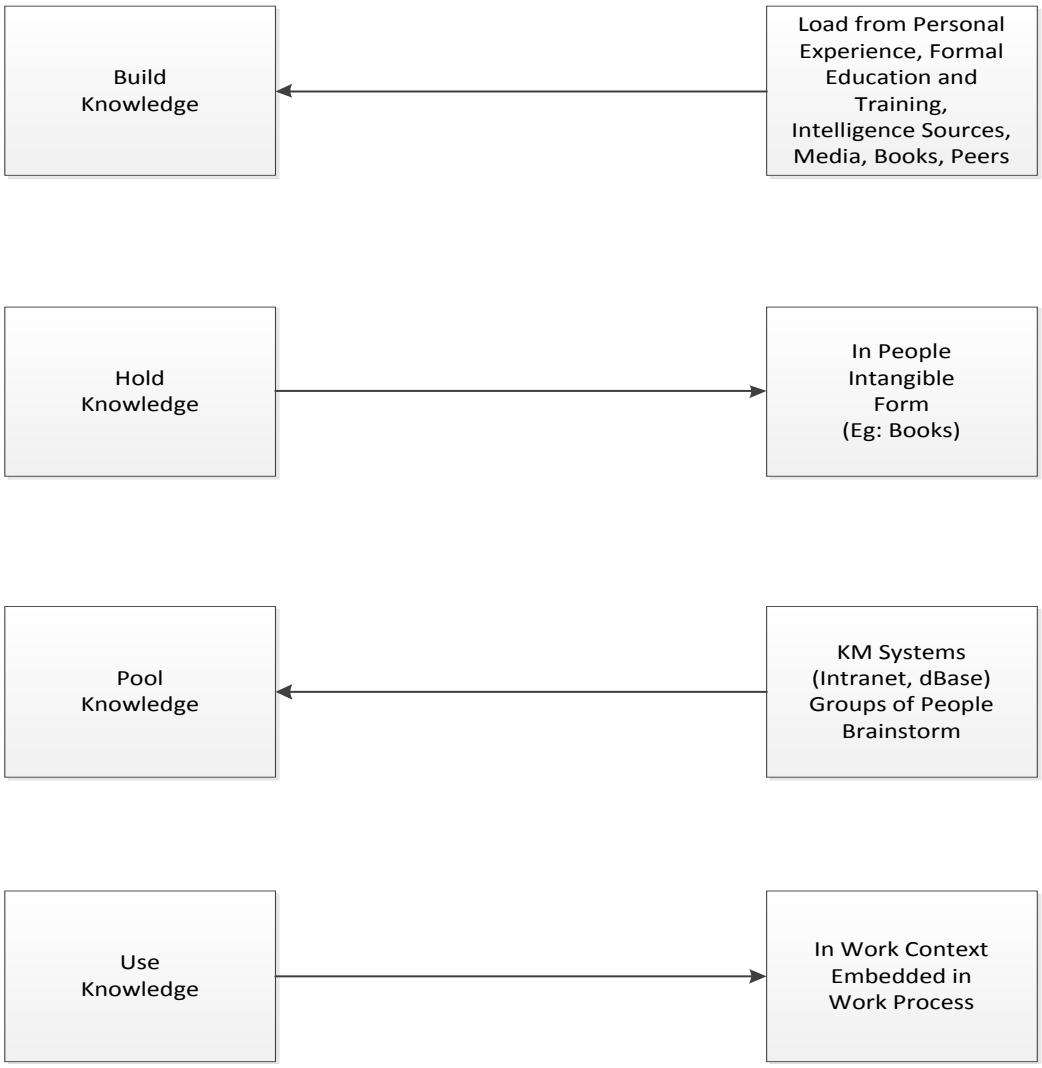


Figure 2.5 WIIG Model

According to **WIIG Model** [3], to have "useful and valuable knowledge," knowledge should be organized differently according to the way it will be used.

- **Building knowledge** − From external and internal knowledge sources
- **Holding knowledge** − Storing the information in a particular form
- **Pooling knowledge** − Through intranets and knowledge management portals
- **Applying knowledge** − In the context of work embedded in the process

WIIG Model also addresses the problem of referring to how much knowledge can be relevant from a specific source. These sources can be either minds of the people (tacit) or knowledge bases (explicit). It is vital to know about the discoverable knowledge and the relations between different objects of knowledge.

Consequently, all the facts, concepts, perspectives, values, and judgments, must be consistent. It is essential to reach a situation with no logical inconsistencies, internal conflicts, or misunderstandings. WIIG model defines many levels concerning the internalization of knowledge.

Internalization represents a continuous process, starting from the lowest level where we are unaware about our lack of knowledge to arrive at the master lever, where we can find profound understanding of all concepts like "know-what", "know-how", "know-why", and "care-why" (values, judgments, motivations).

This model identifies three knowledge forms and four knowledge types:

- Public - Explicit, can be learned and shared.
- Sharing expertise - Intellectual assets are held exclusively by employees and shared during work or embedded in technologies. This type of knowledge is usually communicated through a specialized language and representations.
- Permanent knowledge - The least accessible, but the most complete form of knowledge. It is usually tacit and used without knowing.
- Facts - Data, causal links, measures, and readings – have an observable content, directly measurable.
- Conceptual knowledge - Implies to systems, concepts, and perspectives.
- Methodological knowledge - Used in strategies, in methods for decision refining, and for other techniques.

- Expectation knowledge - Refers to judgments, hypothesis, and expectations of the persons that possess them.

Table 2.1 Knowledge forms and four knowledge types

Knowledge form	Knowledge type			
	Facts	**Concepts**	**Waiting**	**Methodological**
Public	Measuring	Stability, Equilibrium	When stock value exceed the request, the price drops	Searching for values in variables outside norms
Shared	Forecast analysis	Heavy market	A small addition will not generate sell problems	The identification of some errors from the past
Personal	The value of the variable is the most suited	The company has very good references	The suspicion that an analyst made a mistake	What are the most recent tendencies

2.3.6 Nonaka and Takeuchi Model (SECI Model)

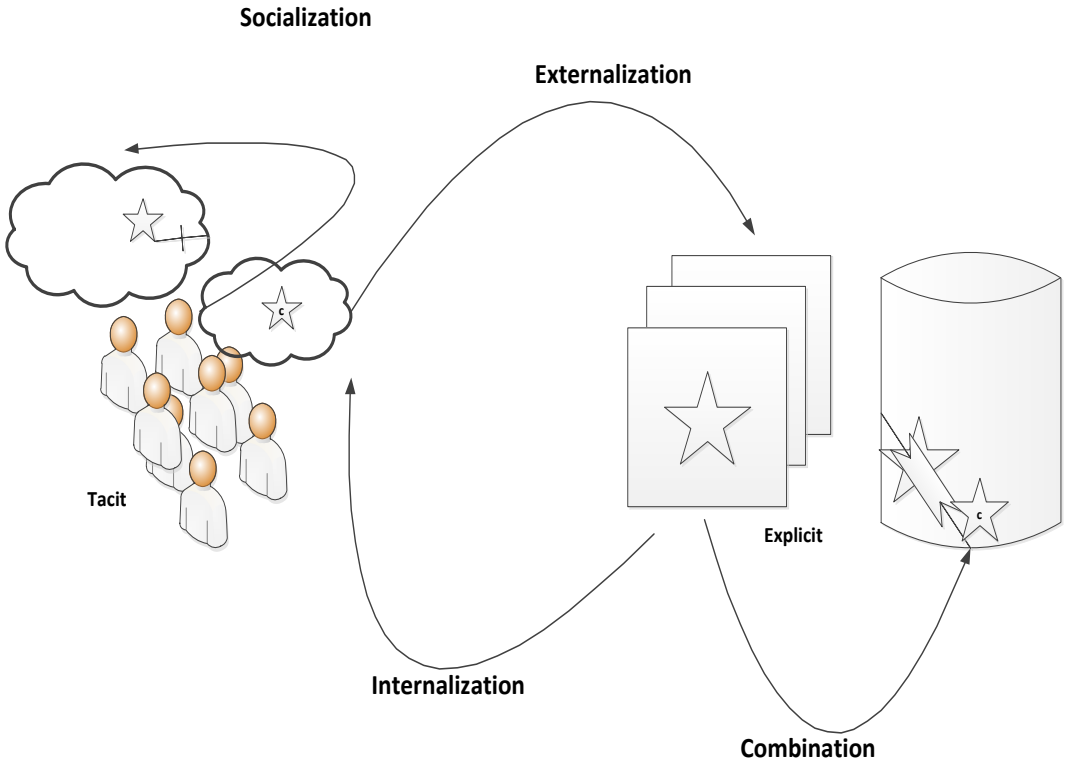


Figure 2.6 Knowledge Spiral

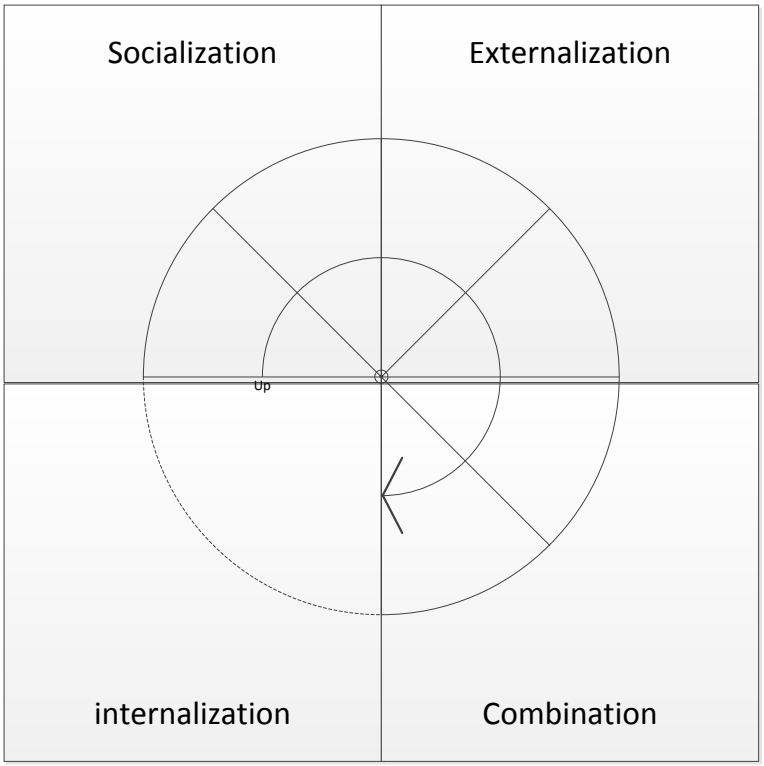


Figure 2.7 SECI Model

SECI [4] is a model of a knowledge creating process used to understand the dynamic nature of knowledge creation, and to manage such processes effectively. According to this model, knowledge assets of an organization are mobilized and shared, so the spiral knowledge convert and amplify the tacit knowledge held by individuals.

This model mainly focuses on the knowledge creation process, which is a spiraling process of interaction between explicit and tacit knowledge. It identifies four types of knowledge creating processes:

- Socialization

This process focuses on TACIT to TACIT knowledge linking. Tacit knowledge goes beyond the boundary and new knowledge is created by using the process of interactions, observing, discussing, analyzing, and spending time in the same environment.

- Externalization

This is developing concepts, which embed the combined tacit knowledge. This process focuses on tacit to explicit knowledge linking and the knowledge is crystallized at this point.

- Combination

Combination of various elements of explicit knowledge to build a prototype.

- Internalization

Here the explicit knowledge is created using the tacit knowledge shared across the organization. When knowledge is shared, the organization can innovate and learn.

2.3.7 Alen Frost's Model

Knowledge can be either the embedded knowledge (knowledge locked in rules, processes, and routines) or knowledge embodied in people (a limited Image is available in a printed copy of the book tacit knowledge). The managerial requirements for these two types of knowledge are different.

Therefore, Alen Frost [5] attempted to extend the scope of SECI model to cover all three types of knowledge to evaluate specific knowledge management and KMS initiatives. He included embedded knowledge in to a SECI knowledge conversion model. Therefore, this model introduces four new processes:

- Integration: Embedded to embedded

New embedded elements (e.g. processes or routines) are integrated into the existing embedded knowledge. For example, when organizational cultures are merged, then the common practices of each culture are shared, adapted, and integrated into one another.

- Analyzation: Embedded to explicit

The processes, routines, etc. are analyzed to extract and codify the knowledge in a form that can easily be transmitted. Essentially, the question arises, "Why does this work the way it does?" or "Why do we do things this way?" within this process.

- Internalization: Embedded to tacit (embodied)

This is the same process as explicit to tacit. The user internalizes the knowledge embedded in a process/routine/etc. through use and learning. In some cases, this might manifest itself as an intuitive understanding of how something is performed. The conversion enables the user to apply the knowledge to a different situation/ process/product/etc.

- Formalization: Explicit to embedded

Explicit knowledge is embedded into processes, routines, cultural practices, etc. For example, if the IT department has learned that two programs tend to create instability in the system, they may embed that into a set rule that “never install program A and program B on the same machine.”

- Formalization: Tacit (embodied) to embedded

Tacit knowledge is embedded into processes, routines, cultural practices, etc. For example, if a consultancy firm, through many years of practice, has gained an understanding into how to approach and negotiate with clients, they may attempt to formalize this into a "best practice" guide.

Alen Frost’s new extended SECI knowledge conversion model would thus have the following conversion processes. Due to the additional process, the Alen Frost’s Model is able to handle three types of knowledge – tacit, explicit, and embedded.

Alen Frost’s new extended SECI knowledge conversion model would thus have the following conversion processes:

- Socialization - tacit to tacit
- Externalization- tacit to explicit
- Combination - explicit to explicit
- Internalization - explicit to tacit
- Integration - Embedded to embedded
- Analyzation - Embedded to explicit
- Internalization - Embedded to tacit (embodied)
- Formalization - Explicit to embedded

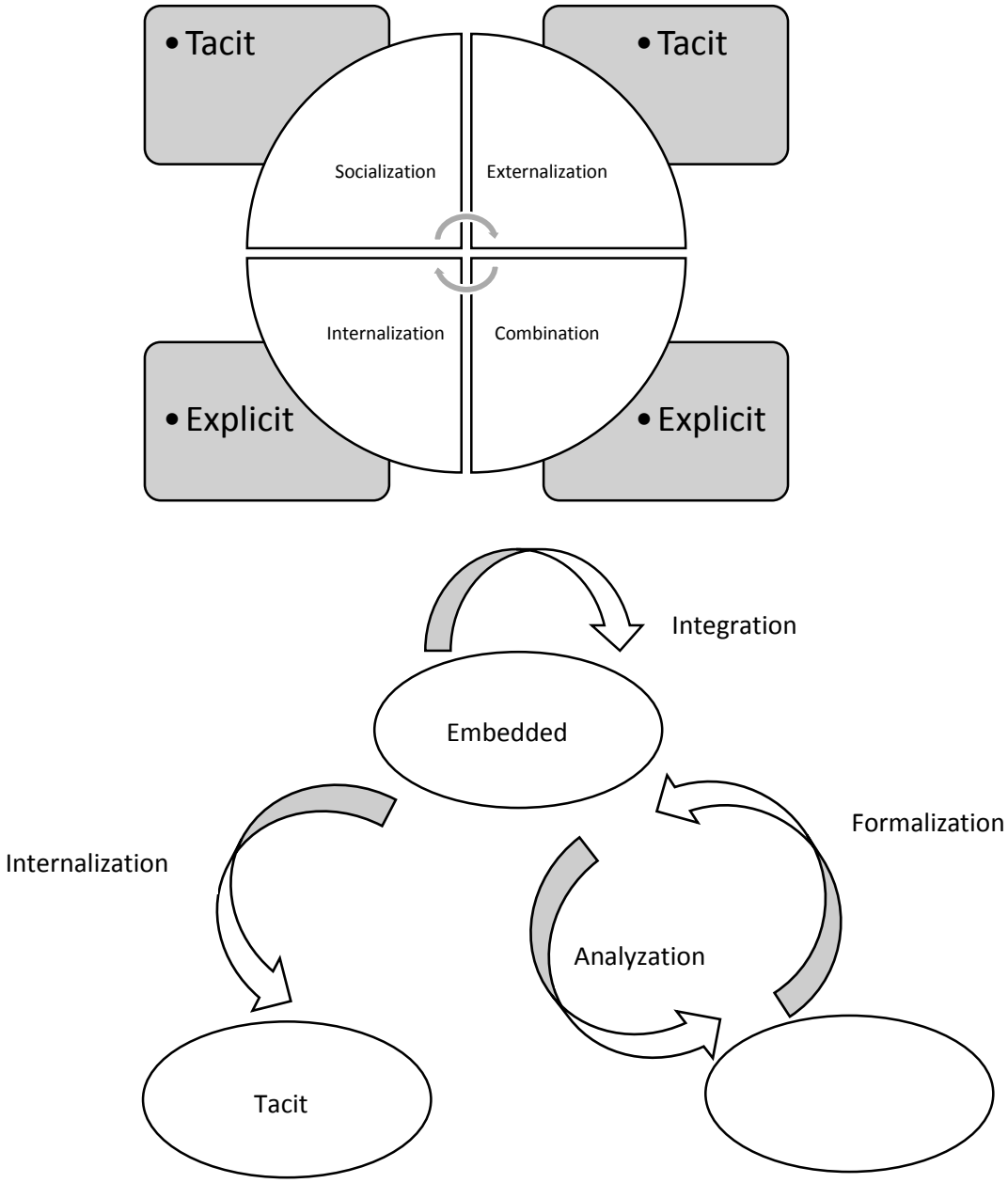


Figure 2.8 Alen Frost's Model

2.3.8 Choo's KM Model

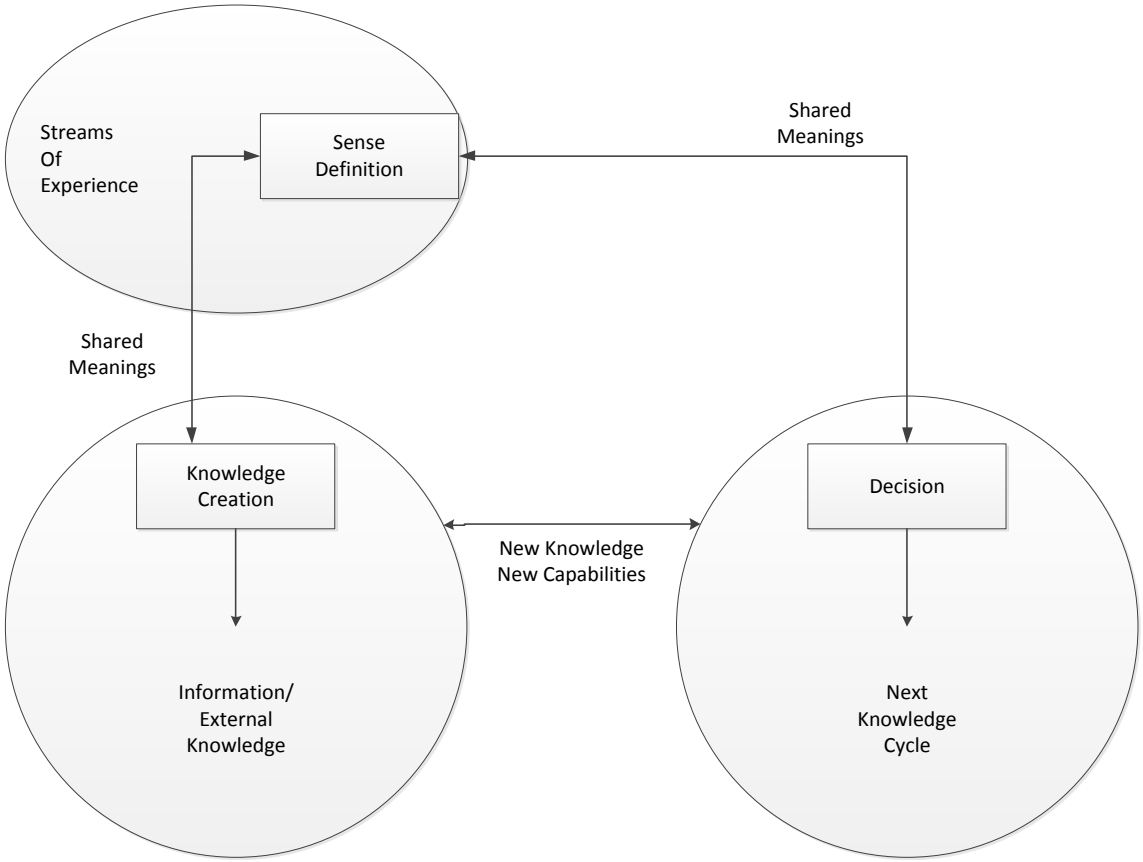


Figure 2.9 Choo's KM Model

Choo's KM model [6] manages knowledge, based on elements used to create new senses for an optimized decision inference. This model centers on how informational elements are selected and introduced in company actions. These actions result from the concentration and absorption of information, coming from the external environment in every cycle.

- **Sense Making** − Its long-term aim is the warranty that organizations will adapt and continue to prosper in a dynamic and complex environment through activities of prospecting and interpretation of suitable information enabling it to understand changes, trends, and scenarios about clients, suppliers, competitors, and other external environment actors.
- **Knowledge Creation** − It is a process that allows a company to create or acquire, organize, and process, information to generate new knowledge through organizational learning. The new knowledge obtained allows the company to develop new abilities

and capabilities, create new products and new services, improve the existing ones, and redesign its organizational processes.

- **Decision Making** − The Company must choose the best option that are plausible and presented, and pursue it based on the organization's strategy. Decision making process in companies is constrained by the bounded rationality principle.

During the identification phase, priorities need to be defined which are later used for information filtering. At individual level, common interpretations will be built from the exchange of information pieces, combined with previous experiences.

- Changing the environment - it is external for the organization, having the possibility to disturb information flow between participants
- Adaptation
- Selection and keeping - when people try to interpret what was observed. This process refers the creation of organizational memory, which will contain experiences finalized with success. This memory can be reused in the future for new interpretations to unify them into a coherent organizational vision.

Knowledge creation can be perceived as a transformation of personal experiences into knowledge through dialog and sharing. The capacity of human mind to formulate and solve complex problems is quite small. Consequently, the persons confronted with ambiguous purposes and fuzzy methods to combine actions will attempt to fulfill those purposes, which take a medium amount of time by using resources that are under their control.

Usually, when mind confronts a world of great complexity, it will build a simple mental model and will act accordingly. Therefore, it is considered that Choo's model consists of a key process regarding knowledge management that often lacks in knowledge management models.

2.3.9 Boisot Model (I-space)

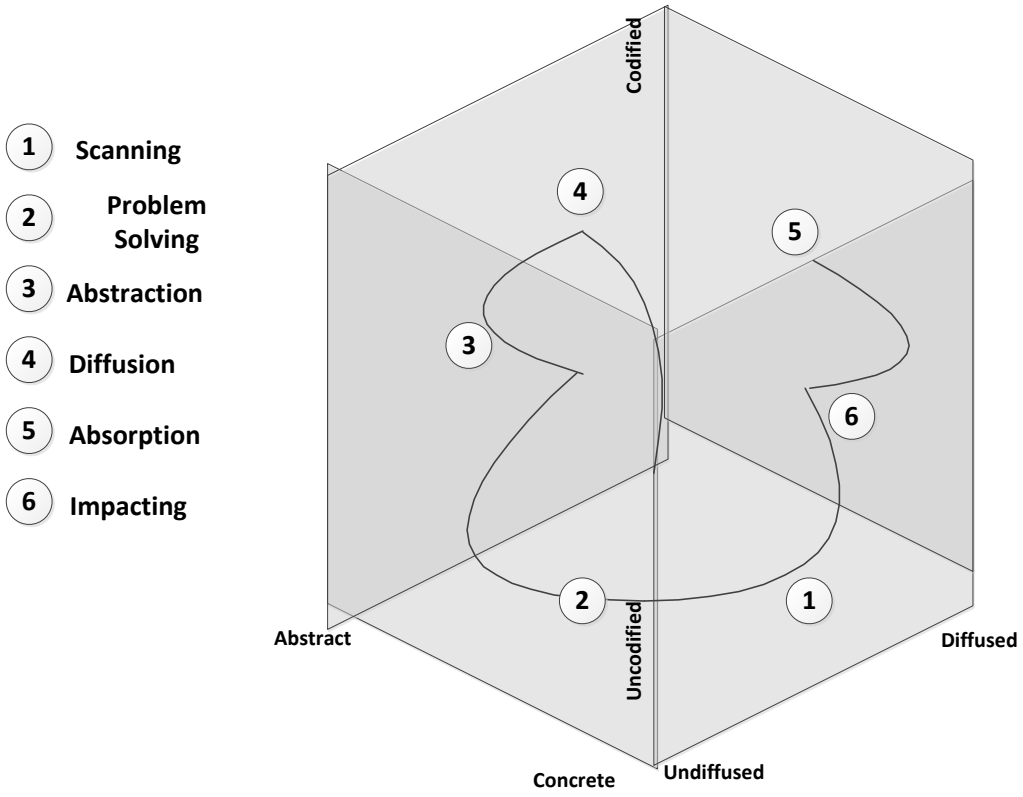


Figure 2.10 I-space

This model [7] is based on the concept of "informational asset," which is different from a "physical asset." Knowledge will also have a context in which it can be described. Thus, both the sender and receiver will have to share the context besides codification scheme. Boisot proposed three key points, which forms together a conceptual framework known as "i-space." Boisot model ("i-space") can be visualized as a cube having following dimensions: coded – un-coded, abstract – concrete, diffused – undiffused.

Boisot model implies that in many situations, the context is lost, which may lead to the loss of important knowledge. Therefore, content needs a shared context to be interpreted and it requires face-to-face interactions (similar to socialization phase from Nonaka model). The activities of codification, abstractization, diffusion, absorption, and impact and analysis, contribute to the six phases of the learning process.

- Scanning

Scanning is identifying threats and opportunities from a fuzzy content, scanning, discovery of new visions, etc. Scanning process can be fast when data is codified and abstract, or very slow and random when data is un-codified and dependent of context.

- Problem Solving

This is the process that offers structure and coherence to these visions. During this phase, main part of uncertainty is eliminated. Problem solving in the un-codified region of I-space model is often hazardous and generates conflicts.

- Abstraction

Abstraction is the generalization of applying new codified visions in many applications. It implies to reach the most important characteristics of a situation – conceptualization. Problem solving and the abstracting often work together.

- Diffusion

Diffusion is sharing new visions with a certain number of persons. The diffusion of well-codified abstract content to many persons will be technically less problematic than the un-codified case and content dependent. Sharing only the context by sender and receiver can increase the diffusion speed of un-codified knowledge.

- Absorption

Absorption is applying new codified visions to different situations in a "learn by execution" manner. Over time, codified visions will interact with those un-codified, the former one being favored in particular circumstances.

- Impact

Impact includes knowledge in real practices. This includes knowledge in technical rules in organizational or organizational practices. Absorption and impact often works in tandem.

2.3.10 Adaptive models of knowledge management

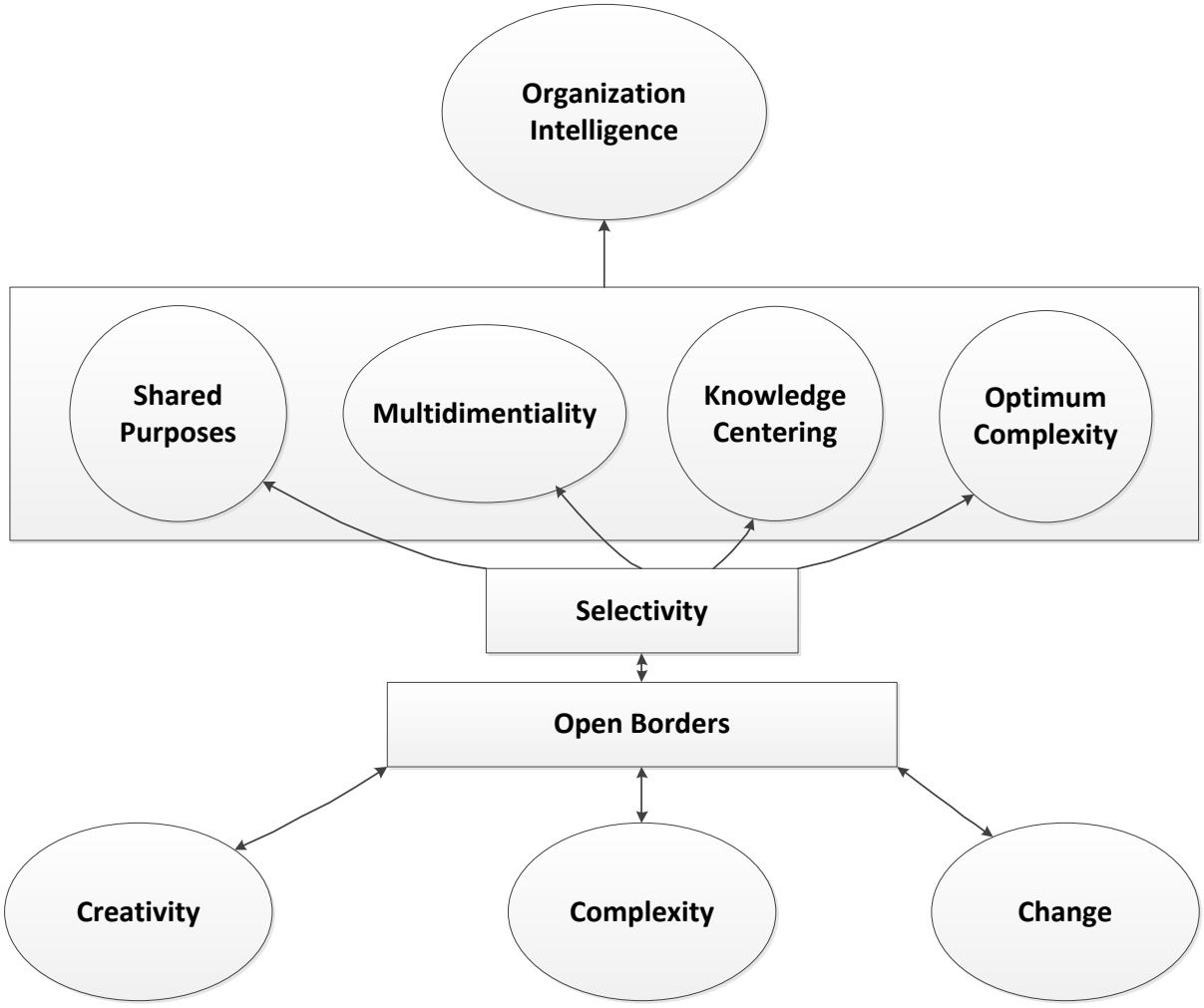


Figure 2.11 ICAS Model

The ICAS (Intelligent Complex Adaptive Systems) [8] theory identifies organization as an adaptive, complex system. These models contain series of functions, which ensures the viability of any living system in general, and in particular, of organizations. ICAS systems are based on cybernetics principles, which use communications and control mechanisms to understand, describe, and predict, the activities of a viable organization.

ICAS model is based on numerous subsystems that interacts and evolves to generate an advanced and intelligent technological company.

In this model, the intelligent components are made of self-organized people, who can remain as a part of general hierarchies of organizations. The challenge is to use the advantage given by the force of the people when they cooperate, keeping a global sense of unity. This model emphasizes the importance of a person's competencies and learning capacity.

According to this model, an organization needs eight characteristics: organizational intelligence, shared purposes, selectivity, optimum complexity, open borders, knowledge centering, optimum streams, and multidimensionality.

The organizational intelligence means the company's capacity to innovate, to acquire knowledge, and to apply it for relevant situations. The correct equilibrium between internal complexity and external environment can represent optimum complexity.

Selectivity refers to the content evolution. It differs from the approach based on data warehouses. To be selective means to filter the input information emerging from external environment. A good filtering requires a deep understanding of the organization, specific knowledge on clients, and a great understanding of the strategic objectives.

Knowledge centering leads to the information aggregation after self-organizing, collaboration, and strategic alignment. Informational streams will activate the knowledge development and will facilitate the connections and necessary continuity to keep the unity and the coherence of the organizational intelligence.

Open borders is crucial, if free movement for the ideas is desired. Multidimensionality brings organizational flexibility to ensure the fact that the staff has the competencies, the perspectives, and the cognitive abilities, to solve problems.

2.4 Knowledge management best practices in the world with telecommunication industry

2.4.1 AT&T's knowledge management methodology

AT&T's knowledge management system [9] provides quick access for customer service representatives. It allows them to solve a customer's problem in a matter of minutes. They use

a network of experts to spread the knowledge around, so the employees can look up a series of knowledge experts.

Their knowledge management methodology consolidates existing systems and simplifies processes. In fact, users can manage, access, and store their countless data sources efficiently in areas such as data warehousing, data mining, workflow, information acquisition, and translation/transformation and information visualization.

The search for knowledge on AT&T's intranet starts at the Info Center. It is the internal corporate Web site with direct access to employee services, training, and major operating units. An AT&T associate can directly enter IntraSearch to find information from nearly one thousand internal web sites. All sites are registered in the IntraSearch database and linked with a search engine to provide a fast keyword search of millions of web pages and documents indexed by various categories.

Benefits

- Meets tactical needs while providing a platform for re-engineering key processes
- Productivity improvement for all users
- A 30% reduction in training for new customer care agents
- Faster decision making
- Reduction in supplier costs

2.4.2 Sprint (USA) [10]

Sprint has selected "Livelink" by Open Text Corporation based on its ability to provide an enterprise-scalable, collaborative knowledge management application. It is capable of providing workflow, document management, search, and directory and file management functionalities.

Initially, Sprint deployed "Livelink" to create a Web-based repository to store customer circuit data in its Network Operating Center (NOC). This allows the company to move from a paper-based system to an electronic document management solution. "Livelink" was also used as a Web-based repository for storing accounts, payable invoices, and managing Sprint employee expense report receipts, linked to an intranet-based reimbursement system.

Sprint's strategic information technology consulting arm, Sprint Paranet, focuses on IT infrastructure and uses “Livelink” for project collaboration, knowledge management, and workflow. Sprint Paranet's expertise of “Livelink” is achieved through internal use. Sprint Paranet install the software and also creates infrastructure, and provides “Livelink” configuration that support customer's knowledge management strategies. This method helps streamline the entire process in an effort to improve efficiency and accuracy.

2.4.3 Verizon Wireless (TM)

Verizon Wireless, the leading wireless communications provider, has selected the “Generation21 Learning Systems' knowledge management software” [11] to drive its blended approach to training. They have chosen this system to keep employees current with business, processes, and products, and to reduce the amount of time associated in training.

TKM's single-source database can ensure that the information receives from one development effort and remains consistent across delivery formats. Verizon Wireless training administrators can also assign courses to individual learners, job titles, entire departments, and specific areas and regions. In addition, TKM can deploy third-party training content. According to their CTO, "Using TKM to support this forward-thinking approach to learning will ensure that Verizon Wireless continues to develop an organized group of people with a common vision who repeatedly produce superior results.”

Generation21 Learning Systems

TKM is the only comprehensive software system proven to deliver exceptional organizational performance by collecting, managing, and distributing all types of information to employees and customers, when and where they need it. Its uniqueness lies in its single-source demand-based knowledge database, which stores all vital information required by the staff members to perform their jobs well, and uses Universal Knowledge Object (TM) technology to ensure that this information is always current, consistent, and readily available.

2.4.4. KM infrastructure at ABC Engineering College India

eTLP methodology [12] is used for training and enhancing students' learning in ABC Engineering College. eTLP is a process improvement methodology for educational institutes that is e-enabled by a state of the art software solution. An eTLP implementation indicates an institute's pledge towards achieving complete transparency at all levels of the academic process.

Students are the key beneficiaries of eTLP:

- Similar to the start of an academic session, a complete course coverage plan for each subject is made available to students online, who can see the plan for each class for each day of the session.
- The course material such as lecture notes, assignments, reference material etc., is directly accessible for students online.
- Finally, students should provide a formal feedback on their faculty, allowing them to improve their teaching methodology during and beyond the given session.

In a similar fashion, parents can remain informed about the students' progress on a variety of parameters such as academic results and attendance and other news or updates from the institute. Parents have a quick access directly from the ABC Engineering College web site, with a summary view that provides them an indication of their child's performance in terms of attendance, internal evaluations, and pending assignments.

A fully equipped online library with around 55,000 volumes with 6,100 titles and Online databases such as IEEE, Springer, etc. and subscriptions to many journal publications such as Emerald, Elsevier, and Ebsco are provided. For the purpose of teaching and research, many sophisticated software packages, i.e. Oracle, SPSS, MAT LAB, SAS, SAP, Rational Rose, and others, are licensed for regular use, and an online virtual tour of the entire campus is provided.

2.4.5 Cingular knowledge management

Cingular Wireless turned to knowledge management, to ensure that each of their customer service agents at any call center can answer virtually any question asked by any one of their millions of clients.

They have first benchmarked knowledge management solutions of technology-oriented companies such as DELL and Microsoft. After reviewing the knowledge management solutions used by other companies, Cingular chose eService Suite by ServiceWare of Edison, New Jersey [13]. A pilot program was initiated at technical support departments at three call centers with the help of leading consulting firms such as Cap Gemini, Ernst and Young, and Innovative Management Solutions.

Knowledge base with technical support information, common topics, and information on rate plans, were completed in four months with the effort of their employees and an existing authoring group from Innovative Management Solutions. Later, Cingular extended its knowledge management solution online and to retail stores to bring its knowledge closer to its customers.

The software uses a complex algorithm to decide the order of the issues, based partly on the exact text and phrase matching. In addition, agents can provide feedback by using the software contribute button located in their toolbars. Cingular has a separate knowledge management team to access agents' input and make appropriate changes. Therefore, their knowledge management cycle can be considered similar to following.

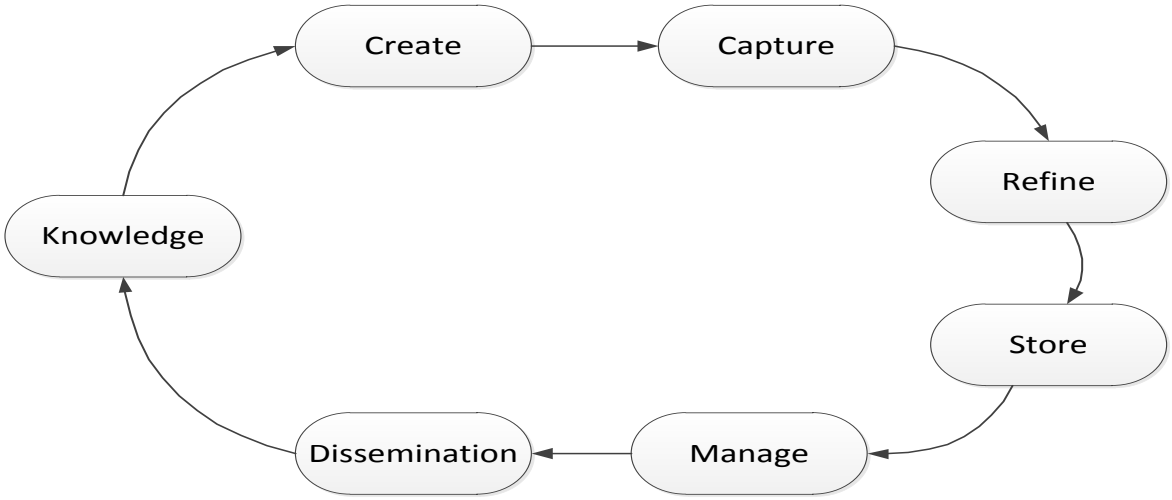


Figure 2.12 Cingular knowledge management cycle

2.4.6 Knowledge management implementation Saudi Telecom

Saudi Telecom launched FORWARD strategy in 2007 [14] and knowledge management was implemented to support this new strategy. Their knowledge management project consisted of four phases:

KM Audit & Taxonomy

- Project initiation and kick-off workshop
- Information gathering – existing knowledge assets, knowledge needs in STC, knowledge processes, barriers to knowledge sharing, relevant IT systems
- Development of STC wide taxonomy
- Creation of knowledge map/knowledge matrix

KM Strategy

- Identification of strategic impact of knowledge in STC's processes
- Definition of potential applications of KM within STC
- Prioritization of KM applications and selection of three pilot projects
- Formulation of general KM vision and strategy of STC that links KM to business strategy

KM Pilots

- Detailed objectives and deliverables for all three pilots
- Set-up of pilot projects
- High level concepts for pilots
- Handover to STC teams

KM Roadmap

- Prioritization of entire long list of KM initiatives
- Detailed roadmap (3 years) for KM initiatives

STC identified three work streams for the KM strategy to focus on, based on the KM audit and the collaboration requirements to implement FORWARD. The KM Strategy aims at aligning KM in STC to support the execution of FORWARD, with priority on inter-sector collaboration.

STC implemented two pilot projects as,

1. Retention best practices - Share best practices for retention and win back strategy between Personal and Home, create new common programs between the two Sectors, based on current Best Practices.
2. Business Rules - Provide a common definition for key business concepts used across STC, to have a common understanding of STC specific concepts, and ensure that these concepts are used systematically for all contents across the organization.

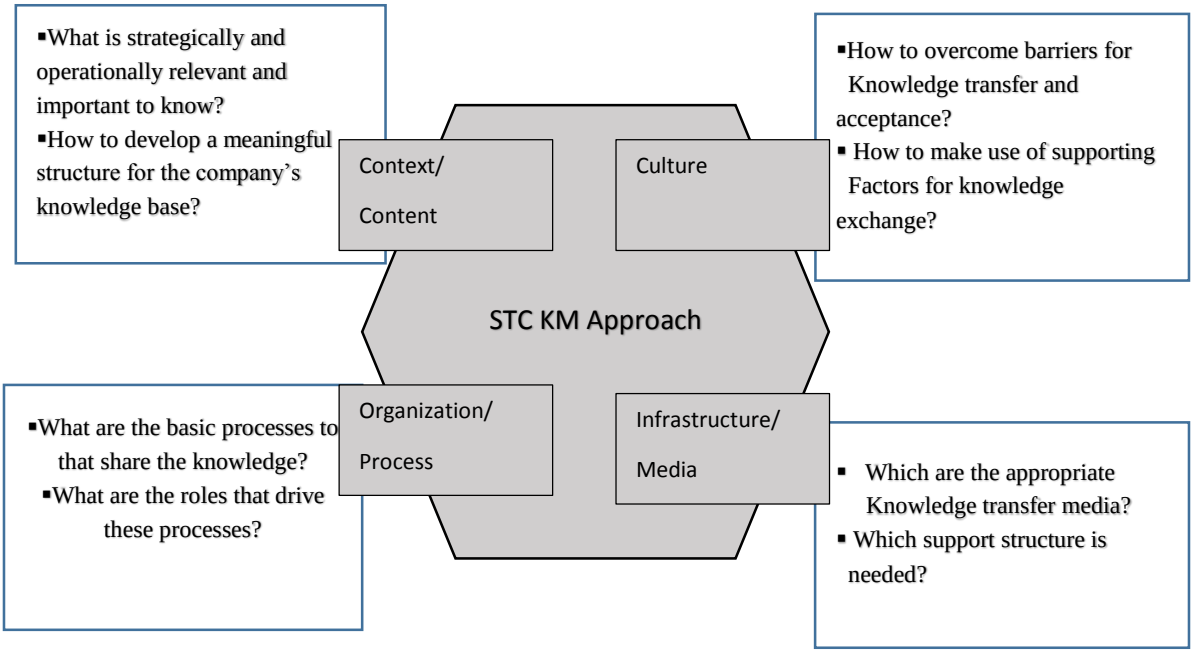


Figure 2.13 STC KM Approach

2.4.7 Schlumberger oilfield and information Service Company [15]

Schlumberger oilfield and information Service Company identified knowledge management as a method to minimize the time between having a problem or an issue and finding a solution. Schlumberger developed an integrated knowledge management system in response to the difficulties experienced by Schlumberger field engineers in receiving answers to technical questions. Schlumberger implemented its knowledge management solution by utilizing both knowledge management techniques and knowledge management technologies.

Communities of practice

Each community of practice focuses on a key engineering or scientific discipline. Communities support global network, hold workshops, publish, and rank best practices. These communities of practice allow technical specialists to pool their collective ideas and knowledge to help build and institutionalize Schlumberger's corporate memory.

Training

Schlumberger offer training programs to transfer knowledge to its employees. They also use the resources of its intranet for interactive training and distance learning to provide instructor based training directly to end user's location. Another training mechanism is "NExT where major universities combine their academic excellence and close links with industry with the experience of Schlumberger professionals to create the Network of Excellence in Training consortium."

Storytelling

Schlumberger has used storytelling to personalize the effects of knowledge sharing and create a virtual coffee bar, which tell success stories.

Content management system

Schlumberger developed a content management system for its knowledge management data storage, organization, collection, and retrieval needs. Its content management system provided meaningful and timely information to end users. To do that, it creates processes that identify, collect, categorize, and refresh content using a common taxonomy across the organization.

Intranet

Schlumberger's partnership with Harvard Business School Publishing known as *Harvard Manage Mentor* is the intranet tool designed to keep Schlumberger's employees informed and on track in today's business environment.

Expertise locator

To help expedite the process of receiving answers to the technical questions of Schlumberger field engineers, they developed a system. With this system, field personnel could have real-time contact round the clock with each other and with global experts at Schlumberger

Technology centers. This system provided access to latest solutions and best practices for technical issues for field personnel.

Benefits

- Schlumberger's investment in knowledge management increased the service quality to customers, which indirectly led to revenue enhancement and cost savings in the field.
- Schlumberger's knowledge management system also allowed it to minimize the impact of its pending labor force retirement by using it as a forum, through which they could share their vast wealth of tacit knowledge.

2.4.8 Accenture, management-consulting organization [15]

Accenture defines knowledge management as, "a systematic process for creating, acquiring, synthesizing, sharing, and using information, insights, and experiences to achieve organizational goals." The reason behind implementation of knowledge management in Accenture is to "improve knowledge and information sharing, decrease response time, accelerate innovation, reduce cost, reduce loss of intellectual assets from employee turnover, and give them the means to function on a global market."

The knowledge management also facilitated Accenture's ability to offer a consistent product on a global basis, and enabled more efficient work and better use of resources by minimizing the time. Due to this system, the time spend by consultants on researching and seeking information is significantly reduced and allowed the firm to disseminate best practices more efficiently and successful client solutions to consultants in the field. Therefore, it can be said that the Accenture required its knowledge management system to "leverage the best internal and external knowledge to maximize performance and deliver innovation."

Knowledge management techniques and technologies implemented,

Communities of practice

Accenture has formed several communities of practice to "create knowledge and career development models mentor within their practice." Communities are also responsible for

contributing to Accenture's knowledge database, "sharing best practices, consulting with each other, and providing a means to bring the company's worldwide resources against a single problem."

Centers of excellence

Centers of excellence are established around key areas of practice. They serve multiple roles from knowledge management perspective centers of excellence work to build knowledge by establishing best practices and promoting such learning. These centers often maintain databases of their work and sometimes publish whitepapers that are shared with stakeholders as a means to transfer knowledge.

Regular meetings

In such meetings, project leaders from across the organization meet to discuss their projects and exchange experiences based on their recent work.

Training

Accenture invests heavily in the training and continuous education of its consultants. New consultants are typically trained on the specific consulting frameworks, methods, and processes employed at Accenture. Through training and continuous education, Accenture can ensure a consistent level of knowledge and is able to share and transfer best practices across the organization.

In addition, Accenture employs an apprenticeship-based staffing model, which also helps serve as a training and knowledge transfer mechanism for junior consultants.

Standardized taxonomy and methods

Accenture has developed standardized frameworks and methods for its consultants to use in solving case problems. Prior to beginning a project, consultants can refer to a set of standardized procedures that Accenture has developed for various types of projects. These procedures provide consultants with models, templates, and checklists, to support and structure their work.

Content management system

Accenture maintains a vast database of prior work products, known as "Knowledge Xchange" database. This database includes all documentation related to prior cases and proposals the firm

has consulted. Such documentation provides consultants with a valuable source of knowledge. In addition, Accenture's content management database includes "best practices" case materials.

Expertise locator

The database permit consultants to identify which Accenture professionals were involved in the original project. Thus, it provides direct transfer of knowledge between different projects and establishment of contacts for a more personal transfer of experience in relation to specific projects.

Search and retrieval software

Accenture's suit of knowledge management technologies include "yellow pages" for browsing topics and interested items, and advanced search software that supports extremely detailed and specific searches.

Discussions and chat technologies

These communication tools allow Accenture consultants to collaborate and have real-time communication with team members, other consultants, and Accenture experts from around the globe.

Data monitors

They use specialized tracking software that allows consultants to monitor news automatically and data based on specified parameters. These data monitors are capable of tracking desired information from major news organizations or industry groups, allowing Accenture consultants to stay informed of industry trends and developments.

Benefits

- Wide adoption and use of the database has helped Accenture consultants to retain, organize, share, store, and transfer, explicit knowledge from Accenture's client work.
- Helped Accenture consultants to make connections and identify experts to facilitate the transfer of tacit knowledge within the firm.
- Procedures and methods make communication between consultants more effective.

2.4.9 Knowledge management implementation in Bouygues Telecom [16]

Bouygues Telecom struggled to manage the flow of information and know-how across the organization. At times, departments and individuals were unable to collaborate effectively with employees in many parts of the business.

The idea of defining and developing short and practical KM projects were difficult to implement, hard to manage, and far too expensive for Bouygues Telecom. Therefore, Microsoft's SharePoint Portal Server solution was selected due to its easiness to implement and flexibility to meet various requirements of the Bouygues Telecom business. SharePoint Portal Server is based on a document management server, which enables organizations to manage all workflow processes associated with publication of documents and to share them in dedicated spaces.

They also chose Valtech (a company specializing in management consulting and enterprise IT) to implement knowledge management system effectively. Therefore, they were able to implement four knowledge management systems that enabled the organization to leverage and extend its current IT systems and infrastructure.

SAP best practice

The knowledge base manages the publication and classification of documents and provides users with a single knowledge portal. Users can add their own advices and experiences relating to SAP via their browser.

Knowledge management in a technical reference system

It gives technicians an online access to a company knowledge base of technical information. In a matter of months, Bouygues Telecom has built a comprehensive online library of technical knowledge. Technicians now have rapid, real-time access to the sum total of the company's expertise.

Using knowledge management to innovate information systems

The knowledge base was used to accelerate the movement of new technology from the Computer Planning Strategy management to operational divisions. All technical documents are classified, and each event in the knowledge base can be traced. No time is wastage in searching for documents and the CPS can make full use of acquired knowledge to develop innovative new information system strategies.

Keeping track of new technologies

The CPS team and operational management would like to access a knowledge base on the latest technological developments. Such a tool is to help them collect and validate new information and leverage knowledge.

2.4.10 Knowledge management in PT TELKOM, Indonesia [17], [18]

Knowledge management implementation is performed in PT TELKOM in order to create business values that can produce sustainable and competitive advantages by optimizing acquisition, sharing, and utilization, of knowledge the company needs for continuous improvements.

To support their knowledge management process, they had a Knowledge Management System called KAMPIUN [19]. It is a data bank (repository) used as a tool for all employees to improve insights and knowledge by uploading or downloading any knowledge they may need via the system to find solutions for many different problems they find at work. Therefore, it is expected to improve the work productivity and quality.

The final objective of knowledge management is to create a learning organization, which is an ideal condition where company will keep running without being dependent upon any particular employee. This is to be achieved by projecting the company into a knowledge-based enterprise through the transformation of Learning Center into a Corporate University (CorpU).

KM implementation in PT TELKOM is conducted with three approaches. First, *Technology Approach* that consists of PC network of all workers, SAP as the core business process, e-document initiative, knowledge PORTAL, e-mail, groupware, e-learning etc. Second, *People Approach* that consists of knowledge sharing (KS) forum as activities to share workers' knowledge, and ideas and experience, conducted on every Wednesday and Sunday. The activity is also to share experience and information on company and technology development demand, and book review. Third, the *Media Approach* consists of library, Patriot 135 magazine, Kilau bulletin, and news clippings (regional/national), in all PT TELKOM offices.

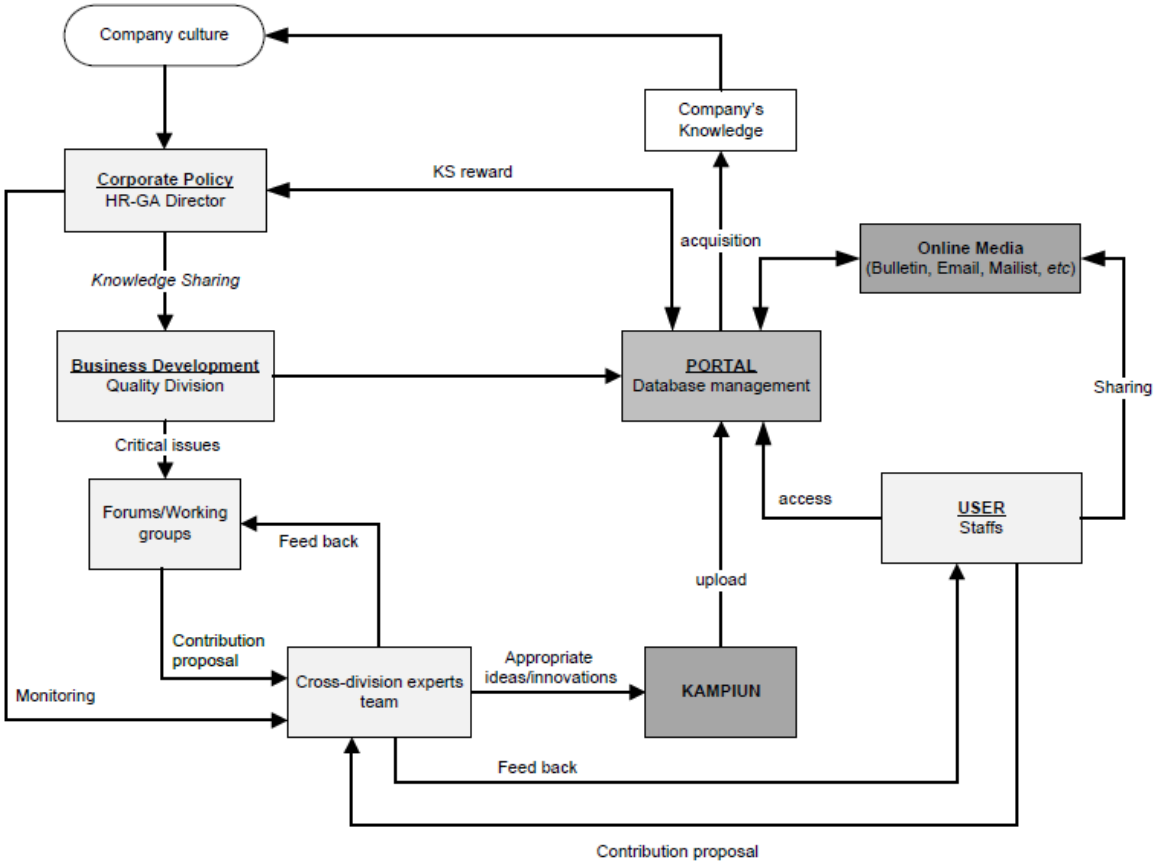


Figure 2.14 Knowledge management process in KAMPIUN

2.4.11 BMC Software has used DIKW model

The service knowledge management system includes a configuration management system (CMS), which is a central logical repository that provide access to the configuration data and the configuration management database (CMDB).

Service knowledge management provides a powerful decision-making tool for IT. BMC has identified that the DIKW [20] model can be applied for IT service knowledge management as follows:

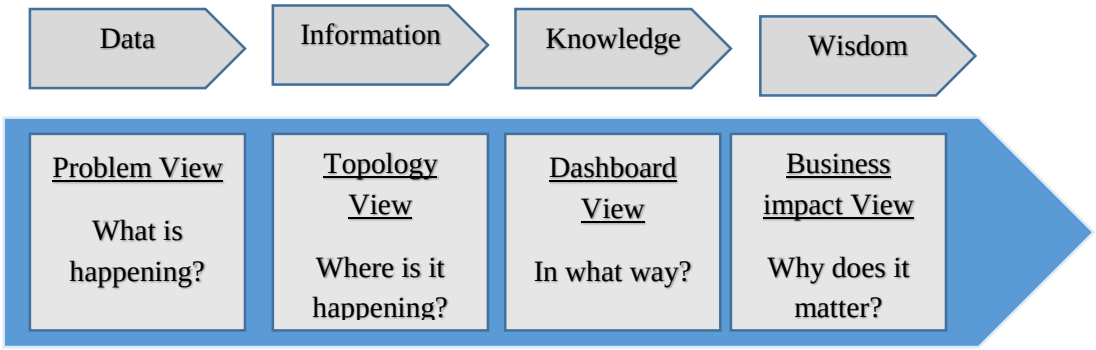


Figure 2.15 DIKW Model

Service knowledge management in IT can also be used for asset management, incident management, problem management, change management, and performance management.

Service knowledge management includes advanced analytic technologies such as data mining, online analytical processing (OLAP), advanced correlative algorithms, and self-learning capabilities (heuristics). With most IT organizations, Enterprise Management Associates (EMA) consultants are working with EMA to deploy more advanced analytic tools to leverage their investments in their CMDBs. EMA has worked with many IT environments to create and deploy analytic systems with well-defined portal access.

These analytic systems are developed with clear objectives to leverage the CMDB investment through more effective business alignment. The results are compelling. A CMDB provides an effective and efficient way of making IT environment data available to the service knowledge management system. The CMDB provides a point of integration for the various IT management silos by consolidating the many silos of IT data scattered across the enterprise into a single, holistic view. The CMDB can incorporate the wealth of IT environment data stored across the IT infrastructure, without having to move all the data to the CMDB itself.

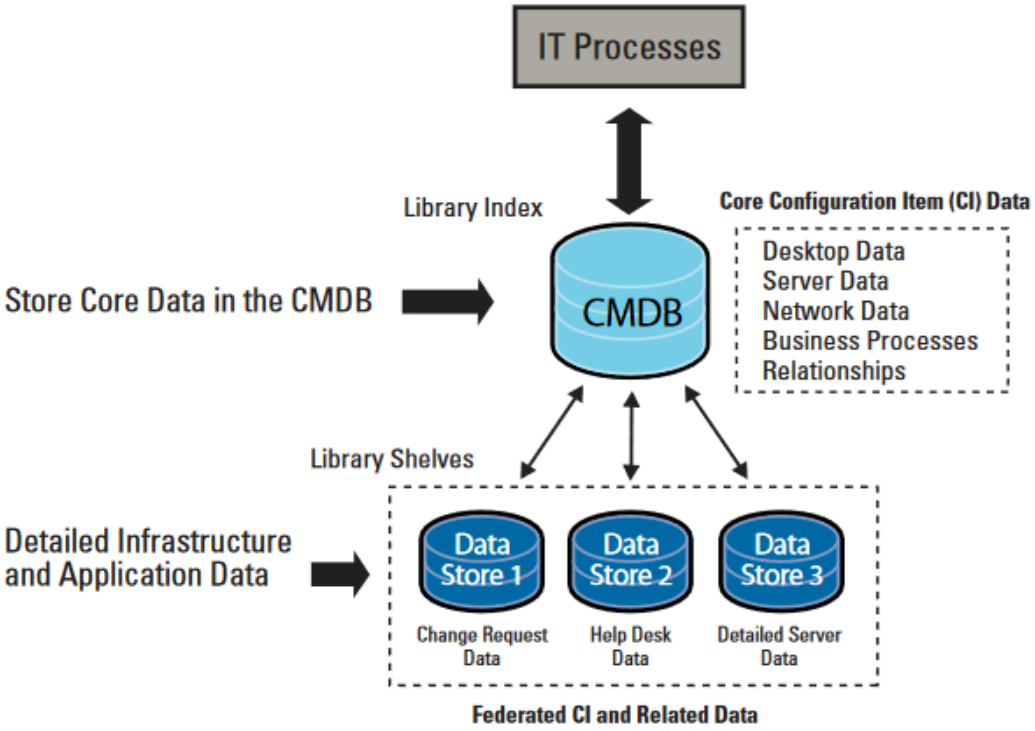


Figure 2.16 BMC IT infrastructure

3. Key motivators to select knowledge management in mobile telecommunication industry as the research topic

The mobile telecommunication industry is changing continuously and the operators attempt to anticipate new customer requirements and design new solutions to attract customers. An Engineer in current mobile telecommunication environment require a vast knowledge in different disciplines to satisfy customer needs and requests. A proper knowledge management system is more important than ever to achieve this objective.

A customer would request a quality telecommunication service. High quality network experience would be valued and recognized. If the service provider cannot provide high quality service, it will result high level of customer disturbance, and customers with bad experiences will communicate such experience via social media. This has a negative impact on customer loyalty. Therefore, a sound knowledge in telecommunication field is essential to improve the customer experience.

Future direction of the mobile telecommunication industry would provide a total communication solution to customers. Hence, it necessitates providing a more customized solution and a wide knowledge of different disciplines would help to cater customer requirements efficiently.

Survival as a competitive organization demands identifying new business opportunities and continuously expanding the business scope. One such example would be in Banking where they can provide attractive solutions on top of their telecommunication infrastructure. In future, most banking services will be performed on online basis.

Another wide area that mobile telecommunication industry needs to study is machine-to-machine communication solution. The machine-to-machine communication is the next dimension to expand their number of connections. For example, in surveillance system & monitoring, NFC based applications, remote tracking, remote meter reading, and in some automobile industries, various opportunities are available to expand the business scope.

Migration of high skill employees in mobile telecommunication field is noted under Sri Lankan context, and it is questionable whether a proper knowledge transferring process is available in the mobile telecommunication sector. Creating a mobile telecommunication expert takes at least five to seven years, and to develop such an expert, it is required to provide various training

and hands on experience sessions. Therefore, to build an expert, it incurs huge costs to operator. However, it is questionable whether there is a proper knowledge transfer process. Most of the tacit knowledge will bind with the action and as a result, it is difficult to transfer without having a proper process and a system. Further, it is doubtful of having central location to access training material. This makes proper knowledge transfer between the expert and new engineers questionable.

To provide a quick solution to a customer issue, it is important to consult a subject expert. In a telecommunication organization with a large number of employees, finding a subject expert is difficult without a proper system to locate the expert. This makes it critical to have a central system to locate an expert.

The standard of the Sri Lankan education system is highly recognized in a global context; conversely, two key mobile operators in Sri Lanka have the latest mobile technology. Frequently they claim that they are the pioneers to introduce latest technology to customers in South Asia. That indicates that practical experience and knowledge level in mobile telecommunication is higher, compared to other South Asian countries. It is questionable why there is no such intuition of technology training sector business in Sri Lanka. Operators can generate additional revenue if they can introduce a mobile technology training program to rest of the world. Therefore, conducting research on knowledge management under Sri Lankan context is important.

As per the mobile customer service experience journey, the main touch point is mobile customer care point. In order to delight the customer, providing a quick resolution to the customer concern is important and to facilitate this, a proper knowledge management system is vital. Therefore, it is worthy to check whether mobile operators properly manage the knowledge management system.

It is questionable whether the telecommunication industry in Sri Lanka has a proper knowledge management system. Hence, it is important to perform a research to find out knowledge management practices in Sri Lankan context. It was also observed that limited research was performed in telecommunication knowledge management area in Sri Lanka. This was the key motivator to select knowledge management as a research subject.

4. Research methodology

This section provides information on the research method of this thesis. The survey research method was designed to obtain knowledge management practices and find out important aspects of the knowledge management in mobile telecommunication industry in Sri Lanka. The final target was to develop a framework for the knowledge management for mobile telecommunication sector in the country. Following subsections describe the sampling techniques, survey measurement procedure, and data collection and data analysis procedures. Finally, limitations of this thesis will be discussed.

4.1 Sampling

An online survey is the basis for this research. The total population consists of the mobile telecommunication engineering staff with computer literacy, e-mail addresses, and access to internet. This population is more vulnerable to knowledge access through a knowledge management system. Survey questions were designed to obtain real practices and attitudes of the employees in the telecommunication field and the estimated total population is one thousand two hundred (1200) persons. An Online questioner was distributed with the support of each Engineering head position of mobile operators in Sri Lanka to represent the entire population. Random sampling technique was applied to receive the feedback where every member had an equal chance to respond. Sampling size comprised of 90% confident level with a 10% error margin and the sample size was sixty-four. To maintain the quality and effectiveness of this survey research, it was decided to collect at least 64 samples for the research work. Detailed calculation of the sampling size is available in Annex B.

4.2 Measurement procedure

The online survey link was circulated using e-mails. This particular tool was used because of unique characteristics of the population and efficiency of data collection. E-mail body contained the basic details of the survey. Research questions were based on current level of knowledge management practices, people attitudes, and information related to develop

framework for mobile telecommunication field. Most questions were constructed on the likert scale and few open-ended questions to obtain their views and future directions.

One of the main advantage of this research instrument was the low cost. Use of e-mail based research technique would promote efficiency and offer responders to answer the questions from a convenient location.

4.3 Data Collection

When responders click the link of the survey request e-mail, the Questioner will appear. The users can then select the most suitable answer for the questions, based on the likert scale. Survey questions can be answered within 10-15 minutes.

A server collected and updated the survey feedbacks, immediately after responders submit the result. The data was organized into separate columns and rows for easy access and analyzed with the Microsoft Excel format.

4.4 Data analysis

Survey feedback data were analyzed using SPSS version 24. Initial data were in the Microsoft Excel format and all data were in “string” format. It required converting all string data into numerical format. All likert scale data were converted in to numerical format range from 1-5, and those numerical data were analyzed using the SPSS software.

Concept variables were derived from the interim of the survey questions and relevant weight was assigned based on the feedback of industry experts. Importance of the key concept variable and their practical usage was separately analyzed. Finally, based on the findings, a knowledge management framework for the mobile telecommunication sector in Sri Lanka was developed.

4.5 Limitations

It would be more suitable to obtain confident interval as 95%, which make sample size around 292. Due to practical difficulty of having a sample of that size, it was decided not to use 95% confident interval.

5. Rationale behind the selection of knowledge management concepts variables

This research work was based on knowledge management model (SECI Model) developed by professor Nonaka and Takeuchi Model developed in Japan [4]. As Sri Lanka and Japan are located in the Asian region, relationship between these two countries extends to several decades; and hence, both countries have common cultural aspects.

Buddhist philosophy is dominant in Sri Lanka as well as Japan, and it has greatly influenced values, believes, and attitudes of the people, most of whom are friendly, in the two countries. Cultural similarity and difference are analyzed using Hofstede's cultural dimensions [21] aspect and five key variables identified, namely, Power distance, Individualism, Masculinity, Uncertainty avoidance, and Long-term orientation.

Table 5.1 Hofstede's cultural dimensions

Country	Power distance	Individualism	Masculinity	Uncertainty avoidance	Long-term orientation
Sri Lanka	80	35	10	45	45
Japan	54	46	95	92	88

Source: (Hofstede world information [22])

Power distance

The aspect of Power distance measures to what extent people accept the uneven distribution of power. A low power distance therefore points to a society where the power structure is flatter, wealth is more evenly distributed, and decisions made are more democratic. According to Geert Hofstede world information [22], scores for the power distance of Sri Lanka and Japan are 80 and 54 respectively, both countries having a middle to high power distance. Sri Lanka has a relatively high power distance where people do not accept current wealth distribution and the current national economic level difference would influence the power distance.

Individualism

Individualism measure the extent to which an individual’s interests and identity prevails over the group’s interest and identity. According to world cultural dimension analysis of Geert

Hofstede [22], scores for Individualism for Sri Lanka and Japan are 35 and 46 respectively, and both countries demonstrate collectivism culture where people collaborate with each other.

Masculinity

Masculine societies emphasize competitiveness, assertiveness, and excelling, while feminine societies focus on quality of life and caring for the weak. According to Geert Hofstede world information [22], Sri Lanka score for Masculinity is 10 while that of Japan is 95.

Uncertainty avoidance

Uncertainty avoidance is a dimension that describes the extent to which people in the society are not at ease with ambiguity and uncertainty. Cultures with low uncertainty avoidance tend to accept risk and change, and prefer implicit or flexible rules and guidelines. According to Geert Hofstede world information [22], scores for uncertainty in Sri Lanka and Japan are 45 and 92 respectively. Hence, Sri Lankan community is a higher risk taker while Japanese community is a low risk taker.

Long-term orientation

Long-term orientation aspect measures the extent to which a society feels threatened by the uncertainty of the future. According to Geert Hofstede world information [22], Sri Lanka score for the Long-term orientation is 45 and for Japan, it is 88. Therefore, Japan community is more long-term oriented whereas Sri Lankan community is more towards short-term. This difference stresses the importance of having a visionary leadership concept in Sri Lankan context.

Cultural analysis between Sri Lanka and Japan depicts similarities and differences. In order to improve long-term orientation, leadership is identified as the key concept variable. Power distance value is relatively high in Sri Lankan context compared with Japan. Therefore, it is important to test shared culture in Sri Lankan framework. As this research aims more toward knowledge management, it is required to test Knowledge sharing culture in within Sri Lankan context. Therefore, introducing Leadership and Knowledge sharing culture as key concept variables to the SECI Model [4] is required to analyze knowledge management in Sri Lankan situation.

5.1 Selected Concept variables versus existing knowledge management model

This section assesses the applicability between selected concept variables and existing knowledge management models. Table 5.2 summarizes the relationship between research concept variables and the other models.

Table 5.2 Concept variable vs. Existing Knowledge management model

KM Models	Key Concept					
	Socialization	Externalization	Combination	Internalization	Leadership	Shared culture
The KM Process Model by Botha et al.	**YES**	**YES**	**YES**	**YES**	**NO**	**YES**
Zack Knowledge Management Model	**NO**	**YES**	**YES**	**YES**	**NO**	**NO**
Bukowitz & Williams Model	**NO**	**YES**	**YES**	**YES**	**NO**	**NO**
McElroy Model	**NO**	**YES**	**YES**	**YES**	**NO**	**NO**
WIIG Model	**YES**	**YES**	**YES**	**YES**	**NO**	**YES**
Nonaka and Takeuchi Model (SECI Model)	**YES**	**YES**	**YES**	**YES**	**NO**	**YES**
Alen Frost's Model	**YES**	**YES**	**YES**	**YES**	**NO**	**YES**
Choo's KM Model	**YES**	**YES**	**YES**	**YES**	**NO**	**YES**
Boisot Model (I-space)	**YES**	**YES**	**YES**	**YES**	**NO**	**YES**
Adaptive models of knowledge management	**YES**	**YES**	**YES**	**YES**	**NO**	**YES**

5.2 Identified concept practices in the world with telecommunication industry

Table 5.3 summarizes the relationship between research concept variables and the best practices in the world.

Table 5.3 Concept variable vs. World best practices in Knowledge management

KM Practices in the world	Key Concept					
	Socialization	**Externalization**	**Combination**	**Internalization**	**Leadership**	**Shared culture**
AT&T's knowledge management methodology-**Expert locator**	**NO**	**YES**	**YES**	**YES**	**NO**	**NO**
Sprint (USA) Web-based knowledge management application software-**Document sharing**	**NO**	**YES**	**YES**	**YES**	**NO**	**NO**
Verizon Wireless(TM) Knowledge Management **Training solution**	**YES**	**YES**	**YES**	**YES**	**NO**	**YES**
KM infrastructure at ABC Engineering College India **training and enhancing learning of students**	**YES**	**YES**	**YES**	**YES**	**NO**	**YES**
Cingular extends the knowledge management system **(Call center can answer virtually any question)**	**NO**	**YES**	**YES**	**YES**	**NO**	**NO**
Saudi Telecom- Implement KM to **support their new strategy**	**YES**	**YES**	**YES**	**YES**	**NO**	**YES**
Schlumberger oilfield and information Service Company **Quick solution to problem through KM**	**YES**	**YES**	**YES**	**YES**	**NO**	**YES**
Accenture **KM for to offer a consistent product on a global bases**	**YES**	**YES**	**YES**	**YES**	**NO**	**YES**
Bouygues Telecom **(Effectively collaborate with employees in many parts of the business)**	**YES**	**YES**	**YES**	**YES**	**NO**	**YES**
PT TELKOM, Indonesian **(Create a learning organization)**	**YES**	**YES**	**YES**	**YES**	**NO**	**YES**
BMC Software Company **(configuration data management)**	**NO**	**YES**	**YES**	**YES**	**NO**	**NO**

The above data revealed that socialization, externalization, combination, internalization, and shared culture, are available in most models and best practices in the world. The variables, Leadership and Knowledge sharing culture were identified as key concept variables to test knowledge management concept in Sri Lanka; hence, the Author introduced two new variables, *Leadership* and *Knowledge sharing culture*, to the knowledge management concept.

6. Survey data analysis

6.1 Survey data summary based on operators

The total population size was 1200, with 90% confident level, and the sample size was 64. There were 67 participants for the online questioner. The Online survey was distributed to each operator and the relevant feedback was summarized as below:

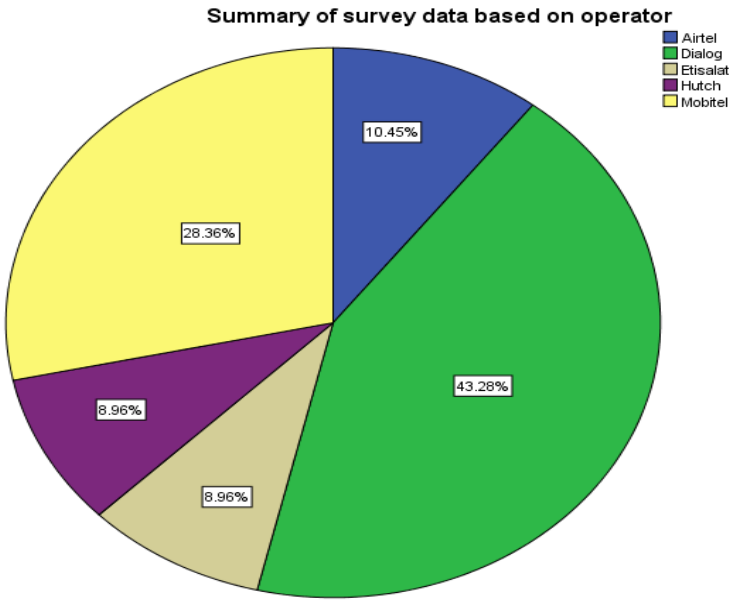


Figure 6.1 Summary of survey data

Table 6.1 Summary of survey data based on operator

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Airtel	7	10.4	10.4	10.4
	Dialog	29	43.3	43.3	53.7
	Etisalat	6	9.0	9.0	62.7
	Hutch	6	9.0	9.0	71.6
	Mobitel	19	28.4	28.4	100.0
	Total	**67**	**100.0**	**100.0**	

6.2 Availability of knowledge management system

According to the survey question on "availability of such knowledge management system in their organization," about 73.1% responded that they do not have such a knowledge management system.

Table 6.2 Survey response to Availability of KMS

Response to the survey question, "Do you have a Knowledge management system to capture tacit knowledge (situational knowledge)?"

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	49	73.1	73.1	73.1
	Yes	18	26.9	26.9	100.0
	Total	**67**	**100.0**	**100.0**	

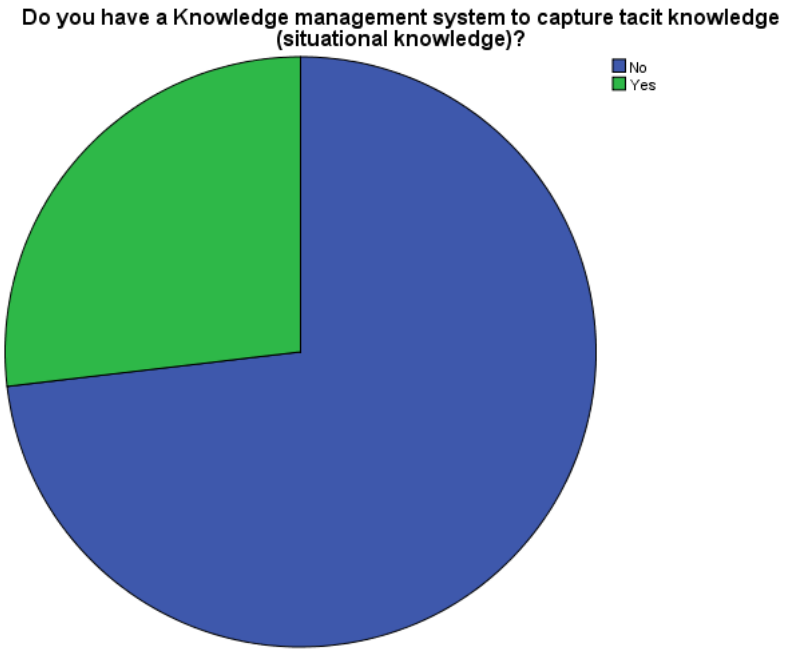


Figure 6.2 Survey response to Availability of KMS

6.3 Socialization concept in Sri Lanka mobile telecommunication industry

Function F1 was given to Socialization in term of survey responses. Function output indicated the importance of socialization and current level of practice about socialization. Weights of the function were derived based on average value of the telecommunication experts' feedback; a detailed calculation is available in Appendix C.

$$F1 = 0.1Q9 + 0.3Q10 + 0.3Q11 + 0.05Q12 + 0.05Q13 + 0.05Q14 + 0.1Q27 + 0.05Q30$$

Table 6.3 Importance of socialization

Statistics

Summary of statistics related to importance and applicability of socialization

N	Valid	67
	Missing	0
Mean		3.6701
Std. Deviation		.66035
Variance		.436

Histogram of socialization

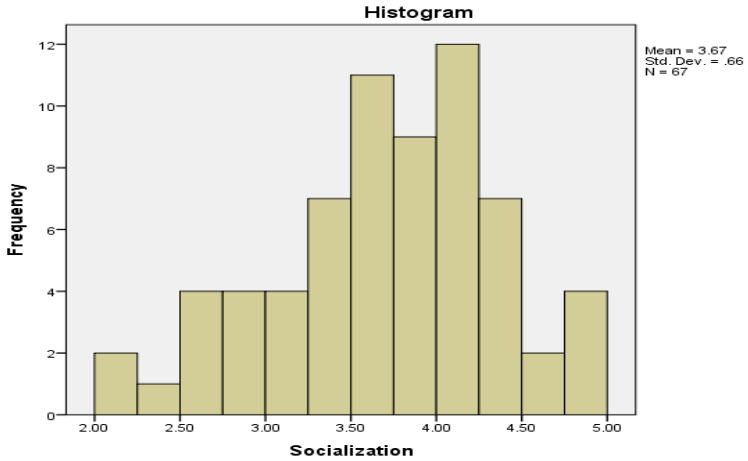


Figure 6.3 Importance of Socialization

The hypothesis to test Socialization is as below.

$$H_0: \mu \leq 3$$

$$H_1: \mu > 3$$

Where μ is the mean of socialization practice.

Table 6.4 Hypothesis test of Socialization

Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
Socialization	67	3.6701	.66035	.08067

One-Sample Test

	Test Value = 3					
					90% Confidence Interval of the Difference	
	t	df	Sig. (2-tailed)	Mean Difference	Lower	Upper
Socialization	8.307	66	.000	.67015	.5356	.8047

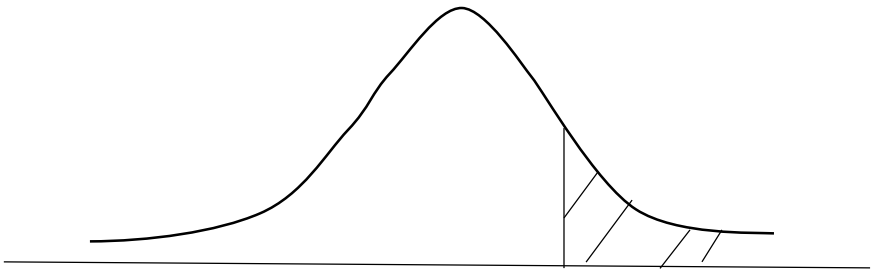


Figure 6.4 Hypothesis test of Socialization

According to statistical finding at 90% confident level, the critical value is 1.282. The calculated t-value 8.307 lie in the critical region. Therefore, H_0 can be rejected. There is

sufficient evidence at 90% confident level, and mean value of F1 variable is greater than 3; hence, it can be concluded that socialization is an important factor for mobile telecommunication knowledge management in Sri Lanka and is being practiced by mobile telecommunication operators.

6.4 Importance of Externalization and Combination concepts in knowledge management in Sri Lanka

Survey question number 3 measured the importance of externalization and combination in mobile telecommunication industry. The survey question, "I believe knowledge management system is important to capture situational knowledge and update individual knowledge" indicated the importance of Externalization and Combination. Considering the importance of externalization and combination, the mean value was 4.48, which is greater than 3. It was noted that externalization and combination are important aspects in the field of mobile telecommunication.

Table 6.5 Importance of Externalization and Combination

N	Valid	67
	Missing	0
Mean		4.48
Std. Deviation		.682
Variance		.465

Table 6.6 Importance of Externalization and Combination

Response to survey question, "I believe Knowledge management system is important to capture situational knowledge and update individual knowledge"

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	1	1.5	1.5	1.5
	Neutral	4	6.0	6.0	7.5
	Agree	24	35.8	35.8	43.3
	Strongly agree	38	56.7	56.7	100.0
	Total	**67**	**100.0**	**100.0**	

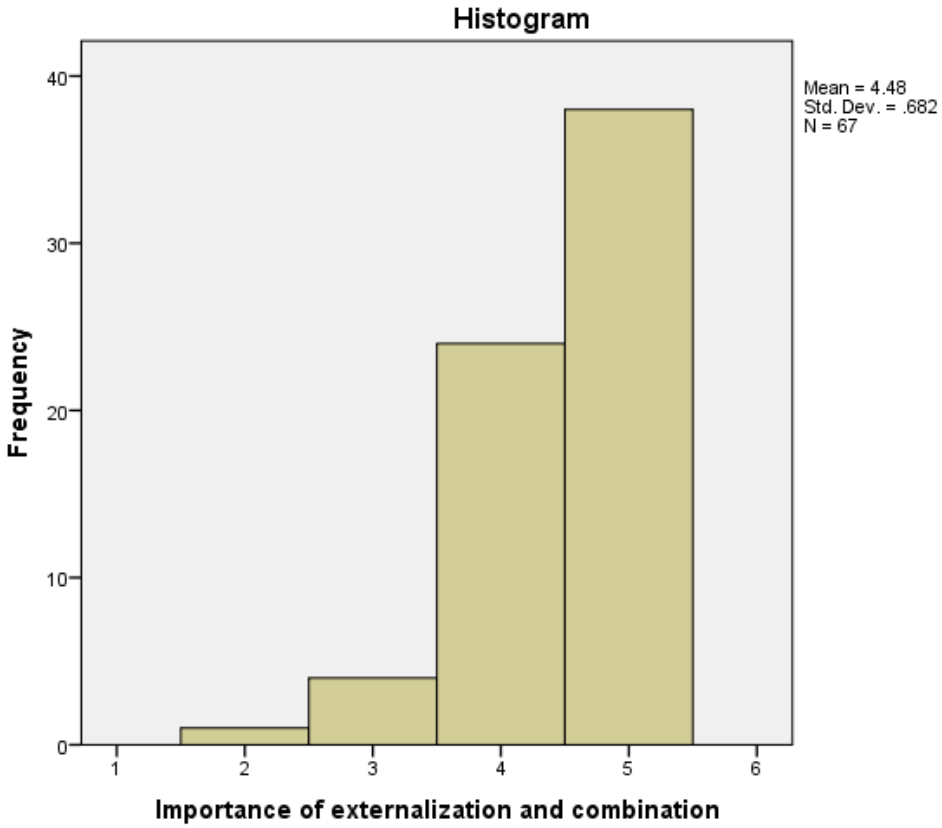


Figure 6.5 Importance of Externalization and Combination

6.5 Externalization practices in Mobile telecommunication in Sri Lanka

Function F2 is defined as the current level of practice of externalization in mobile telecommunication industry in Sri Lanka.

$$F2 = 0.2Q15 + 0.6Q16 + 0.2Q17$$

Table 6.7 Externalization practices

N	Valid	67
	Missing	0
Mean		2.9403
Std. Deviation		.55917
Variance		.313

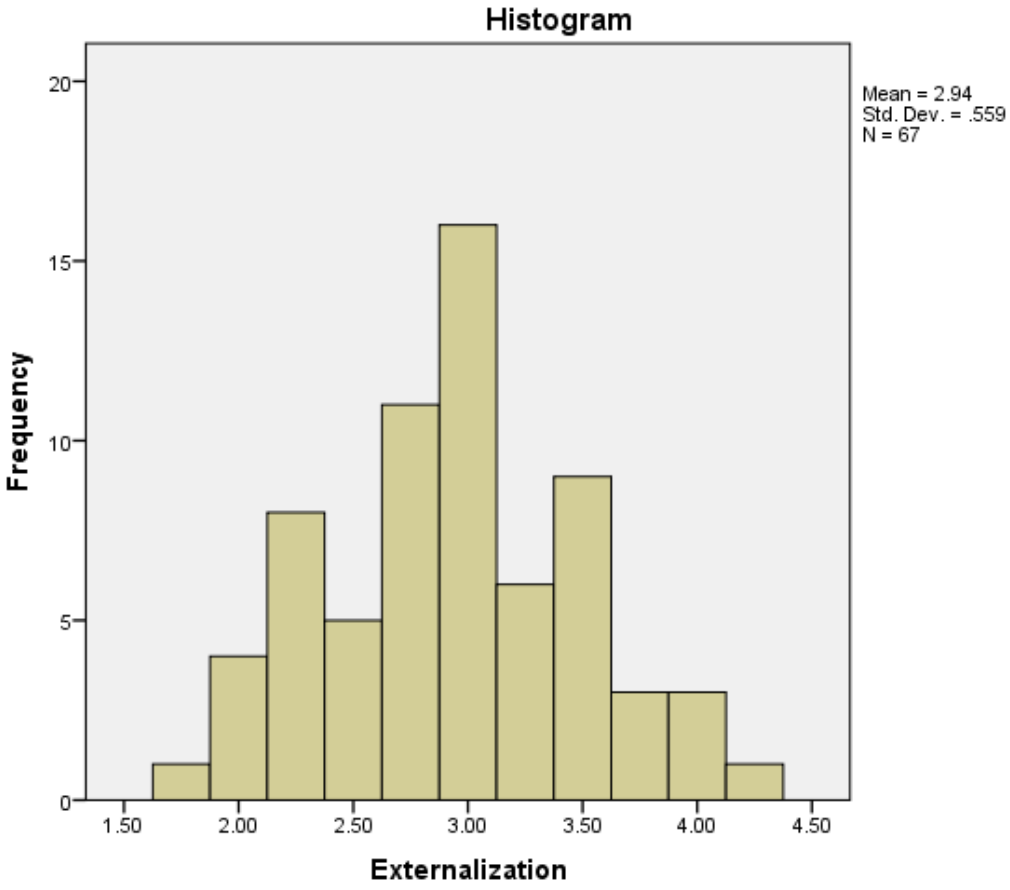


Figure 6.6 Externalization practices

The hypothesis to test Externalization is as below:

$$H_0: \mu \geq 3$$

$$H_1: \mu < 3$$

Where μ is the mean of externalization practice.

Table 6.8 Hypothesis test of externalization

Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
Externalization	67	2.8657	.58194	.07110

One-Sample Test

	Test Value = 3					
					90% Confidence Interval of the Difference	
	t	df	Sig. (2-tailed)	Mean Difference	Lower	Upper
Externalization	-1.889	66	.063	-.13433	-.2529	-.0157

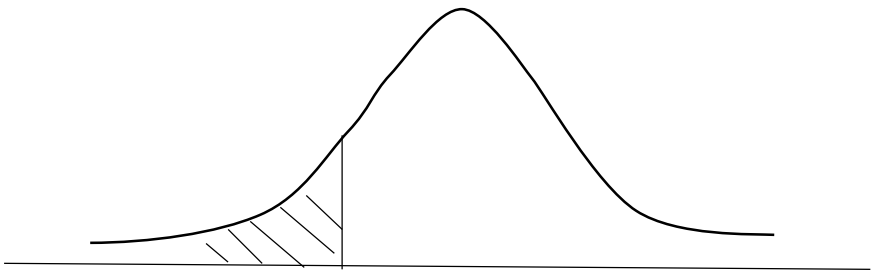


Figure 6.7 Hypothesis test of externalization

According to statistical findings, at the 90% confident level, the critical value is 1.282. The Calculated t value is -1.889 and lie in the critical region. Therefore, H_0 can be rejected. There

is sufficient evidence to denote that at 90% confident level, the mean value of F2 variable is less than 3; hence, it can be concluded that externalization practice is relatively low in Sri Lankan context, and it is therefore necessary to improve this aspect.

6.6 Combination practices in Mobile telecommunication in Sri Lanka

Function F3 is defined as the current level of practice of combination in mobile telecommunication industry in Sri Lanka.

$$F3 = 0.3Q18 + 0.7Q19$$

Table 6.9 Combination practices

Statistics

Combination

N	Valid	67
	Missing	0
Mean		2.8463
Std. Deviation		.76680
Variance		.588

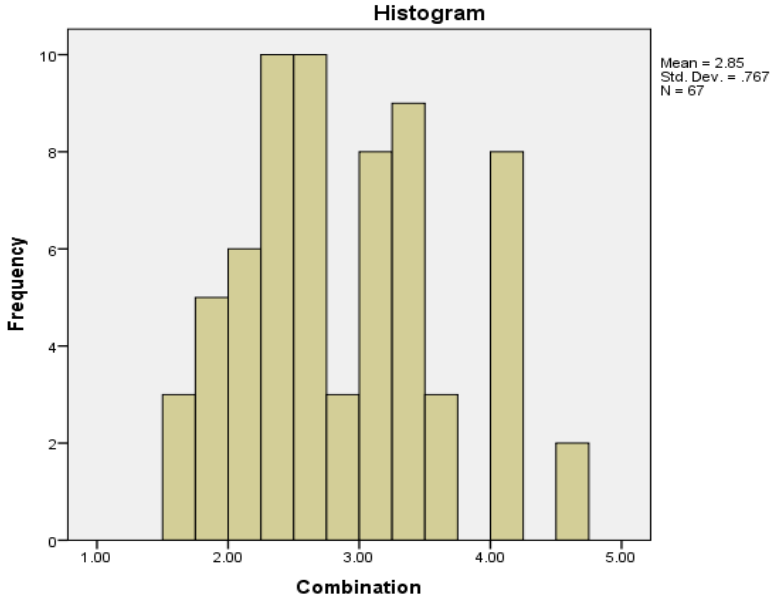


Figure 6.8 Combination practices

The hypothesis to test Combination is as below.

$$H_0: \mu \geq 3$$

$$H_1: \mu < 3$$

Where μ is the mean of combination practice.

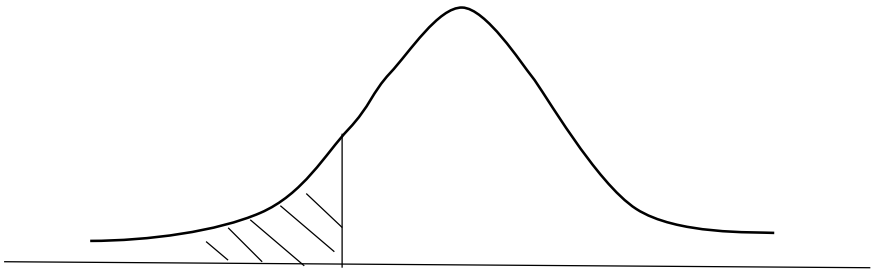
Table 6.10 Hypothesis test of Combination

Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
Combination	67	2.8463	.76680	.09368

One-Sample Test

	Test Value = 3					
					90% Confidence Interval of the Difference	
	t	df	Sig. (2-tailed)	Mean Difference	Lower	Upper
Combination	-1.641	66	.106	-.15373	-.3100	.0026



t Critical = -1.282

Figure 6.9 Hypothesis test of Combination

According to statistical findings, at 90% confident level, the critical value is 1.282. The calculated t value is -1.641, which lie in the critical region. Therefore, H_0 can be rejected. There

is sufficient evidence to denote that at 90% confident level, the mean value of F3 variable is less than 3, which specify the conclusion that combination practice is relatively low under Sri Lankan context and it is required to improve Combination practices.

6.7 Importance of the Internalization concept in knowledge management in Sri Lanka

Survey question number 4 measures at what level the mobile telecommunication internalization is important. The survey question, "I believe knowledge management is very important for the mobile telecommunication engineering field" indicate the importance of internalization. The importance of internalization mean value is 4.58, which is greater than 3; and it was observed that Internalization is important in mobile telecommunication field.

Table 6.11 Importance of Internalization

Statistics

" I believe knowledge management is very important for the mobile telecommunication engineering field"

N	Valid	67
	Missing	0
Mean		4.58
Std. Deviation		.655
Variance		.429

Table 6.12 Survey repose related to Internalization

Response to survey question, "I believe knowledge management is very important for the mobile telecommunication engineering field"

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	1	1.5	1.5	1.5
	Neutral	3	4.5	4.5	6.0
	Agree	19	28.4	28.4	34.3
	Strongly agree	44	65.7	65.7	100.0
	Total	**67**	**100.0**	**100.0**	

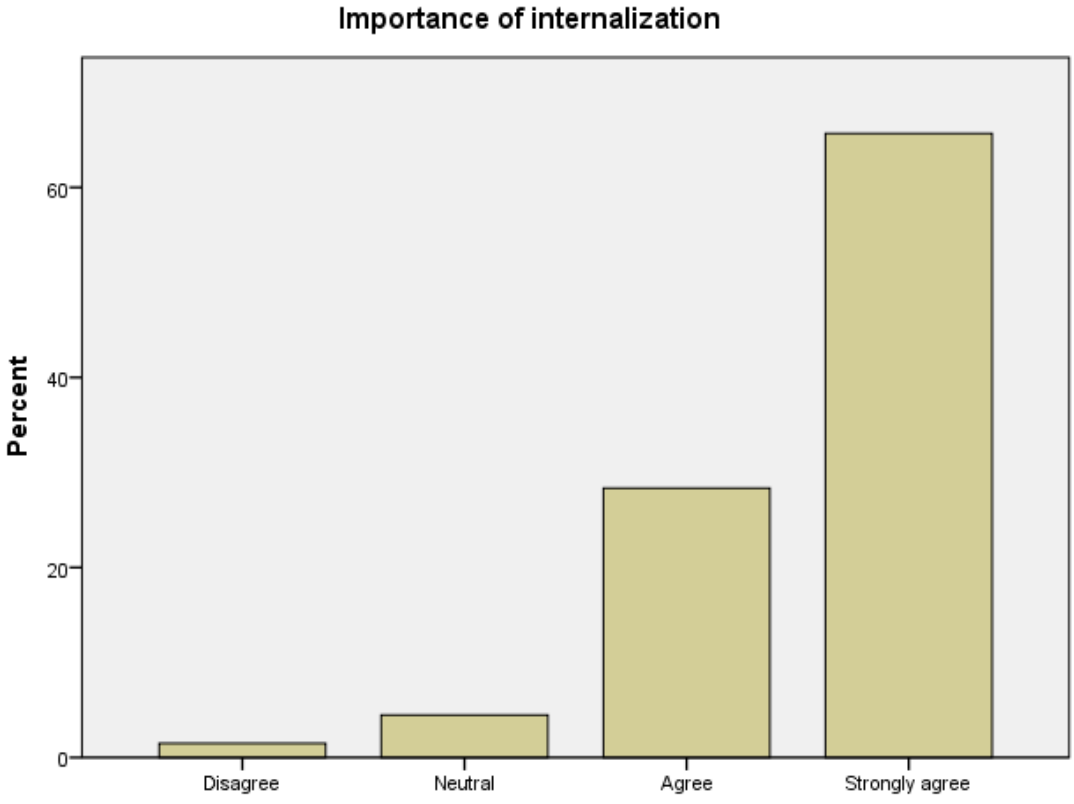


Figure 6.10 Importance of Internalization

6.8 Internalization practices in Mobile telecommunication in Sri Lanka

Function F4 is defined as the current level of practice of internalization in mobile telecommunication industry in Sri Lanka.

$$F4 = 0.15Q20 + \ 0.7Q21 + 0.15Q22$$

Table 6.13 Internalization practices

Statistics

Internalization

N	Valid	67
	Missing	0
Mean		2.7560
Std. Deviation		.65975
Variance		.435

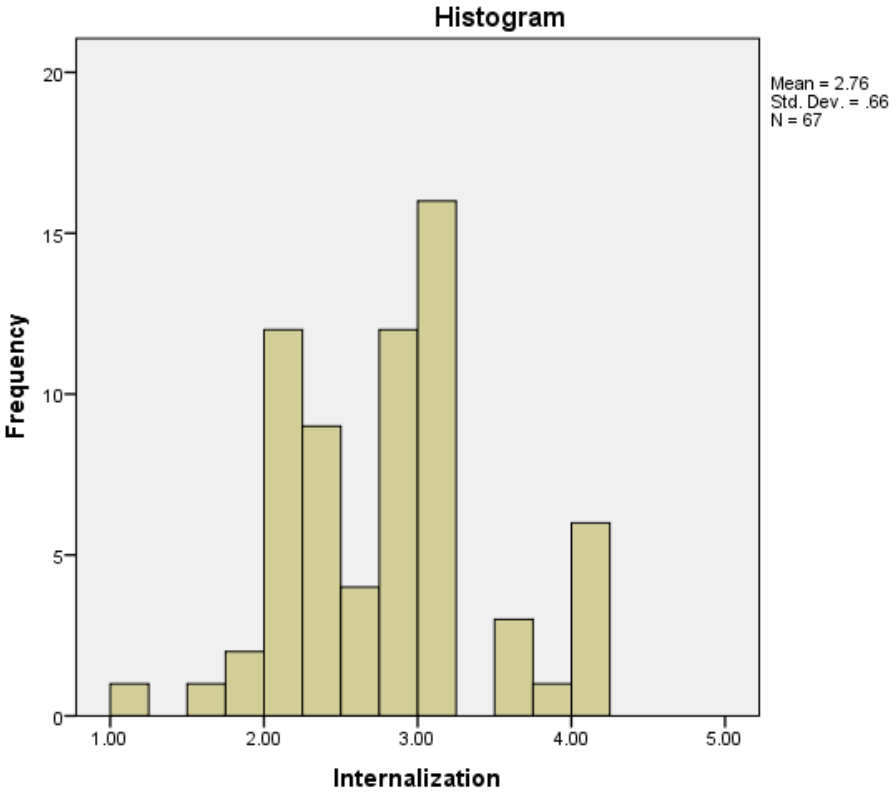


Figure 6.11 Internalization practices

The hypothesis to test Internalization is as below.

$$H_0: \mu \geq 3$$

$$H_1: \mu < 3$$

Where μ is the mean of internalization practice.

Table 6.14 Hypothesis test of Internalization

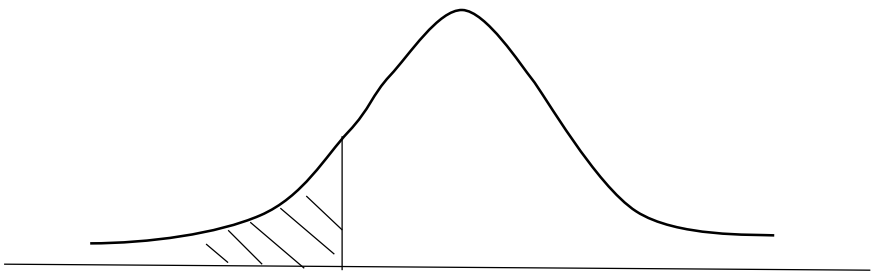
Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
Internalization	67	2.7560	.65975	.08060

One-Sample Test

Test Value = 3

	t	df	Sig. (2-tailed)	Mean Difference	90% Confidence Interval of the Difference	
					Lower	Upper
Internalization	-3.028	66	.004	-.24403	-.3785	-.1096



$t_{Critical} = -1.282$

Figure 6.12 Hypothesis test of internalization

According to statistical findings, at 90% confident level, the critical value is 1.282. The calculated t value is -3.028, which lie in the critical region. Therefore, H_0 can be rejected. There is sufficient evidence to prove that at 90% confident level, the mean value of F4 variable is less than 3. Hence, it is possible to conclude that internalization practice is relatively low in Sri Lankan context and it is necessary to improve internalization practices.

6.9 Importance of Leadership concept for knowledge management

Survey question number 31 measures at what level mobile telecommunication leadership becomes important for knowledge management. The survey question, "If management introduces a knowledge management system to share knowledge, are you willing to support?" indicate the importance of leadership. When the importance of leadership is considered, the mean value is 4.46, which is greater than 3, and it was noted that Leadership is important in mobile telecommunication field.

Table 6.15 Importance of Leadership

Statistics

If management introduces a Knowledge management system to share knowledge, are you willing to Support?

N	Valid	67
	Missing	0
Mean		4.46
Std. Deviation		.682
Variance		.464

Table 6.16 Survey response related to importance of Leadership

Response to survey question, "If management introduces a Knowledge management system to share knowledge, are you willing to Support?"

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Somewhat oppose	1	1.5	1.5	1.5
	Neutral	4	6.0	6.0	7.5
	Support	25	37.3	37.3	44.8
	Strongly Support	37	55.2	55.2	100.0
	Total	**67**	**100.0**	**100.0**	

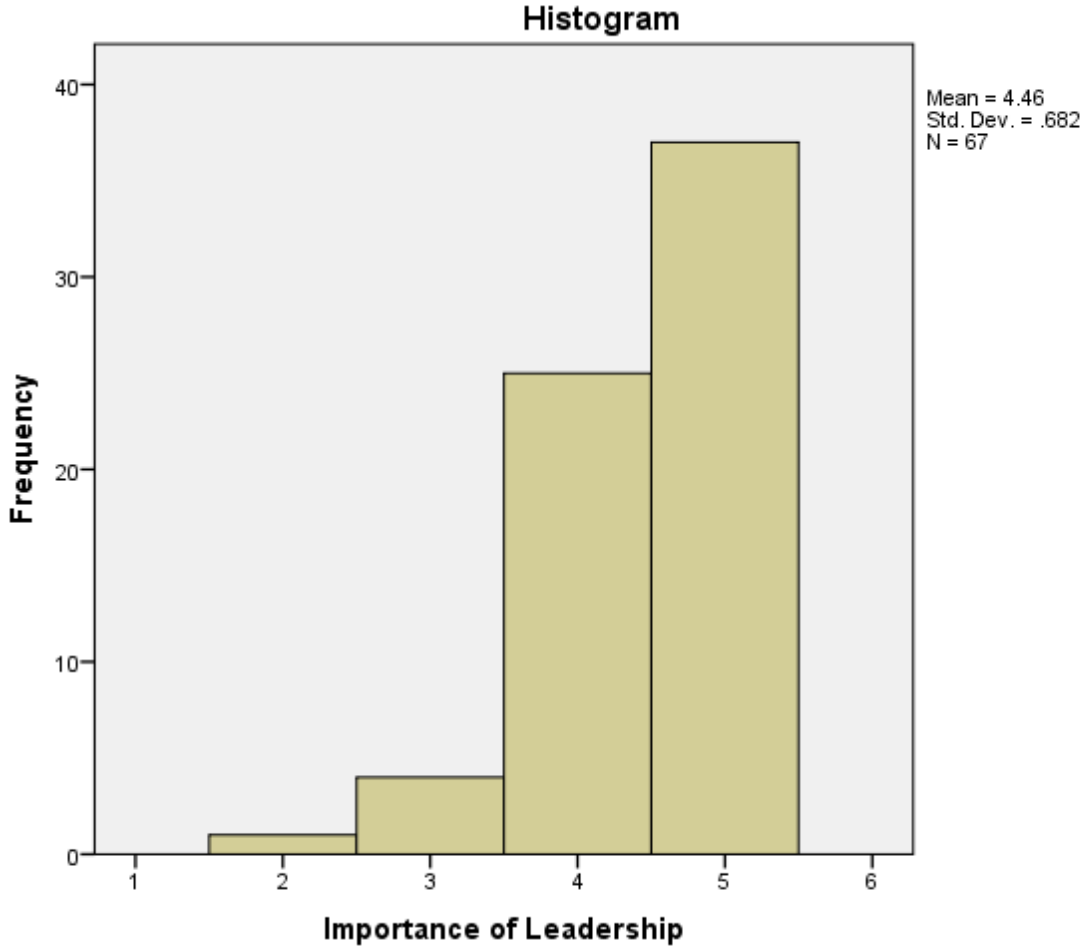


Figure 6.13 Importance of Leadership

6.10 Leadership practices in Mobile telecommunication in Sri Lanka

Function F5 is defined as the current level of practice of leadership to support knowledge management in mobile telecommunication industry in Sri Lanka.

$$F5 = 0.05Q2 + 0.05Q3 + 0.05Q4 + \ 0.25Q6 + \ 0.2Q7 + 0.4Q8$$

Table 6.17 Leadership practices

Statistics

Leadership

N	Valid	67
	Missing	0
Mean		3.6119
Std. Deviation		.62372
Variance		.389

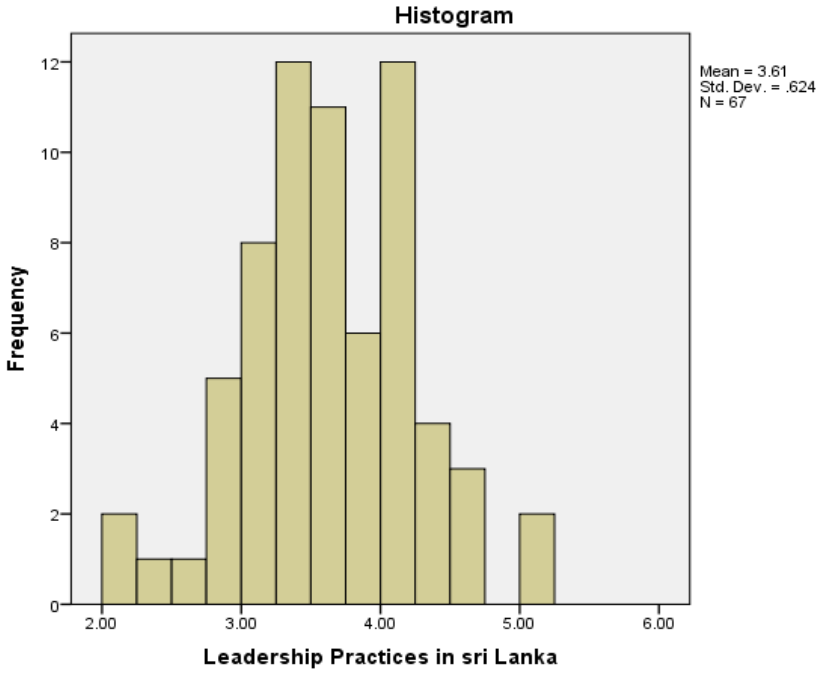


Figure 6.14 Leadership practices

The hypothesis to test leadership is as below.

$$H_0: \mu \leq 3$$

$$H_1: \mu > 3$$

Where μ is the mean of leadership practice.

Table 6.18 Hypothesis test of leadership

One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
Leadership	67	3.6119	.62372	.07620

One-Sample Test

	Test Value = 3					
					90% Confidence Interval of the Difference	
	t	df	Sig. (2-tailed)	Mean Difference	Lower	Upper
Leadership	8.031	66	.000	.61194	.4848	.7391

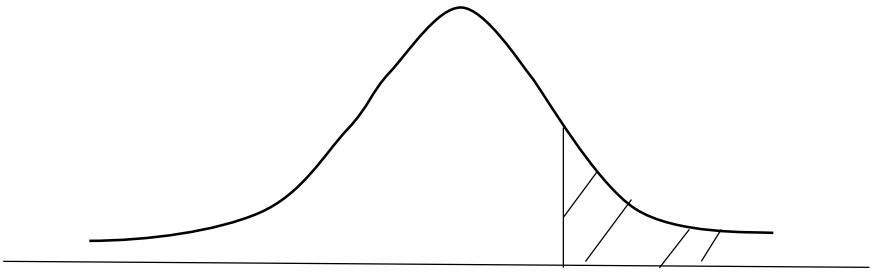


Figure 6.15 Hypothesis test of leadership

According to statistical findings at 90% confident level, the critical value is 1.282 and the calculated t value 8.031 lie in the critical region. Therefore H_0 can be rejected. There is

sufficient evidence to denote that at 90% confident level, mean value of F5 variable is greater than 3; hence, it can be concluded that leadership practice is acceptable in Sri Lankan context.

6.11 Importance of Knowledge sharing culture concept for knowledge management

According to the survey response, function F6 was defined to measure the importance of knowledge sharing culture.

$$F6 = 0.4Q26 + 0.1Q27 + 0.1Q28 + 0.1Q29 + 0.3Q30$$

Table 6.19 Importance of Knowledge sharing culture

Statistics

Importance of knowledge sharing culture

N	Valid	67
	Missing	0
Mean		3.8791
Std. Deviation		.55828
Variance		.312

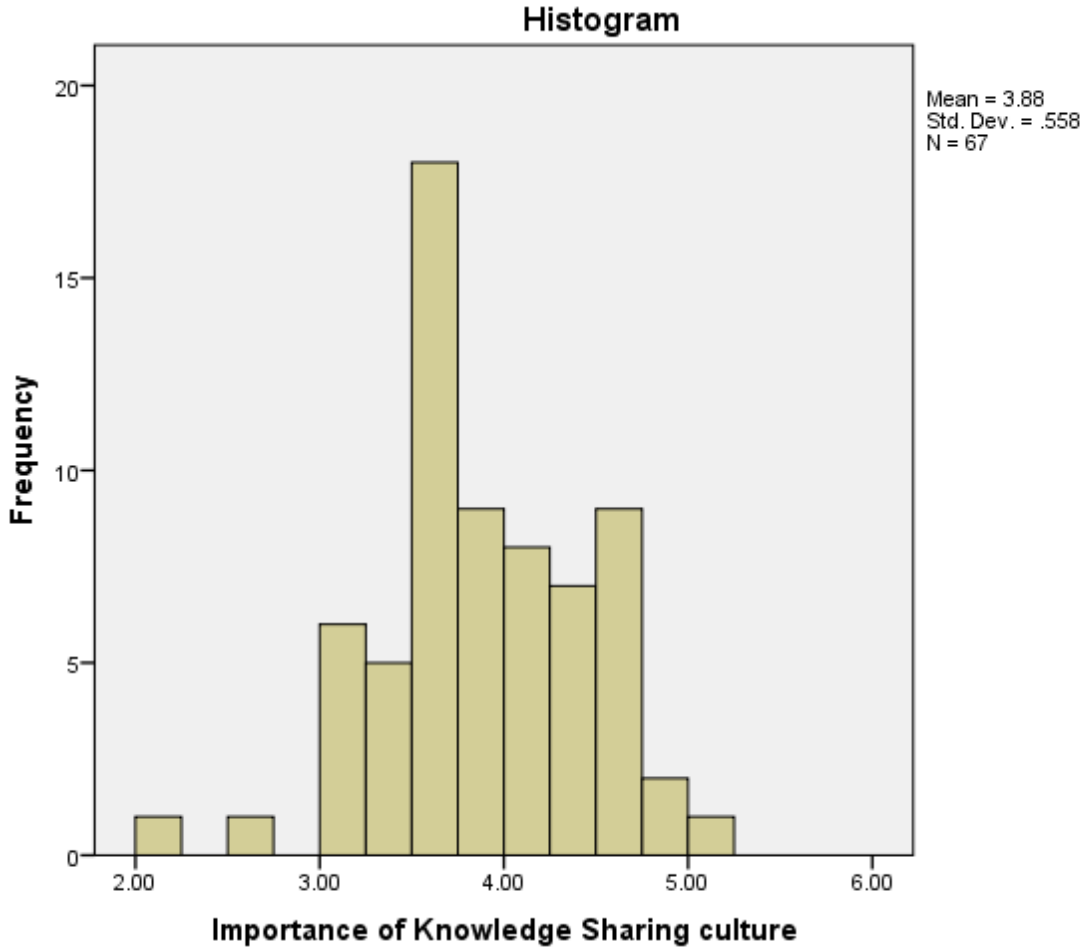


Figure 6.16 Importance of knowledge sharing culture

The hypothesis to test the importance of knowledge sharing culture is as below.

$$H_0: \mu \leq 3$$

$$H_1: \mu > 3$$

Where μ is the mean of Iimportance of knowledge sharing culture.

Table 6.20 Hypothesis test - Importance of knowledge sharing culture

Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
Importance_of_shared_culture	67	3.8791	.55828	.06820

One-Sample Test

	Test Value = 3				
	t	df	Sig. (2-tailed)	Mean Difference	90% Confidence Interval of the Difference Lower
Importance_of_shared_culture	12.889	66	.000	.87910	.7653

One-Sample Test

	Test Value = 3
	90% Confidence Interval of the Difference Upper
Importance_of_shared_culture	.9929

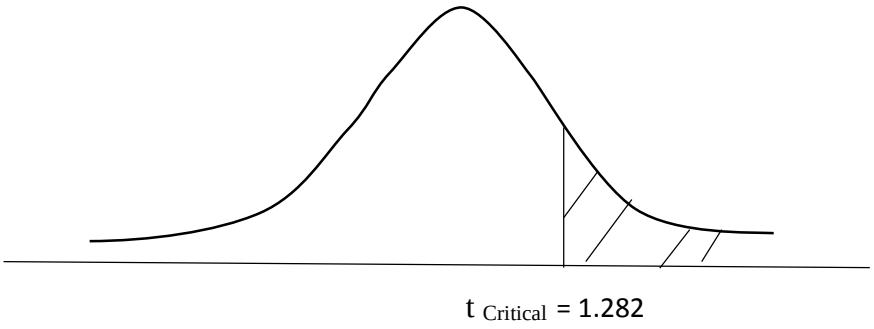


Figure 6.17 Hypothesis test-importance of knowledge sharing culture

According to statistical findings, at 90% confident level, the critical value is 1.282 and the calculated t value is 12.889, which lie in the critical region. Therefore, H_0 can be rejected. There is sufficient evidence to indicate that at 90% confident level, mean value of F6 variable is greater than 3; hence, it can be concluded that knowledge sharing culture is important for Sri Lankan context.

6.12 Knowledge sharing culture concept practices in Mobile telecommunication in Sri Lanka

Function F7 is assumed as the level of practice of Knowledge sharing culture in the mobile telecommunication industry in Sri Lanka.

$$F7 = 0.45Q23 + 0.05Q24 + 0.05Q25 + 0.4Q26 + 0.05Q29$$

Table 6.21 Knowledge sharing culture concept practices

Shared culture

N	Valid	67
	Missing	0
Mean		3.5993
Std. Deviation		.64576
Variance		.417

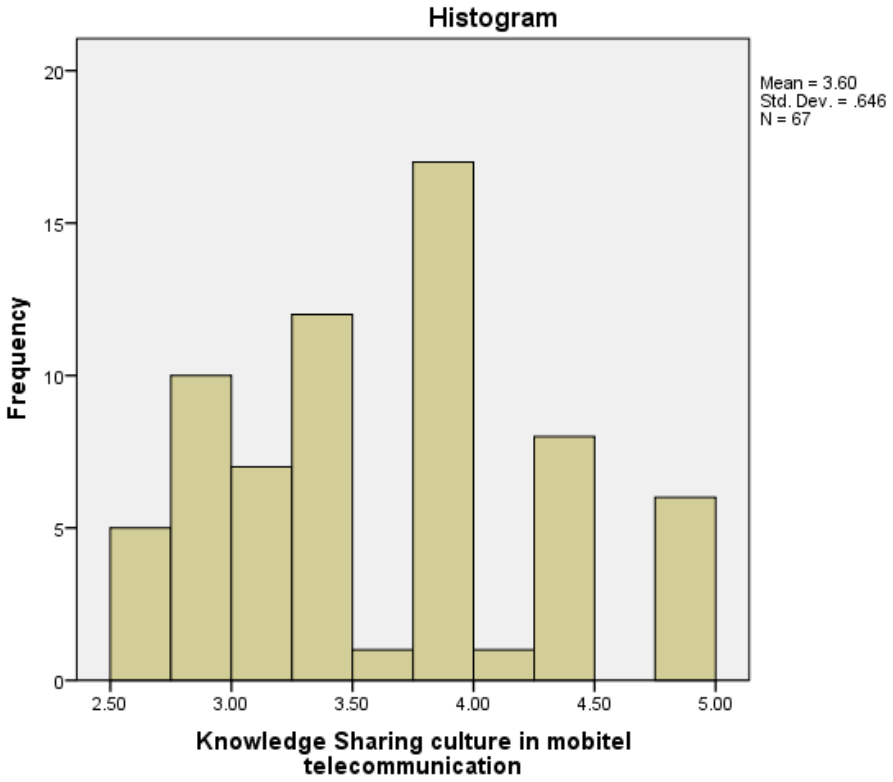


Figure 6.18 Knowledge sharing culture concept practices

The hypothesis to test the practice of Knowledge sharing culture is as below.

$$H_0: \mu \leq 3$$

$$H_1: \mu > 3$$

Where μ is the mean of knowledge sharing culture practice.

Table 6.22 Hypothesis test- Practice of knowledge sharing culture

One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
Practice_of_shared_culture	67	3.5993	.64576	.07889

One-Sample Test

	Test Value = 3				
	t	df	Sig. (2-tailed)	Mean Difference	90% Confidence Interval of the Difference Lower
Practice_of_shared_culture	7.596	66	.000	.59925	.4676

One-Sample Test

	Test Value = 3
	90% Confidence Interval of the Difference Upper
Practice_of_shared_culture	.7309

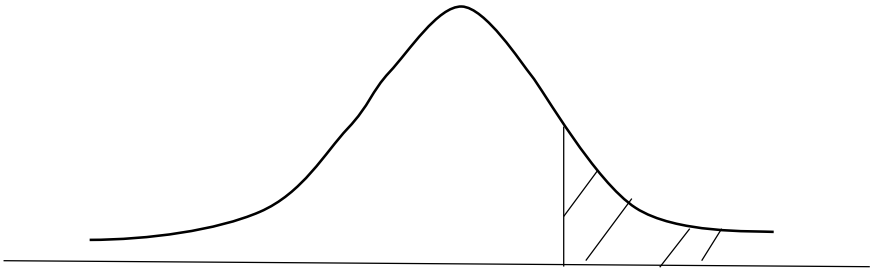


Figure 6.19 Hypothesis test- Practice of knowledge sharing culture

According to statistical findings, at 90% confident level, the critical value is 1.282 and the calculated t value is 7.596, which lie in the critical region. Hence, H_0 can be rejected. There is sufficient evidence to denote that at 90% confident level, the mean value of F7 variable is greater than 3; hence, it is possible to conclude that an acceptable level of knowledge sharing culture exist in Sri Lankan context.

Summary of concepts and their practices in mobile telecommunication industry in Sri Lanka:

Table 6.23 Summary of survey data analysis

Concept	**Requirement of the concept for mobile telecommunication knowledge management**	**Current practices level**
Socialization	Required	Acceptable level
Externalization	Required	Low level; Need to improve
Combination	Required	Low level; Need to improve
Internalization	Required	Low level; Need to improve
Leadership	Required	Acceptable level
Knowledge sharing culture	Required	Acceptable level

7. Gap between best practices in the world and Sri Lankan practices

The survey feedback analysis identified that most participants accepted the requirement of the tacit knowledge management system. On the surface of telecommunication engineering, people give less weight to initiate such a system. Considering the investment approval with financial term, top management requests a return on investment for any investment proposed by employees. In that scenario, it will be difficult to provide the exact figure for the return on investment, because knowledge management is a cycle. If continuously practiced, that will generate new business opportunities and improve the network operation efficiency.

With respect to training and development, if the operators properly maintain the knowledge management system, it can reduce a significant cost of the "training budget". For an example, Verizon Wireless, the leading wireless communications provider, has selected the "Generation21 Learning Systems' knowledge management software" to drive its blended approach to training. Verizon Wireless has chosen this system to keep current employees with business, processes, and products, and to reduce the time spent in training.

Knowledge management system is the only comprehensive software system proven to deliver exceptional organizational performance by collecting, managing, and distributing all types of information to employees and customers, when and where they need it. Therefore, it was observed that lack of such a system in Sri Lankan context would increase the cost of training, and simultaneously, cause a lower penetration of quality information among telecommunication staff.

When this is visualized from national economy perspective, most trainings have taken place in overseas; hence, our national currency will outflow from the country and that would affect the national economy. Internationally, Sri Lanka is recognized as a country with a good education standard. Nevertheless, frequently in telecommunication field, engineering staff training is performed overseas. As operators in Sri Lanka, if they can introduce a knowledge management system, they can reduce a substantial cost by investing in such a knowledge management system. Conversely, if Sri Lankan mobile operators can introduce an effective training program, that can be marketed all over the world and generate additional revenue stream for operators.

This can be positively supported by two key players of Sri Lankan mobile operators. Frequently they claim that they are the first south Asian network, when introducing a new technology. For

example, in their website profiles, Dialog claims as the first commercial operations of mobile 3G, 4G-LTE services in South Asia. The Mobitel web site profile claims that they are one of the first ten mobile service providers in the world to launch a 3.5G HSPA network in 2007. Mobitel was also the first service provider with a super 3.5G network in South Asia, and they successfully demonstrated HSPA + MIMO technology with downlink speeds of up to 28.8 Mbps and conducted a successful trial of 4G/LTE technology with downlink speeds exceeding 96 Mbps for the first time, in the South Asian region.

Dialog and Mobitel recently claimed as the first Sri Lankan networks that performed trials of 4.5G technology, capable of speeds over 1Gbps in South Asia. Such profiles give an indication about Sri Lankan mobile operators and the latest mobile technology introduced to Sri Lanka. Hence, it is a good opportunity to launch a new training program to rest of the world on latest mobile technology to gain a new income stream for operators and for Sri Lanka.

AT&T's knowledge management system provides a platform to share the knowledge of experts, so that the employees can look up a series of knowledge experts. This gives fast decision-making and productivity improvement of employees. Sprint (USA) has selected "Livelink" by Open Text Corporation, based on its ability to provide an enterprise-scalable, collaborative knowledge management application. This system helps to share knowledge between different levels of employees and help to streamline the entire process to improve efficiency and accuracy.

When new employees and existing employees engage with expert organizations, the average knowledge level will be enhanced. Nonaka and Takeuchi Model highlighted this concept of interaction as *socilization*. In Sri Lankan context, a gap of such a system exists to interact with the knowledge base positively.

Schlumberger oilfield and information Service Company identified knowledge management as a method to minimize the time between having a problem/issue and finding a solution. They use that system to provide a quick solution to recurrent problems.

Considering identification of mobile telecommunication network issues, network troubleshooting, and finding appropriate solutions, past experience track is crucial. If network operator can track all the network problems and provide a guide on how they overcome such issues by a single system, it will be a good asset for operators to find a quick solution for their

customers' network problems. In the Sri Lankan context, such a system is not available and this can be considered as a gap between world practices and Sri Lankan practice.

Knowledge management implementation in PT TELKOM, Indonesia – KAMPIUN knowledge management system provide a platform to enhance the work efficiency by introducing a technology approach that consists of PC network of all workers, SAP as the core business process, e-document initiative, knowledge PORTAL, e-mail, groupware, and e-learning. In addition, People Approach consists of a knowledge sharing (KS) forum as activities to share workers' knowledge, ideas, and experience, and conducted on every Wednesday and Sunday. Such forums help people to produce different ideas. In the Sri Lankan context, such systems are not available and this is another gap between world best practices and Sri Lankan practice.

As for telecommunication project management, it is essential to practice knowledge management. Knowledge management implementation in Saudi Telecom produces a good practice in project management.

Saudi Telecom launched FORWARD strategy in 2007. Knowledge management was implemented to support this new strategy. Their knowledge management project consisted of four phases:

1. Project initiation and kick-off workshop
2. Information gathering – existing knowledge assets, knowledge needs in STC, knowledge processes, barriers to knowledge sharing, relevant IT systems
3. Development of STC wide classification
4. Creation of knowledge map/ knowledge matrix

This sort of best practices in project management help to execute the project and lesson learning during the project phase efficiently. It will help make the project more efficient and effective and can help to improve the process.

Knowledge management implementation in Bouygues Telecom – They used Microsoft's SharePoint Portal Server Solution. Microsoft's SharePoint Portal Server solution was selected due to its easiness to implement and flexibility to meet various requirements of Bouygues Telecom business. SharePoint Portal Server is based on a document management server, which

enables organizations to manage all workflow processes associated with the publication of documents and to share them in dedicated spaces.

Preparing a report demands lot of groundwork. There is various divisional specific information distributed among several employees in an organization. Hence, it requires additional effort to compile the report when detailed information is requested from top management. Lack of such a centralized information system was identified during the survey feedback from mobile telecommunication industry.

Another important area of mobile telecommunication is *customer care touch point*, which gives solutions and provides information for customer requirements. Improving the moment of truth about service experience would improve the customer relationship. If customers receive quick rectification to their problem or quick information to their quarries, they will be delighted, and thus, improve customer retention. Sri Lankan mobile telecommunication is a growing business area where it needs to acquire a new customer base while maintaining the existing customer base. Otherwise, market share will change rapidly and diminish the financial position of the business. Providing superior customer service from the customer care division is so crucial than ever.

Customer care of Cingular Wireless turned to knowledge management, in order to make sure that each of their customer service agent at any call center can answer virtually any question asked by any one of their millions of clients. The software uses a complex algorithm to decide the order of the issues based partly on the exact text and phrase matching. In addition, agents can provide feedback using the software contribute button.

Introducing such a system would improve the overall performance of the mobile telecommunication segment. In Sri Lankan context, it would be great if the operator can introduce such a knowledge management to cater more efficient and effective service to their valuable customers. These advanced techniques would improve the creation of service differentiation among operators and obtain a competitive advantage.

It is important to generate new knowledge and circulate among employees. This knowledge circle would improve the average knowledge level of employees and continuously develop learning culture in the organization.

8. Knowledge Management framework for mobile telecommunication sector in Sri Lanka

This section describes suggested knowledge management framework for mobile telecommunication sector in Sri Lanka. Online survey findings, best knowledge management practices of the world, previous research and knowledge management models, and feedback of the telecommunication engineering staff, helped to develop a model.

Leadership, Knowledge sharing culture, Socialization, Externalization, Combination, and Internalization were the main areas identified by the author and tested through an online survey. Following section will describe the framework to accomplish effective and efficient knowledge management in the Sri Lankan context.

8.1 Leadership

Leadership is the ability to help people to achieve objectives that they think are impossible to accomplish. A Leader is a person who transforms an organization or a group to the next level from current position. A leader guides and motivates people to achieve goals. He/she acts as a change agent to move an organization to a higher position through creating an attractive vision. A Leader acts as a coach with a passion to develop and inspire people through a shared vision, and creates an environment where people feel they are valued and fulfilled.

The Author introduced this "leadership" as one of the key concepts, and it was tested during the online survey. The survey responses revealed that Leadership is an important aspect in knowledge management and current practice of leadership supports effective knowledge management. Considering the survey question about 'how Engineering solution contributes to the success of the telecommunication business,' 94% believe that engineering solution based on new concepts and knowledge will support the mobile telecommunication business.

Leadership was identified as a key success factor for the effective introduction and implementation of a knowledge management system. The online survey feedback indicated that 94% people believe the importance of knowledge management, whereas 26.9% believe they have a knowledge management system to capture the tacit knowledge. Hence, the

requirement of an organization wise knowledge management system to capture tacit knowledge emerged. Further, people are willing to support and contribute to knowledge management system, and approximately 92.5% people are willing to support the system if management (Leader) introduces the knowledge management system. It is required the leadership to initiate, implement, and motivate people to share the knowledge through a knowledge management system. Hence, introducing a leadership concept in to knowledge management framework is recommended for the mobile telecommunication sector in Sri Lanka.

Here, the key factor regarding leadership is that he/she should have the capability to effectively motivate people and achieve targets that they think are impossible; and, simultaneously, the leader is a person who has the capacity to absorb uncertainty. If a leader absorbs others uncertainty, then people will share their knowledge freely to the knowledge management system. That will form the base to generate new concepts and new knowledge.

The survey response of key mobile operators revealed that their perception on knowledge management contribution to the telecommunication business is favorable. They believe that knowledge management is important for the telecommunication industry. Even though organizations have small-scale knowledge capturing mechanisms, currently they do not practice an integrated system to create a common platform to share knowledge throughout the Engineering division.

8.1.1 Recommended **Leadership** practices

Based on the findings, it can highlight that leadership plays a vital role in successful implementation and practice of the knowledge management concept. Desirable variable conditions for the successful practicing knowledge management system are listed below.

- Leaders shall create positive synergy among employees across the division

In mobile telecommunication engineering, leadership plays a major role. Leadership approach is important to introduce sustainable tacit knowledge management. For the survey question on "promoting synergy among employees," 61.2% agreed that management create positive synergy among the Engineering staff and to improve current situation further, it is required to create the positive synergy among employees across the division.

Leaders create positive synergy among employees, which will help to create a good socialization platform, so that everyone will help and contribute to the success of knowledge management.

- Encourage employee participation in decision making

Employee participation is vital to knowledge management, so employees should feel that they are part of the organization. It is worthy to make them participate during making important decisions.

With the survey question about employee participation during decision-making and when they feel that they are engaged in the decision making process, this was accepted by 49.2%. Current situation negatively affects knowledge sharing among employees because people believe their ideas and knowledge are not important; there is a tendency of employees for not sharing knowledge and new concepts in the knowledge-sharing platform. Hence, it is recommended to involve people when taking a collective decision.

- It is required to absorb uncertainty currently encountered by employees in the organization

Leaders should absorb uncertainty; otherwise, there will be a negative impact on the creativity of employees. If a leader absorbs uncertainty, employees attempt new things and experiment new concepts. That will help to create a positive image of the company among their valuable customers.

The survey question about uncertainty absorption by leaders, about 49.2% employees believe that their leaders absorb uncertainty. In order to implement knowledge management effectively, it is important to improve uncertainty absorption culture among leaders.

According to cultural dimensional analysis in Chapter 5, Leadership is identified as a key concept variable to improve long-term orientation, and is proved from survey findings. Hence, it is recommended to consider leadership as a core for the knowledge management framework in Sri Lankan mobile telecommunication context and would be a key driver to the functionality

of the entire system. Leadership helps to implement the knowledge management system efficiently and effectively in the organization context.

8.2 Knowledge sharing culture

It is required to create a knowledge sharing culture in the organization to implement effective and efficient knowledge management system. In order to form a knowledge sharing culture, management needs to encourage employees to work together more effectively, collaborate, and share experiences.

Knowledge sharing culture concept was tested during the online survey. The survey responses revealed that Knowledge sharing culture is an important aspect in knowledge management and the current practice of knowledge sharing culture is supportive for the effective knowledge management. Further, it was observed that available knowledge management models have recognized the knowledge sharing culture and most organizations have practiced this concept. Hence, introducing the knowledge sharing culture concept in to knowledge management framework for mobile telecommunication sector in Sri Lanka is recommended.

According to the survey findings, employees in mobile telecommunication are willing to share knowledge, and 86.6% accepted their willingness to share the knowledge; but they do not have a platform to share that knowledge. This is proven from the survey question regarding the availability of such a system, where 26.9% believe they have a knowledge management system. That indicates their existing small-scale systems may work independently and knowledge sharing process need to be regulated in such a manner that it covers a full range of information and build knowledge, connecting unconnected knowledge concepts.

In the proposed knowledge management framework, the second core layer would be the knowledge sharing culture. This is because, in Sri Lankan cultural dimension analysis, a high level of power distance is observed where people believe there is a significant power level difference. Considering the survey findings, it is important to create a knowledge-shared culture, and the current practice of knowledge sharing culture is acceptable. Therefore, the knowledge management framework in Sri Lankan context and knowledge share culture should be interconnected with leadership and rest of the knowledge management concepts.

Knowledge management Framework foundation

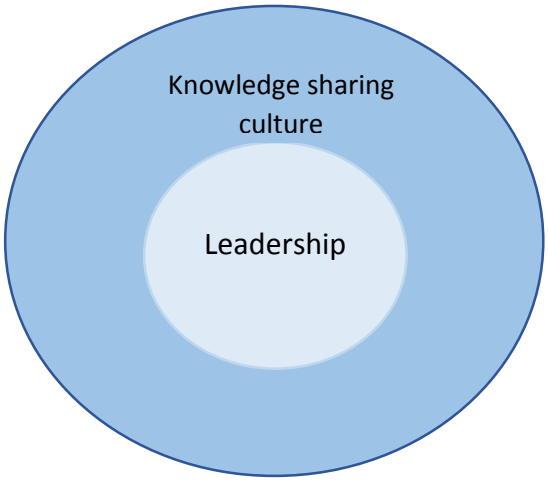


Figure 8.1 Knowledge management Framework foundation

8.2.1 Recommended **knowledge sharing culture** practices.

- Management encourages sharing quality information

Organization knowledge sharing culture is of prime importance to share knowledge. According to the survey data, only 50.7% accept that management encourages sharing quality information among employees. Actually it is an unfavorable situation in Sri Lanka, where people are encouraged less to share quality information. Management requires developing a culture that engineering staff share quality information with the organizational employees. Otherwise, knowledge management cycle would not rotate and prevent materialization of new knowledge.

If organization culture supports sharing quality information among employees, it will improve the effectiveness of the knowledge management system. Management of the organization plays a major role when formulating a culture that shares quality information. Therefore, management shall encourage sharing of quality information.

- Managing excessive competition among the employees

Excessive competition created among employees by the management negatively affects the knowledge sharing process. The survey data depicted that 16.4% accept that management creates competition among employees. Competition to a certain level is accepted but excessive

competition is undesirable. Current level of competition would be appropriate to maintain a good quality knowledge management system.

Excessive competition among employees negatively influences knowledge sharing culture. Thus, the excessive competition needs to be controlled by the line manager or middle level management.

- Allow constructive criticism to find optimal solutions

Constructive criticism refers to as 'criticism or advice that is useful and intended to help or improve something, often with an offer of possible solutions.' When it comes to constructive criticism, it would be appropriate to allow constructive criticism to find an optimal solution in mobile telecommunication engineering field. The survey data revealed that management encouragement on constructive criticism for providing better service to customer is at the level of 52.2%. This need to be further improved where people are allowed constructive criticism, and, at the same time, provides possible solutions. This helps to create a knowledge sharing culture by providing opportunity to raise the voice of people.

Employees should always allow constructive criticism to find optimum solutions for their organization issues and to develop new solutions. By adopting such a mechanism, an organization can find optimal solutions that enhance employees' creativity at the same time.

8.3 Socialization

Socialization refers to how people in the organization interact with each other. When it comes to knowledge management, it is important to have a good relationship and a mutual understanding among organizational employees, and interaction between subject experts with the rest of the employees in the organization.

Socialization concept was tested during the online survey. The survey response revealed that socialization is an important aspect in knowledge management, and the current practice of socialization is at an acceptable level. It was further noticed that available knowledge management models have recognized Socialization and most organizations have practiced this

concept. Therefore, it is recommended to introduce Socialization concept in to knowledge management framework for mobile telecommunication sector in Sri Lanka.

About 85.07% employees believed they have a good relationship between peer workers, 79.1% believed they have a good relationship between subordinates, and 76.11% believed that a good relationship prevails between the boss and the employees. Hence, this is an effective indicator revealing a good relationship between all directions of employees in the organization.

Considering the overall aspect of socialization in the mobile telecommunication field, a favorable condition to the effective knowledge management implementation is observed. Therefore, there is a strong requirement to introduce a knowledge management platform for sharing knowledge among people.

8.3.1 Recommended **Socialization** practices

- Providing a formal training program when employees are recruited to the organization

The survey data denoted that 50.08% believed their organization provides a formal training program when employees are recruited to the organization. This is the first opportunity for newly recruited employees to interact with experts in the organization, and it is crucial to have formal training programs initially during new recruitment of Engineers and technical officers. It gives the opportunity to new employees to interact with organization expert team. Socialization would enhance if the organization can provide such a well-organized training program.

- Frequent engagement of newly recruited engineers and technical officers with technical experts

Frequent engagement with newly recruited engineers and technical officers are important to improve socialization. The survey data revealed that 62.68% believed newly recruited engineers and technical officers frequently engage with technical experts in the organization, and that would be a good sign for the mobile telecommunication industry to have socialization in their organization.

Frequent association between newly recruited engineers/technical officers with the technical expert team is important as new employees will be closely monitored, and will surmount any knowledge or technical skill gap. The organization will benefit here because newly recruited employees can be utilized speedily to business operations.

- Employees can easily reach a technical expert in the organization

System should be developed in such a way that any employee in the organization can quickly access the expert. The survey data denoted that about 83.58% believe that employees can easily reach a technical expert, in case of a problem or a doubt in the organization.

The system should support to obtain contact information of experts and their specialized areas. This will help to solve and provide better solutions to customers' issues immediately.

- Frequent informal team gathering

It is important to have frequent informal gathering among employees, which will help interacting with each other during the office work. The survey data indicate that 66.67% believe they have informal gatherings to build a good relationship between employees. Hence, it helps to interact with employees to solve a problem or make a clarification during their job role. They know whom to contact during business operation, which helps to solve problems quickly and efficiently.

8.4 Externalization

During the externalization process, it is required to assess the process or method that supports converting tacit knowledge into explicit knowledge. This is a very important stage of the knowledge management process because it helps to drive the knowledge management system in sustainable development in the long run.

Externalization concept was tested during the online survey. The survey response revealed that externalization is an important aspect in knowledge management and the current practice of externalization is at a lower level. It was also noted that available knowledge management

models have recognized externalization and most organizations practiced this concept. Hence, it is recommended to introduce the externalization concept in to knowledge management framework for mobile telecommunication sector in Sri Lanka.

Producing Technical experts of mobile telecommunication industry takes at least five to seven years with exposure to various areas of mobile telecommunication. If such an expert migrate to a different country for higher education, or for a new carrier, or even move to a different company within Sri Lanka, it would influence the existing organization because they have spent a significant amount to elevate such an expert to the current level by providing training and development opportunities. Hence, it is a duty and an obligation of the expert to share that knowledge with other employees.

If a technical expert move to a different job role, as an example a management role, there might be reduced opportunities to share such knowledge among the technical staff because he/she has to perform various tasks more related to management area.

From the organization point of view, there is a strong requirement to share such a person's knowledge, experiences, and new ideas. Situational knowledge will only be captured at the incident time. Hence, it needs to update such an incident-related knowledge immediately to knowledge forum where it happened. To achieve that objective, a proper knowledge management platform is required, as it gives opportunities to share the knowledge.

The overall view of mobile telecommunication industry does not have an efficient process to externalize tacit knowledge into explicit knowledge. Therefore, it is recommended to implement a knowledge management system with the capability to share knowledge and experience that will help effective knowledge management in mobile telecommunication industry.

8.4.1 Recommended **externalization** practices

- Convenient when accessing and updating information

An easy method for accessing and updating knowledge management system is a vital component. Knowledge contributor shall not feel extra burdened when uploading knowledge they individually have. When updating information in a knowledge management system, knowledge areas need to be categorized to facilitate people who contribute to the knowledge management system. When analyzing survey responses of "What are features you expect from

Knowledge management system?" respondents highlighted the importance of convenient interface to access and update information.

- Frequent updating an internal forum to share new ideas, concepts, and trends

Frequent updating and sharing new ideas, concepts, and trends, with other people in the organization would help to improve knowledge among employees, so that individual knowledge will be accumulated at the knowledge management system. According to survey data, 44.78% believed that they frequently update an internal forum to share new ideas, concepts, and trends. To transfer tacit knowledge in to explicit knowledge effectively, there should be a mechanism to express employees' day-to-day experiences and share new ideas and concepts among employees. Without such a platform, knowledge management would not implement effectively.

- Having brainstorming sessions when confronted with a new problem or when a critical decision has to be made

Having brainstorming sessions frequently would be beneficiary for the organization to find optimal solutions to their new problems. The survey data revealed 56.7% believed they often have brainstorming sessions when confronted with a new problem or when making a critical decision. In this approach, tacit knowledge will be converted to explicit knowledge. Newly joined employees get opportunities to access such explicit knowledge and thus, it is important to have frequent brainstorming sessions. That helps to externalize individual knowledge to create new knowledge, based on such information.

- Encourage to express their views, argue, and evaluate new ideas

The employees should be encouraged to express their views and externalize the knowledge involved, argue, and evaluate to achieve best solution. As per the survey response, 37.31% believed that management encourages functional conflicts. Functional conflicts are conflicts that are important to improve efficiency and effectiveness of the business operation, and enable to convert tacit knowledge into explicit knowledge. Current condition in the mobile telecommunication industry limits the externalization process of knowledge management, and hence, it is imperative to encourage expressing their views, argue, and evaluate new ideas.

8.5 Combination

According to Nonaka, the combination mode of knowledge conversion is 'a process of assembling new and existing explicit knowledge held by individuals into a knowledge system' [23]. It is also a process of exchanging, sorting, adding, disseminating, sharing, and therefore reconfiguring, different bodies of explicit knowledge among organizational members through documents, meetings, telephone conversations, and computerized communication methods. Nonaka terms the knowledge created through a combination process as *systemic knowledge*. It is required to combine various explicit knowledge with individual to single context.

Combination concept was tested during the online survey. The survey response revealed that combination is an important aspect in knowledge management, and current practice of combination is at a lower level. Further, it showed that available knowledge management models have recognized combination and most organizations practice this concept. Hence, it is recommended to introduce the combination concept into knowledge management framework for mobile telecommunication sector in Sri Lanka.

8.5.1 Recommended **Combination** practices

- Combining information such as network change history, network issue trouble shooting guides, and root cause analysis in the knowledge management system

In mobile telecommunication industry, it is vital to have a proper track of network change history, network issue trouble shooting guide, and previously resolved root cause analysis report updates with knowledge management system, so that everyone can access that information and enhance their knowledge. When analyzing survey response to "What are the features that you expect from Knowledge management system?" respondents highlighted the importance of having a central system to gather change history and network change related information.

- Combining different individual's knowledge

It is important to combine different knowledge and generate valuable knowledge segment. As an example, in one division, an employee can contribute to radio network planning and in another division, an employee can contribute to radio network real practical scenario by combining two areas that can generate full knowledge of radio network.

- High level of contribution from technical experts

Contribution from technical experts is vital for the success of effective knowledge management. Experts are the people who have accumulated the knowledge, and it is everyone's duty to encourage experts to engage with the system actively.

According to the survey response, 22.38% believed that employees continuously update an internal knowledge management system and share knowledge, which is at a lower level. It shows a positive relationship between lack of effective knowledge management system in an organization and frequent update of such a system. Hence, the importance of knowledge management system at the organizational level has emerged. There is a strong requirement of such a system to continuously manage the tacit knowledge and integrate individual knowledge into a single system.

8.6 Internalization

The internalization mode of knowledge conversion is 'a process of embodying explicit knowledge into tacit knowledge' [23]. It uses existing knowledge and creates new knowledge based on the existing knowledge. This work as a cycle and will help to continuously improve and develop knowledge in the organization. It creates various avenues for new businesses and the overall organization benefits by using this process.

Internalization concept was tested during the online survey and the response revealed that internalization is an important aspect in knowledge management and the current practice of internalization is at a lower level. Further, it was noted that available knowledge management models have recognized internalization and most organizations practice this concept.

Therefore, introducing the internalization concept in to knowledge management framework for mobile telecommunication sector in Sri Lanka is recommended.

Approximately 14.93% believed newly recruited Engineers and technical officers frequently access the internal knowledge management system to obtain knowledge. It might be the reason for the lack of an integrated knowledge management system. However, according to the survey findings, organization employees are willing to share knowledge, provided they have a system to share the knowledge. Therefore, a strong requirement exists from management to introduce such a system and provide leadership.

Survey findings on internalization identified that there is an unfavorable condition in mobile telecommunication industry with respect to internalization of knowledge. As a result, new knowledge creation would be limited. Hence, engineers will try only to maintain current solutions and products than finding a new solution and new products.

About 14.93% believed that organization provides opportunities to self-assessment of employees' knowledge by having frequent quizzers and tests. Without such quizzers and tests, engineering people cannot assess their knowledge level. If such tests are available, people will measure the current level and get motivated to improve the knowledge, and will make an effort to create new knowledge.

As a recommendation based on this finding, an organization should introduce knowledge management system and it is required to encourage people to share various knowledge and integrate explicit knowledge in common platform where people can easily access and find explicit knowledge. It is required to encourage people to develop new knowledge based on the existing knowledge. This acts as a cycle. If we can start the cycle, it will consciously rotate year after year and finally, make continues improvements to the organization.

8.6.1 Recommended **Internalization** practices

- Information quality rating mechanism

It is important to provide ratings for each knowledge sharing document or item, to facilitate identifying quality documents and improve efficiency of system usage. According to survey data, 46.27% believed that the newly recruited Engineers and technical officers refer manuals

frequently. In order to improve data access, it is important to have a quality rating mechanism, for employees to filter high quality manuals and information.

- Easy search mechanism and up to date information

Success of a knowledge management system mainly depends on the available search mechanism. If users can quickly search and identify the required quality information, employees will continuously use the system. Therefore, it is important to categorize knowledge and efficiently fetch information to users. About 14.93% believed newly recruited Engineers and technical officers frequently access the internal knowledge management system to obtain knowledge, and to improve this situation, it is important to have an easy search mechanism to find necessary information.

- Structured way to retrieve information

To improve interaction between users and the system, Users should be able to view the knowledge structure and easily predict the location where information is available in the system.

- Encourage to build new knowledge based on existing available knowledge

To improve the knowledge management system continuously, constant enhancement of knowledge associated with the system is required; creating new knowledge based on the existing knowledge is thus imperative.

8.6.2 Integrated Knowledge management Frame work for mobile telecommunication industry Sri Lanka

Based on the survey findings, the key driver for knowledge management is leadership. Around 92.5% are willing to support the system if management (Leader) introduces the knowledge management system. According to cultural dimensional analysis in Chapter 5, Leadership is identified as the key concept variable to improve long-term orientation. Henceforth leadership shall be the core of the knowledge management frame work for mobile telecommunication industry in Sri Lanka. The leadership should initiate, implement, and motivate people, to share the knowledge through the knowledge management system.

According to the analysis, the second layer should be the *knowledge sharing culture*, where people are encouraged to participate in knowledge management. The next step of the Framework is to run the knowledge management cycle: Starting from socialization of employees, Externalization of individual knowledge, combination of knowledge from individual knowledge, and internalization of knowledge that create new knowledge based on existing knowledge. This cycle needs to operate continuously to develop new knowledge in the organization.

Knowledge management Framework for mobile telecommunication industry in Sri Lanka

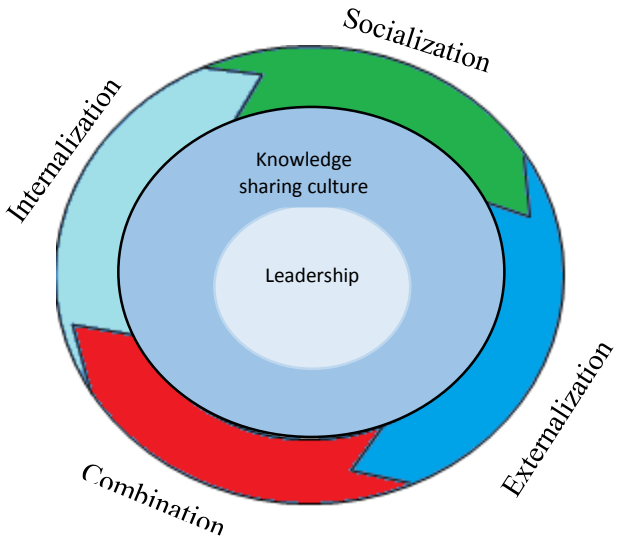


Figure 8.2 Knowledge management Framework for mobile telecommunication industry in Sri Lanka

With a good leadership, knowledge-sharing culture helps to generate new knowledge. Socialization helps people to interact in the organization. The externalization process will extract expert and existing high skilled staffs' knowledge. During combination, different knowledge elements will be integrated to create a complete knowledge. The next step is to create new knowledge, new concept, and new knowledge based on the existing combined knowledge. This shall work as a cycle to facilitate continuous improvement of knowledge management.

9. Conclusion

It is crucial to have a proper knowledge management system in the current competitive mobile telecommunication industry in Sri Lanka. This is simply because knowledge is a tool an organization possesses to compete with rivals. Increasing scale of complexity of organizations, high competition among organizations, rapid changes in technology development, and globalization, have increased the importance of knowledge management. The leading mobile operators in Sri Lanka have covered their services island wide so they cannot differentiate products from their coverage footprint. As a result, in future, the only differentiating factor would be the service quality, to maintain high quality standard, where tacit knowledge would play a major role.

Mobile telecommunication industry is highly dynamic, and in every five to seven years, new mobile technology emerges. Operators always anticipate new requirements of customers and design to attract customers. Today, Engineers should possess a vast knowledge in different disciplines to satisfy customer needs and wants. In order to fulfill this requirement, a proper knowledge management system is more important than ever.

Present day customers search for high quality mobile telecommunication service, and a high quality network experience would be valued and recognized. If a service provider cannot provide a high quality service that badly influences customer loyalty. Therefore, a sound knowledge in telecommunication field is required to improve the customer experience.

Migration of high skilled employees in mobile telecommunication field is noticed in Sri Lankan context and it is questionable whether a proper knowledge transferring process is available in mobile telecommunication sector. Creating a mobile telecommunication expert takes at least five to seven years, as it requires providing various training and hands on experience sessions. This involves heavy costs to the operator to build an expert and hence, a proper knowledge transfer process must be available.

Most of the tacit knowledge will bind with the action and as a result, it is difficult to transfer without a proper process and a system. Therefore, a proper tacit knowledge management system is crucial to capture that valuable situational specific knowledge. Conservation of such knowledge and share that knowledge with future engineers will help to create new technical solutions, enhance the robustness of the telecommunication network areas, and improve mobile customer experience.

The Author analyzed various knowledge management models available in knowledge management area and best practices of the world in knowledge management aspects. SECI model developed by Japanese Professor Nonaka and Takeuchi was used as the base for this research. Geert Hofstede 5D model was employed to identify differences and similarities of a culture. Based on the cultural differences between Japan and Sri Lanka, two other variables, Leadership and Knowledge sharing culture, were identified as key concept variables to test knowledge management concept in Sri Lanka. Hence, the Author introduced new variables, *Leadership* and *knowledge sharing culture* to the knowledge management concept. It is identified that socialization, externalization, combination, internalization, and shared culture, are available in most models and best practices in the world.

The random sampling technique was used for sampling. Total population consisted the mobile telecommunication engineering staff with computer literacy, possess email addresses, and accessible to internet. This population is more vulnerable to knowledge access through a knowledge management system.

Concepts were then tested through an online survey and the importance and current practices in mobile telecommunication industry in Sri Lanka was identified. It revealed six concept variables were important in Sri Lankan framework, while externalization, combination, and internalization practices remain at lower levels. According to the online survey feedback, 94% believed the importance of knowledge management but 26.9% assumed they have knowledge management system to capture the tacit knowledge. It was identified that externalization, combination, and internalization, should be improved in Sri Lankan context to establish a proper knowledge management system. Finally, a knowledge management framework was developed for mobile telecommunication industry in Sri Lanka that can be used as a foundation to develop a knowledge management system in the mobile telecommunication industry.

Leadership was identified as a key concept variable for effective knowledge management in mobile telecommunication industry and it shall be the core for the knowledge management framework. Creating positive synergy among employees across the division, encouraging employee participation in decision-making, and absorbing the uncertainty currently encountered by employees in the organization are identified as desirable variable conditions for successful practicing of knowledge management.

In the proposed knowledge management framework, the second core layer would be the knowledge sharing culture. This is because Sri Lankan cultural dimension analysis reveals high level of power distance where people believe there is a significant power level difference. Considering knowledge management framework in Sri Lankan context, knowledge share culture should in turn connect with leadership and rest of the knowledge management concepts. As for the desirable knowledge sharing culture conditions, management encourages sharing quality information, managing excessive competition among employees, and accommodating constructive criticism for finding optimal solution were identified.

Third stage of the knowledge management framework is to create new knowledge. Thus, it is necessary to perform socialization, externalizations, combination, and internalization, in the organization.

Socialization is very important to interact staff with the expert team. It was identified that providing formal training program when employees are recruited to the organization will help to interact expert team with rest of the staff members. Frequent engagement of newly recruited engineers and technical officers with technical experts will help to improve people-to-people knowledge transfer process. Quick access of technical experts in the organization and frequent informal team gathering are considered as desirable conditions for the socialization practice.

Externalization involves a method or process that converts tacit knowledge into explicit knowledge. In externalization practice, it is important to have a convenient approach when accessing and updating information. Frequent update of an internal forum to share new ideas, concepts, and trends, will help to convert tacit knowledge in to explicit knowledge. Having brainstorming sessions when there is a new problem or while taking a critical decision, and encouraging expressing their views, arguing, and evaluating new ideas, are identified as desirable conditions for the externalization practices.

Combination refers to integrate different knowledge elements in to a central location. This help to gain wide scope of information about mobile telecommunication. For combination of knowledge, it is important to centralize information such as network change history, network issue trouble shooting guides, and root cause analysis in the knowledge management system, so that employees can access past history records to solve new problems. Further, combining different individual's knowledge and high level of contribution from technical experts are important to integrate knowledge.

Internalization refers to developing and creating new knowledge based on existing accumulated knowledge. Having proper information quality-rating mechanism would help to identify vital information and an easy search mechanism and up-to-date information will help to access quality information at the correct time. A structured way to retrieve information will help to retrieve information more efficiently and effectively. It is important to encourage people to create new knowledge and develop new solutions to enrich valuable customers.

Continuously practicing socialization, externalization, combination, and internalization, with leadership and knowledge sharing culture as a cycle would help to create new knowledge and sustainably develop the mobile telecommunication industry.

Testing this framework for different industries is also identified as a future research opportunity.

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Appendix A: Online survey questions

Number	Question					
1	I am working in an engineering job at…	Dialog	Mobitel	Etisalat	Hutch	Airtel
		Strongly disagree	Disagree	Neutral	Agree	Strongly agree
2	I believe an engineering solution greatly contributes to the success of the telecommunication business					
3	I believe Knowledge management system is important to capture situational knowledge and update individual knowledge					
4	I believe knowledge management is very important for the mobile telecommunication engineering field					
5	Do you have a Knowledge management system to capture tacit knowledge (situational knowledge)?					
6	I believe our organization's management promotes synergy among employees					
7	Our Management encourages “Participation of employees in decision-making”					
8	I believe organization management always absorbs uncertainties when an employee make some mistake while testing a new idea or a new concept					

9	Our organization provide formal training programs to newly recruited engineers and technical officers to interact technical experts in the organization					
10	Newly recruited engineers and technical officers frequently engage with technical experts in the organization					
11	We often have a gathering to interact and build good relationship between employees					
12	I trust my boss					
13	I trust my subordinate					
14	I trust my peer workers					
15	We often have brainstorming sessions when there is a new problem or a critical decision to be taken					
16	We frequently update an internal forum to share new ideas, concepts, and trends					
17	Management encourages Functional conflicts (Functional conflicts are conflicts that are important to improve efficiency and effectiveness of the business operation)					
18	Engineering division maintains proper operational and planning manuals and keep them up-to-date					
19	We continuously update an internal knowledge management system and share knowledge					
20	Newly recruited Engineers and technical officers refer manuals frequently					
21	Newly recruited Engineers and technical officers frequently access the internal knowledge management system to obtain knowledge					
22	We provide opportunities to Self-assessment of employee's knowledge by having frequent quizzers and tests					

23	Management encourages to share quality information among the employees					
24	Management always encourages competition among employees					
25	Management encourages constructive criticism to provide better service to customers (constructive criticism is referred to as criticism or advice that is useful and intended to help or improve something, often with an offer of possible solutions)					
26	Employees in our organization are willing to share knowledge					
27	When there is a problem or doubt, I can easily reach a technical expert in our organization					
28	Our organization has a proper career progression plan based on individual competency					
29	I believe the organization provide great opportunities to enhance my knowledge					
30	I am willing to contribute knowledge management system to uplift shared knowledge					

		Strongly oppose	**Somewhat oppose**	**Neutral**	**Support**	**Strongly Support**
31	If management introduces a Knowledge management system to share knowledge, are you willing to Support?					
32	What are features that you expect from Knowledge management system?					

Appendix B: Sample size calculation

$Total\ population\ (N) = 1200$

$Confident\ interval = 90\%$

$Margin\ of\ error\ (E) = 10\%$

$$Sample\ size = \frac{\frac{Z^2\ \times P \times (1-P)}{E^2}}{1 + \frac{(Z^2 \times\ P \times (1-P)}{N \times E^2}}$$

For optimal sample size P =0.5,

90% confident interval Z =1.65

$$Sample\ size = \frac{\frac{1.65^2\ \times 0.5 \times (1-0.5)}{0.1^2}}{1 + \frac{(1.65^2 \times\ 0.5 \times (1-0.5)}{1200 \times 0.1^2}}$$

$$Sample\ size = 64$$

Appendix C: Relative weight calculation

- F1 function relative weight calculation

Expert	Q9	Q10	Q11	Q12	Q13	Q14	Q27	Q30
Expert 1	12	32	27	3	3	4	12	7
Expert 2	15	27	31	5	5	7	6	4
Expert 3	8	33	32	3	4	4	11	5
Expert 4	9	28	30	6	7	6	11	3
Expert 5	6	30	30	8	6	4	10	6
Average Weights	**10**	**30**	**30**	**5**	**5**	**5**	**10**	**5**

$$F1 = 0.1Q9 + 0.3Q10 + 0.3Q11 + 0.05Q12 + 0.05Q13 + 0.05Q14 + 0.1Q27 + 0.05Q30$$

- F2 function relative weight calculation

Expert	Q15	Q16	Q17
Expert 1	25	63	12
Expert 2	22	60	18
Expert 3	15	57	28
Expert 4	17	62	21
Expert 5	21	58	21
Average Weights	**20**	**60**	**20**

$$F2 = 0.2Q15 + 0.6Q16 + 0.2Q17$$

- F3 function relative weight calculation

Expert	Q18	Q19
Expert 1	35	65
Expert 2	30	70
Expert 3	25	75
Expert 4	30	70
Expert 5	30	70
Average Weights	**30**	**70**

$$F3 = 0.3Q18 + 0.7Q19$$

- F4 function relative weight calculation

Expert	Q20	Q21	Q22
Expert 1	15	75	10
Expert 2	17	65	18
Expert 3	16	70	14
Expert 4	12	68	20
Expert 5	15	72	13
Average Weights	**15**	**70**	**15**

$$F4 = 0.15Q20 + 0.7Q21 + 0.15Q22$$

- F5 function relative weight calculation

Expert	Q2	Q3	Q4	Q6	Q7	Q8
Expert 1	4	4	3	25	18	46
Expert 2	6	4	5	26	20	39
Expert 3	8	6	4	24	22	36
Expert 4	4	5	6	24	20	41
Expert 5	3	6	7	26	20	38
Average Weights	**5**	**5**	**5**	**25**	**20**	**40**

$$F5 = 0.05Q2 + 0.05Q3 + 0.05Q4 + 0.25Q6 + 0.2Q7 + 0.4Q8$$

- F6 function relative weight calculation

Expert	*Q26*	*Q27*	*Q28*	*Q29*	*Q30*
Expert 1	37	8	7	11	37
Expert 2	45	10	12	13	20
Expert 3	45	12	10	8	25
Expert 4	38	12	9	10	31
Expert 5	35	8	12	8	37
Average Weights	**40**	**10**	**10**	**10**	**30**

$$F6 = 0.4Q26 + 0.1Q27 + 0.1Q28 + 0.1Q29 + 0.3Q30$$

- F7 function relative weight calculation

Expert	Q23	Q24	Q25	Q26	Q29
Expert 1	40	6	5	45	4
Expert 2	45	7	5	36	7
Expert 3	50	4	4	38	4
Expert 4	47	5	6	36	6
Expert 5	43	3	5	45	4
Average Weights	**45**	**5**	**5**	**40**	**5**

$$F7 = 0.45Q23 + 0.05Q24 + 0.05Q25 + 0.4Q26 + 0.05Q29$$

Expert list is as below:

- Mr Chamara Prasanga Kumara- Senior manager Radio Access Operations, Mobitel
- Mr Raveendra Manimelwadu -Senior manager Core network operation, Mobitel
- Mr Hasitha Amarasinghe-Manager Broad band planning, Mobitel
- Mr Hasitha Hemal Ranaweera - Manager converge charging operation, Dialog
- Mr Dhanushka Senanayake - Manager radio network planning, Dialog

Appendix D: Survey Feedback

1) I am working in an Engineering job at…

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Dialog	29	43.3	43.3	43.3
	Mobitel	19	28.4	28.4	71.6
	Etisalat	6	9.0	9.0	80.6
	Hutch	6	9.0	9.0	89.6
	Airtel	7	10.4	10.4	100.0
	Total	**67**	**100.0**	**100.0**	

2) I believe Engineering innovation & amp; new solution greatly contributes to the success of the telecommunication business

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	1	1.5	1.5	1.5
	Neutral	3	4.5	4.5	6.0
	Agree	15	22.4	22.4	28.4
	Strongly agree	48	71.6	71.6	100.0
	Total	**67**	**100.0**	**100.0**	

3) I believe Knowledge management system is important to capture situational knowledge and update individual knowledge

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	1	1.5	1.5	1.5
	Neutral	4	6.0	6.0	7.5
	Agree	24	35.8	35.8	43.3
	Strongly agree	38	56.7	56.7	100.0
	Total	**67**	**100.0**	**100.0**	

4) I believe knowledge management is very important for the mobile telecommunication engineering field

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	1	1.5	1.5	1.5
	Neutral	3	4.5	4.5	6.0
	Agree	19	28.4	28.4	34.3
	Strongly agree	44	65.7	65.7	100.0
	Total	**67**	**100.0**	**100.0**	

5) Do you have a Knowledge management system to capture tacit knowledge (situational knowledge)?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	49	73.1	73.1	73.1
	Yes	18	26.9	26.9	100.0
	Total	**67**	**100.0**	**100.0**	

6) I believe our organization's management promotes synergy among employees

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	1	1.5	1.5	1.5
	Disagree	5	7.5	7.5	9.0
	Neutral	20	29.9	29.9	38.8
	Agree	34	50.7	50.7	89.6
	Strongly agree	7	10.4	10.4	100.0
	Total	**67**	**100.0**	**100.0**	

7) Our Management encourages "Employees participation in decision making"

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	1	1.5	1.5	1.5
	Disagree	11	16.4	16.4	17.9
	Neutral	22	32.8	32.8	50.7
	Agree	26	38.8	38.8	89.6
	Strongly agree	7	10.4	10.4	100.0
	Total	**67**	**100.0**	**100.0**	

8) I believe organization management always absorbs uncertainties when an employee make some mistake while testing a new idea or a new concept

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	2	3.0	3.0	3.0
	Disagree	12	17.9	17.9	20.9
	Neutral	20	29.9	29.9	50.7
	Agree	26	38.8	38.8	89.6
	Strongly agree	7	10.4	10.4	100.0
	Total	**67**	**100.0**	**100.0**	

9) Our organization provides formal training programs to newly recruited engineers and technical officers to interact with technical experts in the organization

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	5	7.5	7.5	7.5
	Disagree	20	29.9	29.9	37.3
	Neutral	13	19.4	19.4	56.7
	Agree	20	29.9	29.9	86.6
	Strongly agree	9	13.4	13.4	100.0
	Total	**67**	**100.0**	**100.0**	

10) Newly recruited engineers and technical officers frequently engage with technical experts in the organization

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	13	19.4	19.4	19.4
	Neutral	12	17.9	17.9	37.3
	Agree	36	53.7	53.7	91.0
	Strongly agree	6	9.0	9.0	100.0
	Total	**67**	**100.0**	**100.0**	

11) We often have gatherings to interact and build good relationship between employees

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	8	11.9	11.9	11.9
	Neutral	15	22.4	22.4	34.3
	Agree	36	53.7	53.7	88.1
	Strongly agree	8	11.9	11.9	100.0
	Total	**67**	**100.0**	**100.0**	

12) I trust my boss

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	2	3.0	3.0	3.0
	Disagree	3	4.5	4.5	7.5
	Neutral	11	16.4	16.4	23.9
	Agree	34	50.7	50.7	74.6
	Strongly agree	17	25.4	25.4	100.0
	Total	**67**	**100.0**	**100.0**	

13) I trust my subordinates

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	3	4.5	4.5	4.5
	Neutral	11	16.4	16.4	20.9
	Agree	36	53.7	53.7	74.6
	Strongly agree	17	25.4	25.4	100.0
	Total	**67**	**100.0**	**100.0**	

14) I trust my peer workers

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	4	6.0	6.0	6.0
	Neutral	6	9.0	9.0	14.9
	Agree	43	64.2	64.2	79.1
	Strongly agree	14	20.9	20.9	100.0
	Total	**67**	**100.0**	**100.0**	

15) We often have brainstorming sessions when there is a new problem or when a critical decision has to be made

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	14	20.9	20.9	20.9
	Neutral	15	22.4	22.4	43.3
	Agree	34	50.7	50.7	94.0
	Strongly agree	4	6.0	6.0	100.0
	Total	**67**	**100.0**	**100.0**	

16) We frequently update an internal forum to share new ideas, concepts, and trends

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	3	4.5	4.5	4.5
	Disagree	34	50.7	50.7	55.2
	Neutral	19	28.4	28.4	83.6
	Agree	11	16.4	16.4	100.0
	Total	**67**	**100.0**	**100.0**	

17) Management encourages Functional conflicts

(Functional conflicts are conflicts that are important to improve efficiency and effectiveness of the business operation)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	1	1.5	1.5	1.5
	Disagree	12	17.9	17.9	19.4
	Neutral	29	43.3	43.3	62.7
	Agree	22	32.8	32.8	95.5
	Strongly agree	3	4.5	4.5	100.0
	Total	**67**	**100.0**	**100.0**	

18) Engineering division maintains proper operational and planning manuals and keep them up-to-date

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	12	17.9	17.9	17.9
	Neutral	23	34.3	34.3	52.2
	Agree	28	41.8	41.8	94.0
	Strongly agree	4	6.0	6.0	100.0
	Total	**67**	**100.0**	**100.0**	

19) We continuously update an internal knowledge management system and share knowledge

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	8	11.9	11.9	11.9
	Disagree	26	38.8	38.8	50.7
	Neutral	18	26.9	26.9	77.6
	Agree	13	19.4	19.4	97.0
	Strongly agree	2	3.0	3.0	100.0
	Total	**67**	**100.0**	**100.0**	

20) Newly recruited Engineers and technical officers frequently refer manuals

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	1	1.5	1.5	1.5
	Disagree	12	17.9	17.9	19.4
	Neutral	23	34.3	34.3	53.7
	Agree	28	41.8	41.8	95.5
	Strongly agree	3	4.5	4.5	100.0
	Total	**67**	**100.0**	**100.0**	

21) Newly recruited Engineers and technical officers frequently access the internal knowledge management system to obtain knowledge

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	4	6.0	6.0	6.0
	Disagree	23	34.3	34.3	40.3
	Neutral	30	44.8	44.8	85.1
	Agree	10	14.9	14.9	100.0
	Total	**67**	**100.0**	**100.0**	

22) We provide opportunities to Self-assessment of employee's knowledge by having frequent quizzers and tests

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	3	4.5	4.5	4.5
	Disagree	36	53.7	53.7	58.2
	Neutral	18	26.9	26.9	85.1
	Agree	9	13.4	13.4	98.5
	Strongly agree	1	1.5	1.5	100.0
	Total	**67**	**100.0**	**100.0**	

23) Management encourages to share quality information among employees

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	1	1.5	1.5	1.5
	Disagree	16	23.9	23.9	25.4
	Neutral	16	23.9	23.9	49.3
	Agree	26	38.8	38.8	88.1
	Strongly agree	8	11.9	11.9	100.0
	Total	**67**	**100.0**	**100.0**	

24) Management always encourages competition among employees

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly agree	7	10.4	10.4	10.4
	Agree	22	32.8	32.8	43.3
	Neutral	27	40.3	40.3	83.6
	Disagree	10	14.9	14.9	98.5
	Strongly disagree	1	1.5	1.5	100.0
	Total	**67**	**100.0**	**100.0**	

25) Management encourages constructive criticism for providing better service to customers

(Constructive criticism refer to criticism or advice useful and intended to help or improve something, often with an offer of possible solutions)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	1	1.5	1.5	1.5
	Disagree	9	13.4	13.4	14.9
	Neutral	22	32.8	32.8	47.8
	Agree	32	47.8	47.8	95.5
	Strongly agree	3	4.5	4.5	100.0
	Total	**67**	**100.0**	**100.0**	

26) Employees in our organization are willing to share knowledge

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	2	3.0	3.0	3.0
	Neutral	9	13.4	13.4	16.4
	Agree	41	61.2	61.2	77.6
	Strongly agree	15	22.4	22.4	100.0
	Total	**67**	**100.0**	**100.0**	

27) When there is a problem or doubt, I can easily reach a technical expert in our organization

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	5	7.5	7.5	7.5
	Neutral	6	9.0	9.0	16.4
	Agree	38	56.7	56.7	73.1
	Strongly agree	18	26.9	26.9	100.0
	Total	**67**	**100.0**	**100.0**	

28) Our organization has a proper career progression plan based on individual competency

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	11	16.4	16.4	16.4
	Disagree	14	20.9	20.9	37.3
	Neutral	21	31.3	31.3	68.7
	Agree	19	28.4	28.4	97.0
	Strongly agree	2	3.0	3.0	100.0
	Total	**67**	**100.0**	**100.0**	

29) I believe the organization provide great opportunities to enhance my knowledge

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	1	1.5	1.5	1.5
	Disagree	9	13.4	13.4	14.9
	Neutral	20	29.9	29.9	44.8
	Agree	31	46.3	46.3	91.0
	Strongly agree	6	9.0	9.0	100.0
	Total	**67**	**100.0**	**100.0**	

30) I am willing to contribute knowledge management system to uplift shared knowledge

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	1	1.5	1.5	1.5
	Disagree	1	1.5	1.5	3.0
	Neutral	7	10.4	10.4	13.4
	Agree	38	56.7	56.7	70.1
	Strongly agree	20	29.9	29.9	100.0
	Total	**67**	**100.0**	**100.0**	

31) If management introduces a Knowledge management system to share knowledge, are you willing to Support?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Somewhat oppose	1	1.5	1.5	1.5
	Neutral	4	6.0	6.0	7.5
	Support	25	37.3	37.3	44.8
	Strongly Support	37	55.2	55.2	100.0
	Total	**67**	**100.0**	**100.0**	

Appendix E: Concept variables and question mapping

Concept	Variable	Sub variable	Indicators	Measurement unit	Source	Question number
Socialization (Individual tacit to group tacit knowledge)	Interaction	Technical interaction	Training program	Likert scale	Nonaka (1996)	9,10,14,27
		Cognitive interaction	Informal gathering	Likert scale	Nonaka (1996)	11
	Trust	Mutual understanding with superior	Trust with superior	Likert scale	Author	12
		Mutual understanding subordinate	Trust with subordinate and peers	Likert scale	Author	13,14,30
Externalization (Tacit to Explicit conversion)	Group interaction	Brainstorming discussion	Frequency of having brain storming sessions when confronting new problems or critical decisions need to be made	Likert scale	Nonaka (1995)	15
		Discussion forum	Frequency of updating Forum	Likert scale	Author	16
	Functional conflict	Challenge ideas	Arguing and evaluating idea	Likert scale	Nonaka (1995)	17

Concept	Variable	Sub variable	Indicators	Measurement unit	Source	Question number
Combination (Separate explicit knowledge to systematic explicit knowledge)	Documentation	Updating Manuals	Frequency of updating manuals	Likert scale	Nonaka (1995)	18
	Online knowledge system	Central location for information	Frequency of Updating online knowledge management system	Likert scale	Author	19
Internalization (Explicit to tacit Knowledge)	Information access	Accessing Manuals	Reading manuals	Likert scale	Nonaka (1995)	20
		Accessing online knowledge Management system	Accessing online central training system	Likert scale	Author	21
	Assessing knowledge	Self-assessment	Frequency of having quizzers and tests	Likert scale	Author	22
Organization culture (Organization Environment)	Working environment	Freely allow to share quality information	Frequency of sharing quality information	Likert scale	Author	23,26,29
		competition among the employees	How often Management encourage competition among employees	Likert scale	Author	24
		Constructive criticism	How often Management encourage constructive criticism	Likert scale	Nonaka (1995)	25

Concept	Variable	Sub variable	Indicators	Measurement unit	Source	Question number
Leadership (Knowledge management Direction)	Perception	Knowledge management Contribution to the business	To what extent KM Contribute to the success of Telecommunication business	Likert scale	Author	2
		Importance of knowledge Management	How much Importance of knowledge Management	Likert scale	Author	4,3
	Cohesiveness	Synergy among employees	How much management promoting synergy among employees	Likert scale	Author	6
		Participation in decision making	To what extent employee participation in decision making	Likert scale	Author	7
	Uncertainty	Absorbing uncertainty	To what extent leader absorb uncertainty	Likert scale	Author	8