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College of Natural Sciences  
School of Information Science

**DESIGNING A KNOWLEDGE REUSE FRAMWORK FOR  
PROJECT BASED ORGANIZATIONS:**

THE CASE OF INFORMATION NETWORK SECURITY AGENCY (INSA)

**Mekdes Asema Gebreyohannies**

Addis Ababa

October 2020

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**Mekdes Asema Gebreyohannies**

A thesis submitted to School Information Science in partial fulfillment of the requirement for the Degree of Master of Science in Information Systems.

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## **DECLARATION**

I declare that this thesis is my original work and has not been presented for a master degree in any other university.

Mekdes Asema

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October 16, 2020

This thesis has been submitted for examination with my approval as university advisor.

Dr. Million Meshesha

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October, 2020

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## Acronyms

CKO	Chief Knowledge Officer
INSA	Information Network Security Agency
KM	Knowledge Management
KMF	Knowledge Management Framework
KR	Knowledge Reuse
PBO	Project Based Organization
PK	Project Knowledge
PKR	Project Knowledge Reuse
PKRF	Project Knowledge Reuse Framework
PM	Project Manager
PMD	Project Management Department

## Abstract

Use and reuse of previous project knowledge is of great importance for an integrated project team to achieve project success. Reuse of the project knowledge that is generated or acquired during projects is a factor that leads project based organizations to be more effective, efficient and successful. Project knowledge in the Information Network Security Agency is collected and saved manually, and it is not used properly. As a result, the project knowledge is not easily available for reuse, in order to reduce project rework and reinventing the wheel.

The general objective of the research was to propose knowledge management framework to improve project knowledge reuse within the organization so that an organization will be able to successfully retain knowledge management practice and decrease chances of project rework.

As a case study the researcher used Information Network Security Agency. Data was collected using questionnaire, observation and document review. This process set the foundation to identify INSA's current project management with the areas of improvement. Subsequently, these areas of improvement enabled to design a project knowledge reuse framework based on design science research methodology (which incorporates problem identification, objective, design, demonstration, evaluation), As a first step of design science research methodology process problem identification is done by analyzing questionnaire. Then the study proposed a prototype to demonstrate the proposed project knowledge reuse framework with components of the framework.

This study has significant implications for project stakeholders. The paper identifies and analyzes the causes and impacts of not using previous project knowledge also the study indicated that project managers, team leaders and team members should consider using previous project knowledge and then the study proposed the appropriate project knowledge reuse framework in order to mitigate the problem.

**Key words:** - Knowledge Management, Project management, Project based organizations, Project knowledge reuse framework.

# Chapter One: Introduction

## 1.1 Background

Knowledge Management is a discipline that is focused on systematic and innovative methods, practices and tools for managing the generation, acquisition, exchange, protection, distribution, and utilization of knowledge, intellectual capital, and intangible assets (Montana, 2000).

Knowledge is becoming one of the main assets for organizations that seek a competitive advantage in a dynamic market place. Knowledge comes from many different sources within the organization. Such as internal processes, projects, customers and stakeholder information. As markets change, the way of doing business changes. Many companies implement different projects to deal with these changing environments. Projects accumulate a lot of intellectual knowledge which can be later used. Projects embraces capturing, organizing, refining and the exchange of captured knowledge. Pemsel (2014) noted that organizations that don't manage their knowledge allow organizational memory and knowledge to diminish. Knowledge Management should be given a high importance within the organization in order to avoid doing the same task over and over again which in turn saves a lot of time and budget as well as resource optimization.

According to Hanisch et al. (2009) Knowledge Management refers to how organizations manage the knowledge resource in a company to achieve a business benefit. As stated by Kamara et al. (2002), knowledge management "is not an end in itself, but a means to achieve business goals." Project Management refers to the process of ensuring that projects deliver the intended benefits. A 'project' is a temporary organization within a permanent organization defined as "unique, transient endeavors undertaken to achieve a desired outcome." (The Association for Project Management 2006).

Successful Project Knowledge Management facilitates project-oriented organizations and employees with the information required for better decision making. This in turn enables considerable cost saving in time and effort. In many cases successful project completion is based on accumulated knowledge, and individual and collective competence (Kasvi et.al, 2003).

Organizations gain enormous benefit by managing knowledge; among this benefits managing knowledge is advantages for the people involved on the project. It provides useful data about any project that has been performed, which in turn will give contribution for future projects to minimize difficulties and issues. It will be beneficiary for the customer because of the fact that managing knowledge helps the project to be done on time, reduce budget and be more efficient. It also gives the opportunity to make better decision making and helps to asses best and worst practices of the organization which helps to adapt the best practices and eliminate the worst practices for future project work, reduce resource usage and also reduce errors.

A number of challenges within Project Knowledge Management lay in the nature of the projects themselves. Projects are unique, these differences give rise to a requirement for different resources and they integrate internal and external expertise and knowledge. Also, organizations that are project based can lack organizational memory, routines and other mechanisms for knowledge capturing, storing, disseminating and organizational learning (Principe and Tell, 2001).

There are many problems associated with knowledge transfer within a project environment. As emerging technology can accomplish the communication of existing knowledge, only human social interaction can result in the creation and sharing of new knowledge (Ajmal and Koskinen, 2008).

In this research, information network security agency is being considered for the case study to examine the design of project knowledge reuse framework for project based organizations.

The National vision of Information Network Security Agency (INSA), is “to transform Ethiopia from a poverty stricken country to a middle income economy and society with deep rooted participatory democracy and good governance based on the mutual aspiration of its people” (INSA,

2009). In order to achieve the vision of the organization to become reality knowledge management plays an important role. The organization, INSA is chosen for this study because of the fact that the organization runs enormous national level projects, so it suits to conduct this study.

This study focuses on how project knowledge management could be improved to better support knowledge sharing and reuse between projects within the specific case organization, INSA.

## 1.2 Statement of the problem

The organization, INSA retain different business practices. From the very different types of business they possess, project management is the major one. INSA undertakes diverse and enormous projects. In the Organization there is no knowledge management process regarding project based knowledge in particular. The most regular Knowledge Management activity is, saving project documentation on hardcopy and the project managers and employs (the project team members) communicate frequently via e-mails, meetings, hardcopy materials and presentations, new employs know about the existing work process by contacting the relevant person and asking questions. Besides most of the project managers and team members work on more than one project concurrently and they might start a new project work after finishing one. Because of the inadequate time they have very limited time dedicated for knowledge management activities. There are some IT tools in the organization that support knowledge management activity like PRINCE-2 and Ms-project but most of the time the employs spent time by searching around for other coworkers for sharing information or consulting rather than to apply the existing tools. In addition, most of the time employs communicate through telephone, project managers handle the project by their own experience than using knowledge management to review previous projects.

There are gaps observed from the existing knowledge management practice in the organization. Project documents are collected, however they are not easy to access and use them appropriately. Knowledge preservation, sharing and reuse at the selected organization need for improved processes, the temporary nature of projects requires engaging useful Knowledge Management

practices for difficulties such as knowledge leakiness and rework. Additionally, deficit of codified knowledge resulted in doing the process repetitively which in turn leads to inefficiency.

Hanisch et al. (2009) attempted to advice Project Knowledge Management challenges by identifying specific actions and key success factors to manage knowledge in a project context; however, research has shown that the application of Project Knowledge Management remains limited within organizational practice. (Frey et.al, 2009) explored project knowledge management, organizational design and success factors. The results of this study showed that companies and experts are aware of the problem of project knowledge management throughout industry lines, enterprise sizes, and project types.

Koskinen (2002) suggested the level of communication of tacit knowledge within a project is significant to its success. It is important to manage the conversion of tacit and explicit knowledge on the project, if the project was to succeed; the user of the knowledge need to understand the generation and character of the knowledge well enough to take advantage of it.

As stated by Obaide (2008), technologies such as knowledge bases and lessons learned systems are available to support knowledge storage and documentation, but that documentation is rarely meant for future projects. (Ajmal & Koskinen, 2008), stated project managers must find ways of preserving and utilizing knowledge within established practices of everyday teamwork.

Rubenstein-Montano et al. (2001) noted that, even though there are a variety of approaches to knowledge management implementation in an organizations, they rarely fulfil the knowledge management needs of these organizations fully and comprehensively. The authors recommended the need to focus on collecting and storing knowledge but also on reusing it, since the latter is considered the ultimate goal of KM.

In addition as Landaeta (2008) and Todorović et al. (2015) pointed out projects in project-based organizations was not investigated enough and there is a lack of a method for systematic knowledge

accumulation, which prevents organizations from proper knowledge transfer. Also (Duffield & Whitty, 2015) claimed that even though there are numerous opinions and ideas, there is little practical advice regarding workable processes that effectively enable the organization to learn from past project experiences.

Referring to the above studies, most scholars, including, Landaeta (2008); Hanisch et al. (2009); Todorović et al. (2015) and Duffield & Whitty (2015) suggested that, it would be better if more research is done on this area by different geographic locations, by different organizations and on different cases.

In addition, there have been valuable researches in our country regarding knowledge management, however most of the researchers concern on Agricultural knowledge management (Getahun, et. al, 2013), and indigenous knowledge management. (Mariye & Marie-Claude Boudreau, 2010), knowledge management in health care institutions, Knowledge management practice on different organization such as Enabling Knowledge Sharing in the Work place: the case of commercial bank of Ethiopia (Temtim, 2013) and knowledge management in education sectors (Rahel & Ermias, 2011). As to the researcher knowledge there is no study conducted concerning project knowledge management in our country.

Therefore the aim of the current study is to design project knowledge reuse framework that could help the project organization manage their knowledge and reuse it in effective and efficient manner.

### 1.3 Research questions

The study explores and answers the following research questions.

- What is required from a knowledge management system in order to enable project knowledge reuse?
- What are the requirements for designing knowledge management reuse framework?
- How to evaluate the designed knowledge management reuse framework?

### 1.4. Objective of the study

#### 1.4.1. General objective

The general objective of this research is to propose knowledge management reuse framework to improve project knowledge reuse between and among projects within the organization, so that an organization will be able to successfully retain knowledge management practice and decrease chances of project rework.

#### 1.4.2. Specific objectives

To achieve the general objective of the study, the following specific objectives are identified.

- To review literature and understand the state of the art in KMF design.
- To define knowledge management requirements for project knowledge reuse.
- To design project knowledge reuse framework.
- To evaluate the suggested framework.

## 1.5 Significance of the study

This study is expected to reduce confusion between many existing approaches and suggest a framework that could enable the selected organization's success by applying the suggested knowledge management framework and decrease chances of its failure by improving the decision-making mechanisms within the organization so that they would become more sager and more practical, as well as make the use of resources more economic, efficient and effective. So that, it is expected INSA, other project based organizations and the project owners or the customers to be satisfied from the output of the intended research because the suggested framework aid the project work to be successful in return it reduces time and cost. Moreover researcher has published the work in hard and soft copy, which will be available for researchers on Addis Ababa university library.

## 1.6 Scope and limitation of the study

Stakeholders in project organization are individuals or group of people within an organization whose support is required for successful development of knowledge reuse framework. So this study assesses project managers, team leaders and team members within the organization to develop a knowledge management framework for project based organization.

The study assesses to find relevant information from the organization employees to identify requirements as well as, the study gathered different types of project reports.

The study apply SECI model of knowledge management. This model mainly focuses on creating and sharing of explicit and tacit knowledge (Nonaka's: Knowledge Creation framework). So, this study covers mainly the tacit and explicit forms of project knowledge towards knowledge reuse.

The researcher aimed to participate the whole population for the survey but time constraints of employees influenced the number of participants and lack of immediate access to the project documents in the organization was a limitation for this research.

## 1.8 Organization of the thesis

The thesis has seven chapters. The first chapter presents introduction which included the overview of the study, background of the study, statement of the problem, objective of the study, significance of the study and scope of the study. The second chapter presented review of related literatures on Knowledge management, project knowledge management and challenges and opportunities of knowledge management on a project based organizations which discusses related works in the area and so on. The third chapter dealt with methodologies of the study in respect to the design science methodologies and procedures followed for the research design, data collection methods and method of data analysis and interpretations. The fourth chapter focused on problem identification and setting the objective of a solution. The fifth chapter provided the proposed framework, and demonstration and evaluation of the proposed framework is presented in chapter six. The last chapter, chapter seven presented conclusion and recommendations.

## **Chapter Two**

### **Literature review**

This section introduces the fundamental aspect of this work by first discussing what knowledge and knowledge management is. Following this, it argues about project, project management, the alignment of project management and knowledge management. The challenge encountered by project based organization regarding knowledge management and the enabling factors of knowledge management on project based organizations are also discussed. Finally, related works review are provided so as to identify the research gap the study attempts to explore.

#### **2.1 Overview of knowledge**

Ansari<sup>1</sup>, Youshanlouei, Mood (2012) stated the current world is experiencing an era in which knowledge is a basic commodity, knowledge streams have been highlighted as the most important factor of economy. And knowledge has been transformed into a competitive advantage. In such a situation, those organizations can hope to survive which rely on their knowledge itself rather than their physical assets (Davenport & Prusak, 2010).

Zins (2007) represents the relationships between data, information, knowledge, and wisdom by stating knowledge as the mental world map as tacit, and thus could not be shared without first being reduced to information.

Ajmal & Koskinen (2008) pointed out, the relationship of data, information and knowledge is usually confused. However, by making distinction, data is unprocessed raw facts and information consists of meaningful aggregations of data. Knowledge involves a person using his or her perception, skills, and experience to process information thus converting it into knowledge. According to (Zack, 1999), data represents facts or observations out of context that are, therefore,

not directly meaningful. They are the raw material of higher order constructs. Information results from replacing data within some meaningful content, often in the form of a message (Zack, 1999). Knowledge is much greater than information (Beijerse, 1999). It is closer to action and experience. (Davenport and Prusak, 1998; McInerney, 2002). The following figure 2.1 shows the knowledge pyramid consisting of data, information, knowledge and wisdom.

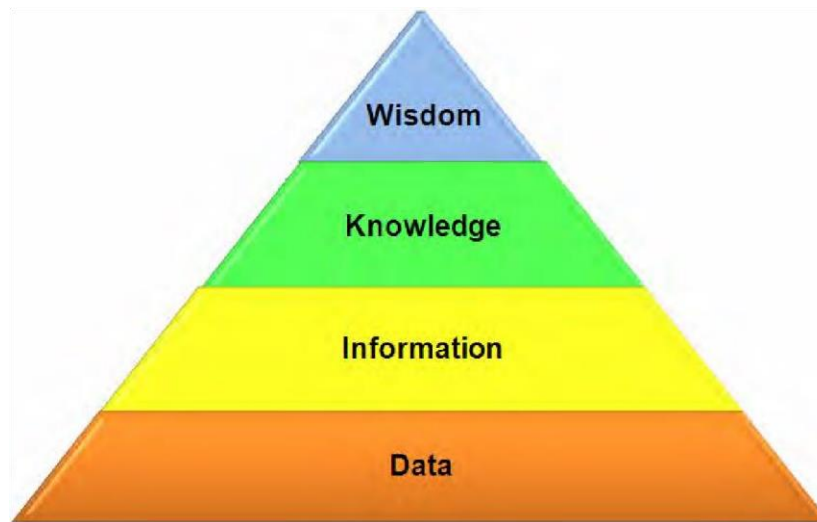


Figure 2.1 Knowledge pyramid: (Source: Awad and Ghaziri, 2004)

Gasik (2011) defines knowledge by dividing knowledge into two aspects; micro-knowledge and macro knowledge. As said by Gasik “Micro-knowledge describes processes performed in projects on knowledge needed to perform a single activity or needed for solving a single problem”. A record of price list, the name of a person who perform the specified task, or the way of fixing software bugs of a particular types are examples of such knowledge.

Macro-knowledge is the further project knowledge management processes, carried out at the organization level that undertakes the projects. In addition, (Gasik, 2011) define four sub-levels of project macro-knowledge; knowledge possessed by one team member is termed as Individual macro-knowledge, knowledge possessed by the project team termed as Project team macro-

knowledge, knowledge possessed by the organization termed as organizational macro knowledge and knowledge possessed by the whole global community of project managers as Global macro-knowledge.

Another approach made by Davenport et al. (1998) defines, knowledge is a fluid mix of framed experience, values, understanding contextual information, skills and expert insight that provides a framework for evaluating and incorporating new experiences and information. Knowledge originates and is applied in the minds of knowers. In organizations, it often becomes embedded not only in documents or repositories but also in organizational routines, processes, practices, systems and norms.

## 2.2 Knowledge Management

Ansari, Rahmany & Mirkazemi (2012) defined Knowledge management as a process which helps the organizations to identify, choose, organize, distribute and share significant information and skills, as a part of their context, and is usually available in unstructured form.

Applying the knowledge management based on their knowledge and intellectual capital will enable the organization to produce wealth or to create value from intellectual and knowledge based assets (Nonaka and Takeuchi, 1995). Knowledge management was at first just a process to adopt a systematic approach to gain, structure, manage and distribute knowledge throughout an organization in order to implement tasks quickly, reuse procedures and reduce unnecessary repeats (Nonaka and Takeuchi, 1995). However, (Davenport, De Long and Beers, 1998) believes that knowledge management is trying to explore the properties hidden in individuals' mind and transfer this hidden "treasure" to organizational assets which can be accessible and usable extensively by people who are responsible for organizational decision making.

As stated by Alavi & Leidner (2001), knowledge management is a comprehensive and organizationally specified process for acquiring, organizing, and communicating both tacit and explicit knowledge so that others can use that knowledge to become more effective, efficient and productive. (Robinson, 2005) specified, knowledge management aspiration to reduce rework, provide a platform to share tacit knowledge, and help in the process of knowledge transfer.

According to Gonzalez & Martins' (2017), knowledge management focuses on the management of knowledge and it is a process to enable identification, sharing, application and creation of knowledge within the organization. (Alavi & Leidner, 1999) define knowledge management as “a systemic and organizationally specified process for acquiring, organizing and communicating knowledge of employees so that others may make use of it to be more efficient and productive”. Knowledge management is the process of distributing the right knowledge for the right individual at the right time and place (Donate & de Pablo, 2015).

O'Brien (2015) explained Knowledge management as a framework that upshots in knowledge creation, acquisition, sharing, and reuse by organizations and the individuals inside the organization. Knowledge management is a process of systematically and actively identifying, activating, replicating, storing, and transferring knowledge (Probst, Raub,& Romhard, 2003).

KM process consists of three elements (people, technology, and organizational factors) that collaborate with each other as shown by the following Figure 2.2.



Figure 2.2 KM components (Source: Awad and Ghaziri, 2004)

According to Awad & Ghaziri (2004), People are a key element to KM as they are responsible for the creation of knowledge. People in an organization include knowledge workers, managers, suppliers, and customers. In order for people to successfully participate in KM processes organization should make sure that people have all necessary applications and tools, people whom they can contact for solutions, the associates they can collaborate with, the email they can send and receive and the database they can access and people are most keen to learn more in order to perform their job better.

According to Stolovitch, Pershing, & Keeps (2006), the culture in the company with its beliefs, values, and behaviors reflects on its employees' behaviors towards KM. For instance, the point to which making the mistakes is acceptable or organizational culture, people must be comfortable to communicate their work problems with their management, the authors added that , the best organization for KM is the one where people exchange knowledge across the functional areas of the business by using technology and established processes. And they have recommended that there should be established a number of processes within the organization in regards to KM for example

management within the organization should support and promote KM processes and underline their importance for the whole organization and each individual. Leaders should demonstrate knowledge sharing in their own activities, such as sharing of knowledge, which supports organizational competencies.

## 2.3 Knowledge reuse

Maiden (1993) defined knowledge reuse as either taking requirements that have been written for previous projects and then using them for a new project, or writing requirements from scratch at a reasonable level of generality and abstraction in order to use them over different projects.

As Maiden (1993) stated the knowledge reuse process can be described in terms of the following stages: capturing or documenting knowledge, packaging knowledge for reuse, distributing or disseminating knowledge (providing people with access to it), and reusing knowledge.

Dixon (2010) further pointed out, successful knowledge sharing or reuse requires a complete solution. Knowledge reuse is not just a matter of providing access to information technology and repositories. It also means careful attention to the design of incentives and reward structure for contributing to and using repositories and to the roles of intermediaries to develop and maintain repositories and to facilitate the process of knowledge reuse.

Lynne (2001) to adjust strategic direction, solve new problems, and improve efficiency It is significant that knowledge management assistances the organization to use the acquired knowledge. According to Lynne “A regular review is, therefore, required to know what has worked well and what has not during the lifecycle of KM. These processes also enable the organization to replace knowledge that has become outdated.” By utilizing, fragmented, unstructured and unrelated knowledge can be converted into interrelated, systematic and structured knowledge in order to making it useable and searchable (Zhao & Zhu, 2012). As (Niles & Pease , 2001) designated, using previous project knowledge avoids reinventing the wheel with better incorporation and preservation

of existing knowledge. Thus, an expected subsidiary benefit of greater knowledge sharing is a positive subsequent effect for a better knowledge reuse.

## 2.4. Project knowledge management

Turner & Miller (2003) defined project as a temporary organization to which resources are assigned to take on a unique, new and brief attempt that involves managing the inborn uncertainty and need for integration in order to deliver valuable objectives of transformation.

In a project environment, communication provides critical links between the people, ideas and information necessary for project success (Project Management Institute 2004). (Mintzberg, 1973) designated that people prefer to turn to other people rather than searching previous documents for information.

Burns & Stalker (1961) stated, project teams often consist of people with diverse skills, working together for a limited period of time, a project team often includes members who have never worked together previously and they might not work together again.

### 2.4.1 Project management

PMBOK define the term project management as “the application of knowledge, skills, tools, and techniques to project activities and processes in order to meet or exceed stakeholders’ needs and expectations with respect to that project”. The term project management is also sometimes used to describe the organizational approach to the management of ongoing operations (PMBOK 2004).

According to the PMBOK (2004), the increase in project management indicates that the application of appropriate knowledge, process, skills, tools, and techniques can have a significant impact on project success. The main objective of project management is to ensure that a project is completed at the required scope, within budget, on time and delivers a quality product or service as the end

result. PMI thus explain project management as “the application of knowledge, skills, tools, and techniques to project activities to meet the project requirement” (PMI 2008; Yeong, 2010).

According to British Standard in Project Management (1996), project management is “the planning, monitoring, and controlling of all aspects of a project, and the motivations of all those involved in it, to achieve the project objectives on time and to the specified cost, quality, and performance”.

Project management is the process of creating knowledge for an organization from information all around (Akbar & Mandurah, 2014). Project management is the process of using ones’ knowledge to accomplish various activities by stipulating deadline (Lindgren, Packendorff, & Sergi ,2014). As shown in figure 2.3, Project Management contains three main elements, such as people, systems, and tools, without which it will not be possible.

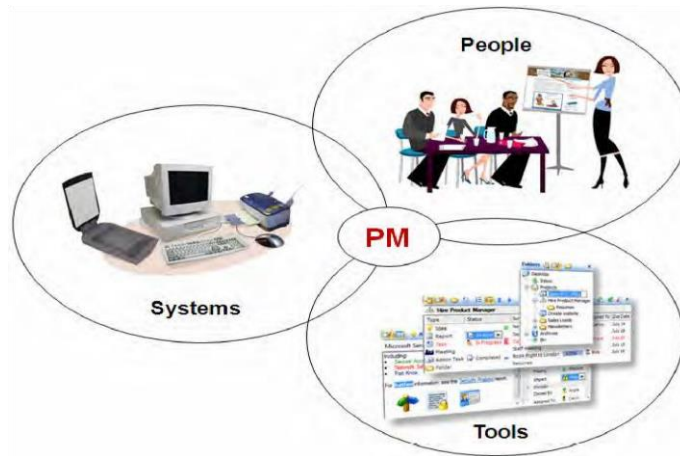


Figure 2.3 Elements of PM: (Source Lewis, 2005)

Project Manager is responsible for planning project phases, running the project, making sure that all people involved in the project are being communicated with and resolving any occurred risks and obstacles. According to (Heerkens, 2001) each project must have a Project Manager who is ultimately responsible for the success or Failure of the project. Project Team is a part of any project, as these are the people who are involved in implementing different phases of the project.

Functional Managers also may have involvement in the project as they have the responsibility to provide resources to accomplish project objectives (Kerzner, 2009). Stakeholders also have involvement in the project, as a stakeholder can be a project sponsor, customer or a person who will be affected by the performed project. Project Management Office (PMO) is a project department that supports and guides each project implementation by providing templates, PMIS, methodologies, policies, “lessons learned” and other useful information for the project implementation and also supports the project team.

#### 2.4.2. Project based organizations

As Lundin & Soderholm (1995) defined, Project-based organization (PBO) refers to a variety of organizational forms that occupy the formation of temporary systems for the performance of project tasks. (DeFillippi, 2002) and (Sydow, 2004) noted that, a PBO incorporates the meaning of an organizational structure specially formed for a temporary period to enable it carry out a specific task. In a wide expressions, project-based organizations are economic companies that structure their activities around a number of relatively discrete projects that can be treated as separate organizational entities.

According to Hobday (2000), Knowledge acquired during one project is not effectively transferred and utilized by other projects. (Prusak, 1997) noted that, whenever a new project starts, there is a tendency to reinvent the process, instead of learn from the experiences of previous projects. Schindler & Eppler (2003) stated; by effectively managing project knowledge, organizations could avoid significant amount of costs triggered by project rework and reappearance of mistakes. (Pensel & Wiewiora, 2013) defined Project based organizations as organizations with managers who can deliver and manage several projects or services for the use of internal or external customers.

### 2.4.3 Project based organizations and Knowledge management

Regardless of project's uniqueness, project experiences can be reused in other projects in addition to providing valuable lessons. Thus, it is important to share knowledge across projects in order to avoid unnecessary reinventions of what has been already done (Carrillo, 2005).

Desouza & Evaristo (2006) and Landaeta (2008) stated that project based organizations tend to repeat the same mistakes too often because of the lack of effective knowledge transfer which could potentially be found in other projects within the same organizations also, poor performance of knowledge transfer results in knowledge being wasted and unsuitable for reuse in other related projects. Lack of efficient knowledge transfer causes, in effect, unnecessary reinventions, errors, and time wastage.

Grabher (2002) defined the term project as a temporary coordination of specialists which are skilled at different aspects working together to achieve a common goal for a specific period. As (Kelly, 2003) stated in order to improve project management through knowledge management the projects' content, process, technology, most importantly people involving on the project must be considered.

Fedida, Missonier, & Saglietto (2014) noted the difficulty of project knowledge management, the first difficulty concerns learning times; knowledge management and project management are deployed over different temporal horizons of learning. Whereas knowledge takes time to develop and become reliable, project management increasingly meets the requirements of reducing deadlines in the design and development of new products and services. The second difficulty arises in terms of different objectives and results. Whereas knowledge management aims to improve intellectual assets of organizations, projects result in a product, service or technology with objectives of quality, cost, and deadlines. Projects are not prompted by knowledge development. However, project development necessarily involves knowledge development. This is because tomorrow's projects will be based on the maintenance and renewal of today's knowledge.

Studies of KM in project environments have stressed the difficulties of learning from projects not only within individual projects, but also across and between projects (DeFillippi, 2001). Topical attention in the emerging knowledge economy has reinforced the vision that project organizations need to organize their knowledge resources more efficiently. Project-based organizations can avoid traditional barriers to organizational change and innovation, since each project is presented as a temporary, relatively short-lived, phenomenon (Sydow, 2004).

Nevertheless, many project-based businesses lack the expertise to handle their knowledge assets (especially those gained from the experience of previous projects); indeed, most knowledge management initiatives in project based firms have failed for a variety of reasons including technological, cultural, knowledge content, and project management reasons (Chua & Lam 2005). Without a certain knowledge system and supporting culture during a project's life cycle, knowledge assets can be misplaced once a project is completed. This results in organizational knowledge destruction and loss of organizational learning (Kotnour, 2000).

If knowledge is managed effectively, it can help to decrease project time, improve quality and customer satisfaction, and minimize delivery times. The KM, whether explicit or tacit, is a necessary prerequisite for project success in today's dynamic and changing global environment (Love, 2005).

According to Love (2005), achieving knowledge utilizing to learn from failures or successes that have occurred in projects is vital for the long-term sustainability and competitiveness of business. (Mannan, 2013) investigated in his study, a culture that is able to connect knowledge as a transferable asset and can be used to improve future projects, and in certain cases expand the scope of an organization's project capability, can and should be created. Moreover, knowledge management in project-based organizations draw attention to the fact that the process of knowledge capture, transfer and learning in project settings rely very heavily upon social patterns, practices and processes. Usually, the knowledge created through the effort to resolve problems during a project is retained by the project members who will be able to use and apply this knowledge in future projects. Launching an effective knowledge management initiative to capture this

knowledge, sharing it and using it even after the disbanding of the project team should be made a priority (Dulaimi, 2007).

Kasvi (2003) categorized Knowledge management in a project into four groups of activities; such as knowledge creation (collection, combination and refinement), knowledge administration (storage, organization and retrieval), Knowledge dissemination within and outside the project and knowledge utilization and production, including integration into products and decisions, and application in other projects.

Ansari, Rahmany & Mirkazemi (2012) stated that, a big part of organization's culture is the capability to manage knowledge on projects includes the capacity to create, absorb and share project-related information by using gained knowledge to learn from the failures and successes in previous projects which is vital for long-term sustainability and competitiveness of the organization. The following figure 2.4 presents components of project management and knowledge management.

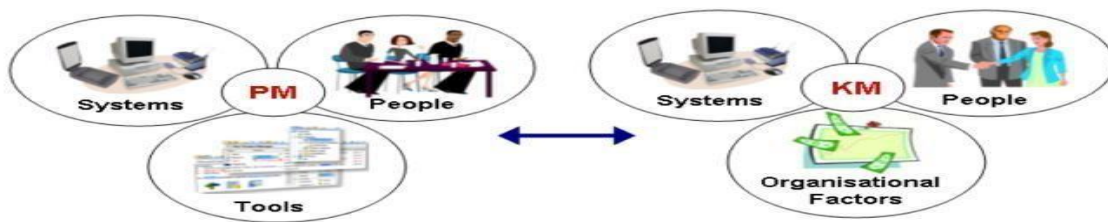


Figure 2.4 Knowledge Management and Project Management Components (Source: Lewis, 2005)

## 2.5 Challenges of knowledge management

Allameh, Zare & Davoodi (2011) stated that, critical success factors have a key role in successful implementation of knowledge management in the meantime providing proper infrastructure for the success factors can lead to successful knowledge management on project based organizations.

Drucker (1993) suggested that, in the 21<sup>st</sup> century using knowledge management specially reusing the existing knowledge and inhibition, the use of materials and a vast amount of money, and people's labor to solve the same problem that has been solved previously is the secret success for project based organizations. He also added the application of knowledge management on project based organizations as it leads to support strategic organizational innovation, generate enormous profit also helps to create value and creativity.

Based on Peter & Waterman (2009), human elements which exist in the culture are regarded as effective key determinants on business performance and change management. (Davenport & Pursak, 2000) noticed organizational culture as the fundamental index to evaluate success of knowledge management within organizations; such that successful knowledge management in the organization depends on its value in the organizational culture.

Pemsel (2014), describes how PMOs with proactive approaches to knowledge and learning provide mechanisms that allow for active knowledge search. This is likely to influence the willingness of project managers to engage in knowledge related activities. In consequence, this may impact knowledge behaviors and communication patterns among individuals and project teams, which in the longer term impact the PBOs' ability to build organizational capabilities and communities of practice.

As stated by Gasik (2011), project knowledge management comprises processes that aim to generate, utilize, and distribute the micro-knowledge necessary for project execution, as well as processes regarding macro-knowledge on all organizational levels with the aim to increase the

capabilities of effective project execution or to increase people's possibilities for influencing project execution. Organizations and projects will profit from project knowledge management only when they will be able to effectively implement such a process.

The theoretical model of Ismail (2009) and Yeong (2010), suggested that, there are significant relationships between effective project knowledge sharing practice and project success. The model is based on Nonaka's Knowledge Conversion Model, known as the SECI model. (Yeong, 2010) focuses on the socialization of tacit knowledge, the authors concluded that ensuring when and how tacit and explicit knowledge is shared is essential for enhancing project success.

According to Boh (2007), most documentation often is stored on the hard disks of individual team members or shared spaces accessible only to the team members, and thus is unavailable to others. Even when a centralized database is available, individuals sometimes need to ask the right person to locate the relevant documents if the categorization and search facilities are not sufficiently refined.

Knowledge is essential to individuals and organizations (Nesbitt & Barton, 2014); however, several studies have illustrated how knowledge transfer is difficult within industries that focus on projects (Bosch-Sijtsema & Henriksson, 2014; Ding, Liu, & Song, 2013). Knowledge management process is vital for organizational leaders (Lotti Oliva, 2014). To implement successful knowledge management within an organization, organizational leaders have to first determine the barriers that may prevent the successful implementation of knowledge management (Valmohammadi & Ghassemi, 2016).

Many project managers are not aware of the knowledge management abilities that they can bring to their organization (Kelly, Edkins, Smyth, & Konstantinou, 2013). Without the ability to distinguish the importance of knowledge outside of a project, this can limit learning within project-based organizations (Bartsch et al., 2013). In addition, many employees do not want to share their knowledge because of distrust and suspicion (Tong et al., 2015); Waheed et al., 2013). In some

organizations, knowledge is a controlled mechanism where employees only reveal certain information for their benefits (Wiewiora, Murphy, Trigunarsyah, & Brown, 2014). People want to gain knowledge, but without organizational wide trust, knowledge sharing will not increase among employees (Waheed et al., 2013). The effective use of knowledge management within an organization depends on overcoming the barriers that may hinder the transfer of current knowledge (de Bem et al., 2016)

Researchers Williams (2008) ; Milton (2005) ; Pilsmo (2010) ; Rhodes & Dawson (2013) have found the most significant barriers to effective implementation and use of knowledge management systems to be organizational culture, time, opportunity cost, lack of incentives, lack of management support and the temporary organization of projects.

Pilsmo's (2010) on his study discovered that even if the management were promoting and encouraging employees to reflect towards acquired knowledge and sharing the knowledge, the consultants claimed that not enough time were provided to the task and this is because of the fact that there were always another project requiring the resources. In addition to this, barrier also occur in the beginning of projects, where there is often a rush to "get started", and not enough, if any, time is allocated to search for previous lessons learned. This causes inconsistent situation where the organization knows there is an advantage to managing the knowledge, but fails to make it a priority. As said by (Rhodes & Dawson, 2013), time limitation of projects can make knowledge transfer a difficult task and if the project team members dispersed before the useful knowledge been stored it will be unmanageable to gather and gain the same knowledge once again.

### 2.5.1 Challenges of knowledge management on project based organization

Effective knowledge management enabling initiatives should be informed by an understanding of the barriers and enablers. As such, knowledge transfer and management should be developed around some understanding of the environment under which knowledge will be used (Liyana et al., 2008). Besides, practices that enable effective knowledge management are driven by awareness

of the barriers and enablers of effective knowledge management enabling initiative. Knowledge management issues are usually apparent with the nature of projects, such as the inability to capture and reuse project generated knowledge, which may result in mistakes and situations where project managers are “reinventing the wheel” (Dave & Koskela, 2009).

Parker & Craig (2008) in their study focused on barriers specific to inter-project knowledge transfer, and they have classified barriers to the knowledge transfer into three main categories: barriers related to a lack of social communication, barriers related to transfer of documented lessons learned, and barriers related to the project manager.

Thomas & Keithley (2012) further noted the challenge where project network servers were taken out of service as soon as the projects were completed. Because of this situation, project team members had to save copies of relevant files to their personal flash drives as personal backups before they leave the projects. Also, without access to previous projects, one of the few ways to gain access to knowledge resources from those projects would be to “pick the brain” of someone that was on those projects, assuming they were still with the company the situation is highlighted as “reinventing the wheel.”

Khalifa & Jamaluddin (2012) have intended to identify the key success factors which affects knowledge management in the construction industry in Libya. Some of the factors which the authors found include organizational culture, IT infrastructure, top management support, ease of use of IT, and knowledge structure.

Khalifa & Jamaluddin (2012) also added that work pressure and thus a lack of time to produce lessons learned is one of the main causes for lessons learned not being transferred. Projects have to be delivered within the desired time. In the project environment, time is accurately limited and is always running out. People are focused mainly on delivery rather than on knowledge transfer activities. In addition, organizations struggle with the idea of how to create a lessons learned data base. When there is no proper repository of lessons learned within the organization, searching for

them can be time consuming. Furthermore, the collection of lessons is conducted periodically rather than throughout the performance, which causes important information to be missed or forgotten. People mostly tend to keep lessons learned in their minds. Another factor that prevents a transfer of valuable knowledge across projects is a lack of social communication between projects.

According to the empirical findings of Cook & Brown (1999); Foos et al. (2006); Liebowitz (2005); Newell et al. (2006), the major reason why knowledge transfer did not reach the expected level, was because a project manager's first priority is to deliver the project. They are not focused on transfer of lessons learned unless it is mandated in the project scope and budget. Moreover, project managers often hoard their knowledge, as they view it as a potential threat for them in the future.

In addition existing research found that social networks such as informal meetings, coffee breaks, and workshops are excellent means to share knowledge (Cook and Brown 1999; Foos et al. 2006; Liebowitz 2005; Newell et al. 2006). However, even if there is an opportunity for direct interaction in project based organizations, people work under pressure, and often have no time for social communication. Moreover, specific characteristics of projects such as tight schedules and geographical dispersion of projects reduce the amount of social communication, which can take place during projects. When this social communication is missing, the project must develop specific means that better enhance knowledge sharing activities (Arenius et al. 2003).

Wiewiora<sup>1</sup>, Trigunaryah, Murphy & Chen (2012) identified another way to ensure effective knowledge transfer across projects is to capture and transfer lessons learned beyond the project and they have emphasized that it is essential to ensure complete lessons learned approach that not only ensures documentation of lessons learned, but also regulate the aspect of transfer of lessons learned beyond the project, to other projects and organization. "Lessons learned are defined as key project experiences, which have certain general business relevance for future projects. They have been validated by a project team and represent a consensus on key issues that should be considered in future projects" (Project Management Institute 2004). Lessons learned are part of the knowledge transferred that can be regulated, including transfer of mainly explicit knowledge.

Researchers Wiewiora<sup>1</sup>, Trigunarsyah, Murphy & Chen (2012) pointed out that it has been observed that people are most likely to produce documentation when the documentation is intended to benefit themselves rather than others, when the benefit is immediate rather than delayed, and when the effort required is minimal, as when the documentation is produced as a byproduct of the work itself. But even when these conditions are met, the effort required to produce and use good documentation can be excessive.

## 2.6 Enablers of knowledge reuse on project based organizations

According to Project Management Institute (2004), to ensure effective knowledge transfer across projects there is a need to capture and transfer lessons learned beyond the project. Projects are often geographically dispersed and the use of a lessons learned repository is the only way to get knowledge from other projects experience. Therefore, it is important to ensure complete lessons learned approach that not only ensures documentation of lessons learned, but also regulate the aspect of transfer of lessons learned beyond the project, to other projects and organization. Lessons learned are defined as key project experiences, which have certain general business relevance for future projects. They have been validated by a project team and represent a consensus on key issues that should be considered in future projects Lessons learned are part of the knowledge transferred that can be regulated, including transfer of mainly explicit knowledge.

Project managers typically have a high status and direct control over business functions, personnel, and other resources. (Hobday, 2000) and so play an important role as connectors between projects and organization and across projects.

Parker & Craig (2008) stated a project manager's communicate with senior management, clients, senior members of the project team to coordinate their activities, all team members, heads of functional departments, suppliers, and subcontractors This communication needs to be constantly maintained as the communication chain is wide, maintaining this communication plays a vital role in knowledge acquisition and transfer.

According to Blackburn (2002), Project managers are the ones who have executive project network and they know more about project issues. Nevertheless, project managers often store knowledge they will not use later on for other projects. Blackburn added, even though people constantly talk about the importance of lessons learned, there is still lack of effective approach to produce and transfer lessons learned. Very few organizations that actually have regulated the processes of lessons learned. As he find out from his study, Blackburn noted that, often this process is done in a rush, and it is hard to involve the right people to properly analyze and incorporate lessons learned into the organization.

According to Fong (2003), inter-project learning can be seen as gaining knowledge from a project and transferring it directly or indirectly to other subsequent or concurrent projects. It can be both concurrent and sequential. In concurrent transfer, a project transfers knowledge to another project before the tasks of the current project are completed. This corresponds to diachronic inter-project learning (projects to future projects). Sequential transfer occurs when knowledge and experience from a completed project are transferred to a subsequent project. This corresponds to synchronic inter-project learning (projects to ongoing projects). PBOs should therefore spread the new knowledge generated by projects, diachronically and synchronically.

Roth & Kleiner (2009) suggested “content authoring” as facilitator of knowledge reuse. They have also found in their study that a number of the learning history including a written document having records of expectations, the way of thinking to solve a specific problem, and arguments that helps them to express their experience is a main technique that a number of companies have found useful.

Storage of KM processes are oriented towards making existing knowledge available at a central location, easily accessible by everyone. Some of the processes that enable knowledge conversion are a firm’s ability to organize (Davenport & Klahr, 1998), integrate (Grant, 1996), combine, structure, coordinate (Miller, Friesen, & Mintzberg, 1984; Moore, 1996, Sanchez & Mahoney, 1996), and store knowledge (Zander & Kogut, 1995). An organization must develop a framework

for organizing or structuring its knowledge (O'Dell & Grayson, 1998). Without common representation standards, consistency or common dialogue of knowledge would not exist. This would make it difficult to effectively manage the asset. Knowledge about a particular subject may reside in different parts of the organization or in different systems within the organization. Combining or integrating this knowledge reduces redundancy, enhances consistent representation, and improves efficiency by eliminating excess volume.

Akgun et al. (2005) noted that, in order for effective knowledge management the repositories are vital source for knowledge reuse by providing codified expertise as they are needed and helping mitigate problems, meanwhile providing efficiency. Storing knowledge in easily accessible and user friendly manner is important for organization, storing the explicit knowledge as a best practice or lesson learned database and storing the tacit knowledge providing portal for accessing the expertise system detector.

As noted by Shoeleh, Yakhchali, Golabchi, & Yazdani (2016), because of the fact that projects are temporary in nature and with organizational boundaries, it make the transfer of lessons learned between them necessary and very important.

## 2.7 Conceptual Framework

According to European Guide to Good Practices in knowledge management by CEN (2004), a framework is represented pictorially, which serves as an “aide- memoire” for the implementation of knowledge management within the organization by including the depiction of assets, people, process, tools; which are the essential factors of knowledge management influencing the success or failures of a knowledge management.

Fteimi (2015) categorized frameworks into two groups as holistic KM frameworks and specific KM frameworks. According to (Fteimi, 2015), a holistic KM framework is a framework that focuses on different elements of KM and discusses KM disciplines in general, he illustrated the

definition by giving (Pawlowski & Bick, 2012) and (Handzic, 2003) study as an example which elaborates knowledge processes, business processes, and external processes and these processes are related to several other components such as KM strategies, stakeholders, culture KM instrument, working knowledge, and knowledge enablers, which can be subdivided into organizational environment-and technological enablers. As compared to holistic KM framework, a specific KM framework focuses on few concert KM elements such as knowledge definitions, KM theories, critical success factors of KM implementation, KM models or knowledge management systems, different KM perspectives like the transactional KM, process-based KM or analytical KM. He illustrated the definition by giving (Tzortzaki & Mihiotis's, 2014) framework as an example in which, the authors divided the theories into the following categories: as positivistic, interpretive with a resource-based orientation, interpretive with a knowledge-based orientation and organic approaches. And the other example he mentioned was the study by (Alavi & Leidner 2001). (De Carvalho & Ferreira, 2011) based on the SECI model; which focuses on KMS and discusses different classification proposals for technologies used in KM then the results were presented in form of a KMS framework. Based on these definitions this study is categorized under a specific KM framework.

Different KM frameworks have been proposed by different researchers, of which, most are prescriptive and procedural, saying not much about specific details on how those procedures should be accomplished. After a review of knowledge management frameworks, the researcher choose McKinsey 7S organization readiness model because of the fact that the assessment of organizational readiness towards implementation of knowledge management framework is important in order to reduce risk of failure, it is important to identify some weak points that should be improved by the organization. Thus the researcher identified variables based on McKinsey 7S model in order to develop the suggested framework with aligning the organization readiness and to formulate questionnaire.

## McKinsey 7S Model

The McKinsey 7S Model was developed by Tom Peters and Robert Waterman in 1980s. Since then, the model has been used to analyze over 70 large organizations. As suggested by Alshaher (2013) the model is easily recalled and recognizable as the seven variables began with the letter “S” as “structure”, “strategy”, “system”, “skills”, “style”, “staff” and “shared values”.

According to Alshaher (2013) there is no agreement on the definition of what “readiness” means; since different researchers give different definition. But one commonly used definition used for the term “readiness” is the assessment of organizational and individual factors that would be considered whether the organizations to be successful or not by the implementation of the knowledge reuse framework.

### ➤ Strategy

According to Alshaher (2013) strategy is a systematic and comprehensive plan of activities intended to safeguard the success of the organization by adding values meanwhile enabling the firm to be sustainable. By referring (Ossiannilsson, Ebba,2012), (Alshaher, 2013) stated that the organizations strategy must associate with the organizations mission and vision.

- *Vision and mission:* By referring Rosario (2002), and Alshaher (2013) Stated that the importance of having a vision and a clear action plan to guide the direction of implementation of the project throughout its life cycle of and should be a project related needs of the project.
- *Goal:* By referring to Faherty, Rodger (2003) and Hanafizadeh, Payam & Ravasan, Ahad Zare (2011), Alshaher (2013) defined goal as the general aim of the organization that align with its mission and the initial state of any project should start with the goal and possible ways of achieving them in mind.

- *Strategic plans*: planning helps to develop an idea, which enables it to articulate plans and activities that will bring any project closer to its goals and strategy is needed to set the direction.

As described by Anninos (2012), Knowledge Management governance mechanisms are the foundations upon which the strategy was built. In addition these mechanisms are management's commitment and leadership, allocation of roles and responsibilities, monitoring and strategy risk management.

### ➤ **Structure**

Structure is defined as a basis of specialization and co-ordination influenced primarily by strategy, size, and diversity of organization.

- *Centralization*: According to Alshaher (2013) Centralization refers to the degree to which project decisions are controlled by the top management or project managements and by referring (Hanafizadeh, Payam & Ravasan, Ahad Zare, 2011), pointed out that light control over project decisions can ensure that system implementation is consistent with the organization's goals and conflicts can be efficiently resolved.
- *CKO position*: According to Alshaher (2013) the role of the chief information officer (CKO) has grown in importance and the role of CKO has evolved into the one responsible for providing IT infrastructure and capabilities to ensure effective business operations. CKO's help planning and implementing IT strategies in organizations. (Alshaher, 2013) suggested that CKO's are responsible for ensuring quality content of the document and must be able to align IT investments with strategic business priorities.

## ➤ Systems

According to Alshaher (2013) Systems refer to formal and informal procedures and systems that support the strategy and structure. According to Alshaher the computers should be available to project managers and employees and the hosting network being capable of providing the content at a speed, security level and reliability that is considered to be necessary for the organization's planned strategy and an organization's technology readiness include making sure that the content is easily accessible to staffs; that speed and reliability issues with the Intra- and/or Internet will not hinder any process; that IT support exists for helping staffs and solving technological problems; and that security issues are resolved to protect the company's information and content.

- *Platform support:* According to Alshaher (2013), it is necessary to choose the platform before the framework design. If the platform is not powerful enough or supportable, it will lead to problems later during the implementation stage.
- *Documentation:* According to Alshaher's study it's important to store the knowledge or experience of employees because of the fact that members of the team leave the organization for different factors and be replaced by someone new. Consequently, documentation can help the work process to continue not from the scratch, but from where it's been left and to continue without being seriously disabled by any knowledge gap. To help the new employee to become familiar with the project without delaying the progress, the previous documentation include many lessons learned from the project in the documentation to pass on his/her experience.
- *Content:* refers to the understandability, usability, usefulness, relevance of the documented project knowledge. As stated by (Damodaran & Olphert, 2000) the fullness of existing explicit knowledge in the electronic repositories or archives of an organization is considered as an enabling factor of knowledge reuse. In addition (Chung & Galletta,2012); (Wu & Wang, 2006) defined the importance of quality of content as ,the higher the quality

of arguments in the knowledge content, the more the knowledge recipient will select a knowledge object for reuse and the easier will be for him/her to apply it in the new context. According to (Tongchuay, 2008), In the process of assessing and selecting among the search findings, knowledge quality can be perceived as timeliness of information, consistent representation of the information indexing and sufficient context description Although applying the knowledge in the new case, quality can be perceived as concise representation, completeness, correctness, practicability of information, as well as ease of information manipulation.

### ➤ **Style / Culture**

In the Mcknsey model, Style mainly refers to organizational culture and management style. Alshaher (2013) also pointed out four factors to refer style/culture which include the following;

- *Organizational culture*: By referring Hanafizadeh, Payam; Ravasan, Ahad Zare (2011) Alshaher (2013) suggested that successful technological innovations require that both the technology be aligned with the organization culture and the culture be reshaped to fit the demands of the new technology. He also included by referring to (Engholm, Peter, 2001) the organization must ask itself whether learning is supported and encouraged; whether learners are given time and opportunities to learn; whether employees and managers, in general, have a positive attitude toward training and learning; and whether knowledge management is supported by top management and linked to broader organizational goals.

According to Damodaran & Olphert (2000) and Majchrzak, Neece, & Cooper (2001), organizational culture towards knowledge reuse is seen as an important organizational enabler which should be taken into account (Majchrzak et al., 2001) when studying knowledge reuse. (Ruggles, 1998) support this view with his study, where 431 executives in both USA and Europe mentioned that organizational culture is the most important factor concerning knowledge reuse. At

the project team level, the project/departmental manager should cultivate a knowledge reuse culture by transmitting regularly appropriate values and beliefs to the team members (Ajmal et al., 2009).

- *Leadership Skill*: are decision making and problem solving skills. As stated by (Argyris, 1991); (Yeung & Holden, 2007) project team members are influenced positively on their decision to engage in knowledge reuse when top management communicates regularly its commitment on knowledge reuse and when the project head is leading the reuse process.
- *Top management support*: According to Mckensy Top management support can range over three different aspects, notably funding support, technological support and experience support.
- *Communication*: According to (Alshaher, 2013) communication is another important factor for knowledge management framework implementation and its importance is not limited only within the team, but also those outside the team and within the project, communication between the project manager, technicians, and team members is vital besides each participants in a project should understand each other, through communication.

### ➤ **Staff**

Staff refers to people/ human resource related issues. Alshaher (2013) identified four factors which are affecting staff:

- *Sufficient Manpower*: It's crucial for organizations to exploit proper mechanisms to recruit and preserve qualified employees, and nurture and maintain a high level of employees' morale and motivation among them.
- *Project team*: The team work and composition of the important factors in the success of any project, and the team must consist of the most efficient people in the organization.

- *Trust*: as Alshaher (2013) stated, there are two types of trust required. The first type is “inner trust”, built within the project team and the second type is inter trust, between the project team and other stakeholders. Mistrust can seriously delay the progress of any project implementation. (Watson & Hewett, 2006) identified another factor, regarding individuals’ trust on the knowledge that exists in the knowledge repositories. The author proposes that intention to reuse knowledge is a matter of recipient’s trust on whether the existing knowledge is correct and timely. In other words, the greater the individual’s belief is that the results value pays off for the effort and time spent, the more he/ she will be engaged in knowledge reuse. (Szulanski, 2000) and (Ajmal et al., 2009) added recipients’ trust on the reliability of the knowledge author as an important factor in the assessment of search results.
- *Training and education*: by referring different authors. Alshaher (2013) stated that training and education are another most widely cited critical factors and training that allows employees to understand the overall concepts about how to perform tasks in efficient and effective manner. (Watson & Hewett, 2006) proposes that training on knowledge reuse, increases people’s intention to engage in knowledge reuse practice.

### ➤ **Skills**

As Alshaher (2013) mentioned on his study, it is vital to have skilled people to guarantee the success of a project and pointed out two key people groups as management and IT personnel.

- *Management skills*: As stated by Alshaher (2013) this types of skills are referred as political and personal skills, communication, and team-building skills.
- *IT staff’s skills*: by referring to different researcher Alshaher (2013) concluded that, the IT staff’s skills are vital factors required to ensure success with in a project.

### ➤ **Shared Values**

According to Alshaher (2013) the term shared values refers to the extent to which a project team accepts and believes the project goals and a belief about the overall impact of the system on the organization with regard to its benefits. (Alshaher, 2013) pointed out that, it is believed that if employees have a shared understanding of why a technology is being implemented, it is likely to foster trust and cooperation among them that can lead to project success.

## 2.8. Related works

There are some research works in the area of knowledge management system framework design which are related with this study. Accordingly the related works are reviewed here respectively.

### *2.8.1. Designing a knowledge management system framework for knowledge sharing*

Eshetu (2017), explored the existing practice of knowledge sharing and designed the knowledge sharing framework for Addis Ababa land holding registration and information agency (AALHRIA). The main purpose of the research was to explore the existing knowledge sharing practice at Addis Ababa land holding registration and information agency and design a knowledge management system framework in order to capture the employees' tacit knowledge, sharing among all employees and transfer individual knowledge to organizational knowledge for the Addis Ababa Land Holding Registration and Information agency (AALHRIA).

The study followed qualitative and the design science research methodology in addition with in depth interview method was used as the data collection method.

The research identified organizational and individual factors that have direct influence on tacit knowledge sharing activities. The study proposed a Knowledge Management implementation model and a Knowledge Management System design Framework that serves as a blueprint to implement Knowledge Management in Addis Ababa Land Holding Registration and Information Agency (AALHRIA).

The work of Eshetu (2017) is the design a knowledge sharing framework for Addis Ababa Land Holding Registration and Information Agency (AALHRIA). But this thesis focused on designing a project knowledge reuse framework.

### *2.8.2. Designing a Knowledge Sharing Platform for Inter Organizations*

Mindahun (2016) explored the existing practice of knowledge sharing and designed the knowledge sharing platform for the Ethiopian Chamber of commerce and sectoral associations. The main purpose of the research was to explore the existing knowledge sharing practice among member associations of Ethiopian Chamber of commerce and sectoral associations (ECCSA) and design a knowledge sharing platform to facilitate inter organizational knowledge sharing in achieving organizational success among member associations of Ethiopian Chamber of commerce and sectoral associations.

The study followed both qualitative case study and design science research methods. Interview, observation and document analysis is used as a data collection method.

The finding of the research indicated that the inter-organizational knowledge sharing among the different member associations of ECCSA is carried out mostly through formal knowledge sharing rather than informal methods. Through formal means of inter-organization knowledge sharing was more of tacit in nature rather than being explicit knowledge. Informal knowledge sharing method among the different member associations allows them to obtain specific knowledge that solves tasks

related to problems. Designing appropriate ICT infrastructure enables and support members to use and share knowledge among associations.

### *2.8.3. Comprehensive KMF*

Karemente et al. (2011) have constructed a comprehensive framework for IT-based Organizations, which addresses the shortcomings of the existing ones. The proposed framework, based on the literature survey and analysis, consists of two main distinguishing aspects or elements. The first one is the integrated KM Influences aspects encompassing environmental, information technology and organizational factors. Environmental influences are in the outer circle of the KMF model to represent governmental, economic, political, social, and educational factors. Technology, especially Information Technology, has been instrumental in enhancing communication and the interaction of individual, group, organizational, and inter organizational knowledge. Therefore it has been identified as internal as well as external influential aspect. Organizational influences include corporate culture, leadership, corporate infrastructure, knowledge structure, vision, continuous learning, knowledge worker, measurement, reward and incentives, among others. However according to (Karamente's, 2011), it has been observed that particular attention be paid to organizational influences without the success of KM becomes uncertain.

The other aspect is knowledge development that consists of KM planning, resources and activities. These aspects interact with each other and within each aspect. The influential aspects shape the other key knowledge development aspects of the framework that include knowledge planning, knowledge resources and knowledge activities or processes (Karemente et al., 2011).

Knowledge activities include knowledge acquisition, creation, repository, sharing, use and evaluation. (Karemente et al.,2011), has also classified knowledge resources to be fitted into his proposed comprehensive knowledge management framework as a major pillar. These are Human capital, Structure capital, Customer capital, and collaborative technological capital.

#### *2.8.4. Role of knowledge management in project management of complex systems organizations*

Gudi & Becerra-Fernandez (2006) studied the role of knowledge management in project management in a complex systems organizations. Their research was driven by the motivation to reduce risk and prevent failures during the development of complex systems and focus on the dynamic aspects of project management using knowledge management. They claimed that knowing the nature of project work enables mitigate problems related to project management.

Gudi & BecerraFernandez suggested that when the project complexity increases, it becomes important to find the means to manage the inter-relatedness of sub-projects and related activities and events in the project environments. Their intent is to identify knowledge management strategies, which organizations could institute in project management practices to reduce risk of failure and increase the chance of project success.

Gudi & Becerra-Fernandez (2006) identified certain knowledge management mechanisms, processes and technologies that could be appropriate for project management requirements. They concluded that there are many factors affecting project risk in complex project organizations. These include external factors like political and economic impacts. The extent of innovation, complexity and coupling are some internal factors affecting project risk. Finally, knowledge management mechanisms and technologies influence project team adaptation which in turn affect project success which is measured in terms of time, budget and functionality.

#### *2.8.5. Integrating knowledge management with programme management*

Owen (2008), suggested that knowledge created, transferred, captured and reused within a project results improving project management maturity. The author provided structure to link project or program management to knowledge management.

Owen suggests that knowledge is embedded throughout the project lifecycle at both tacit and explicit levels. Tacit knowledge is captured and reused at the project level in the form of personal knowledge contributed by the project team members. Tacit knowledge is transferred and reused via mentoring from project members with more experience. Explicit knowledge is reused in terms of project documentation captured during the project lifecycle. The framework proposed by Owen uses the concept of reclusiveness and extending the project to the program level, where the program is a group of projects managed together allowing added benefit and control which would not normally be achieved from managing the projects individually.

Owen concludes that in order for an organization to deliver successful projects, continuous learning needs to occur to improve its capability. Continuous learning can be derived in terms of developing guidelines for creating, sharing, and reusing knowledge in a project management environment, thus integrating knowledge management practices with project/program management.

Owen's framework shows how knowledge is developed at the task level which is embedded into the project methodology in the project environment and eventually improves the capability of an organization.

The above discussed related works focused on designing a knowledge sharing framework. But this thesis focused on designing a knowledge reuse framework to facilitate project knowledge reuse in the context of INSA.

## **Chapter Three**

### **Research Methodology**

Research methodology is the set of processes, methods, tools and techniques deployed and used to conduct a research and reach to the final output of the study. The following are the methods and techniques used for the study.

#### **3.1. Study design**

This study followed design science research methodology. As defined by (Hevner & Chatterjee, 2010) design science is the mechanism in which designing and validating the suggested solution for the specified problem. According to (Hevner & Chatterjee, 2010) two features of design science makes it unique from other branches of science. These features are 1) Rather than facts, design science is concerned about artifacts and (2) it is apprehensive rather on narrow design rules than on prediction, explanation and description. This research method is used because of the final output of the study is a framework or an artifact.

Scientific consistency in the design science research is achieved initially by applying existing theories and methodologies and then by contributing with the design to knowledge base. According to (Hevner & Chatterjee, 2010) practical applicability is achieved by identifying a practical problem and designing a solution for an existing organization.

Throughout this thesis, In order to answer the research question raised, a design science process model suggested by (Peffer et al., 2007) is followed, which encompasses six steps: problem identification and motivation, define objective of the solution, design and development, demonstration, evaluation finally communication. The following figure 3.1 shows the design

science research methodology process model and the DSRM, activities and the knowledge base.

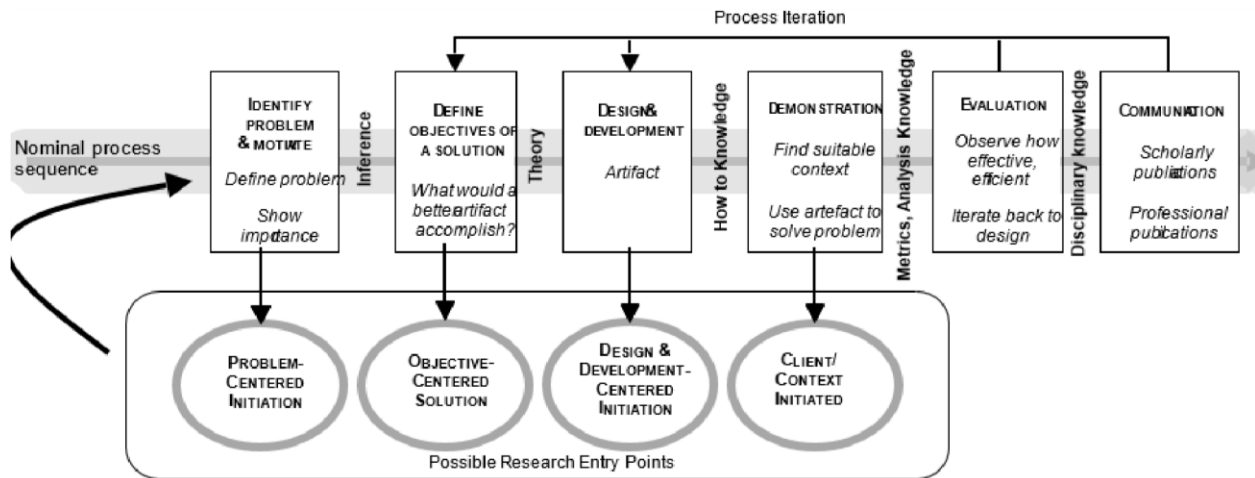


Figure 3.1 Design Science Research Methodology (DSRM) Process Model. Source (Peppers et.al, 2006). The design science research methodology activities with their description and knowledge base is shown in table 3.1.

DSRM activities	Activity description	Knowledge base
Problem identification and motivation	<i>What is the problem?</i> Define the research problem and justify the value of a solution.	Understand the problem's relevance and its current solutions and their weaknesses.
Define the objectives of a solution	<i>How should the problem be solved?</i> In addition to general objectives such as feasibility and performance, what are the specific criteria that a solution for the problem defined in step one should meet?	Knowledge of what is possible and what is feasible. Knowledge of methods, technologies, and theories that can help with defining the objectives.
Design and development	<i>Create an artifact that solves the problem.</i> Create constructs, models, methods, or instantiations in which a research contribution is embedded.	Application of methods, technologies, and theories to create an artifact that solves the problem.
Demonstration	<i>Demonstrate the use of the artifact.</i> Prove that the artifact works by solving one or more instances of the problem.	Knowledge of how to use the artifact to solve the problem.
Evaluation	<i>How well does the artifact work?</i> Observe and measure how well the artifact supports a solution to the problem by comparing the objectives with observed results.	Knowledge of relevant metrics and evaluation techniques.
Communication	Communicate the problem, its solution, and the utility, novelty, and effectiveness of the solution to researchers and other relevant audiences.	Knowledge of the disciplinary culture.

Table 3.1 DSRM activities description and knowledge base. Source (Peppers et al, 2006)

### 3.2. Problem identification and motivation

According to Peffers et al. (2007), problem identification and motivation as being first process of a design science research, on this stage we need to specify research problem with substantiate solution because of the fact that the solution in the form of the artifact is based on the problem definition.

Here, the study used primary data collected using questionnaire and on the job observation in order to identify problem and understand the INSA's project management department ways of managing knowledge process. Questionnaire have been chosen as a data collection method because of the fact that questionnaire is cost efficient, with high possible response rate, offer away to gather data on any subject, relatively easy to collect result, and most importantly it allows anonymity of respondents. And on the job observation is selected as a data collection method because it's the one way to know the accuracy of the collected data through questionnaire and its independence of people's willingness. One hundred sixty eight questionnaires were distributed. First one hundred eight take part the other sixty respondent were not able to fill the questionnaire but to increase the response rate the questioners were redistributed and helped to raise the respondent by twenty nine.

### 3.3. Defining objectives of a solution

The general objective of this study is to propose a project knowledge reuse framework to improve Project Knowledge Management between and among projects within the organization, so that an organization will be able to successfully retain knowledge management practice and decrease chances of project rework.

In order to achieve this objective requirement is gathered by conducting questionnaires, case studies, and on job observation; moreover to know more about project based organization literature review is carried out on related literature topics.

The study population covers different project managers who are managing diverse types of project activities. Project team leaders and also team members of the project and in order to analyze data gathered, the collected data fed in to SPSS for examination and interpretation.

### 3.4. Design & development

The output of design science artifacts are possibly designed objects in which a research output is developed, mostly hypothetically artifacts such as constructs, models, frameworks or instructions. Peffers et al. (2007) on designing process starts with requirement gathering by participating end users, analyzing the documentation.

After collecting the data, analysis is done, using SPSS version 24.0 tool. SPSS is used because it enables the researcher to store and organize the provided data then it compiles the data to produce suitable and easily understandable output.

Inorder to analyze Data gathered, Data collected fed in to SPSS for examination and interpretation, the questionnaire items have been tested for reliability using SPSS scale (reliability analysis function). Then based on the questionnaire, problem is identified in the selected organization regarding project knowledge reuse which helped to design a PKRF.

In this study the privacy, legal and confidential matters is respected by the researcher by keeping any respondents and interviews identifying information such as name and address out of published reports as well as on the questionnaire.

The output of this thesis is a project knowledge reuse framework. The framework is drawn by using Ms-vision 2013, Ms Vision offers a wide variety of shapes, objects, and outlines to work with. Subsequently the requirements has been identified the structure of the document specified in a way that fulfills the whole set of requirement that are identified then after the requirement has been

identified the requirement are used to design a prototype in a way that could answer the research questions specified.

In this phase, PKR framework design prototype was proposed. According to (Peppers et al, 2012) prototype instantiation to demonstrate the efficacy of a design can provide strong evidence when used to show a design works as intended. It helps to illustrate the usefulness of the proposed framework and whether the intended framework has a potential to achieve an expected performance level, in addition it helps to demonstrate the implementation of an artifact in terms of its utility or suitability.

### 3.5. Demonstration

The demonstration step of design science Prove the application of the artifact on the problem by taking one or more instances which involves simulation, case study, proof, prototype or other suitable activities by using resources such as actual guideline to use the artifact (Peppers et al, 2012).

For this study to demonstrate the artifact, prototype is used because prototype helps to realize how usable and valuable the artifact is to the intended users also it helps to insight improvements. According to (Peppers et al, 2012) prototype instantiation to demonstrate the efficacy of a design can provide strong evidence when used to show a design works as intended. It helps to illustrate the usefulness of the proposed framework and whether the intended framework has a potential to achieve an expected performance level, in addition it helps to demonstrate the implementation of an artifact in terms of its utility or suitability.

### 3.6. Evaluation

According to Peffers et al (2012), without evaluation, we only have an unconfirmed design theory or hypothesis that some developed artifact will be useful for solving some problem or making some improvement.

Because of the fact that this study aims to develop a framework, the researcher followed (Peffers et al, 2012) evaluation methods. These evaluation methods are Logical Argument, Expert evaluation, Technical experiment, Subject based experiment, Framework, Case study, Illustrative scenario, and Action research.

According to Peffers et al. (2012) distribution of evaluation methods, the researcher chose the illustrative mechanism since it is a framework type evaluation method and (Peffers et al, 2012) recommended this evaluation method for a framework type artifact. (Peffers et al, 2012) described illustrative mechanisms as an application of an artifact to a synthetic or real-world situation aimed at illustrating suitability or utility of the artifact.

The proposed PKRF is evaluated by selected employees from two departments that represents PMD and domain experts (CKO). The expert feedback is used as an input to check the framework of the proposed PKR design to enable project knowledge reuse in INSA. The evaluation criteria for preparing the questions were adopted from (Prat, Comyn-Wattiau, & Akoka, 2014) which evaluate artifact by using its goal, environment, structure, activity and evaluation dimensions. The researcher evaluated the proposed framework by environmental dimensions since it allows to evaluate the three components of knowledge management which are people, organization, and technology thus the evaluation dimension helps to evaluate the artifact with the components of knowledge management.

### 3.7. Communication

Presenting the problem and its importance, the artifact, its usefulness, the accuracy of the design, and its effectiveness to researchers and other significant audiences (Peppers et al., 2007). The framework design is delivered as full thesis work, the study is being presented on the organization regarding its usefulness, effectiveness and so on. The research work will be accessible to both researchers and practitioners.

## **Chapter Four**

### **Problem Identification and Setting the Objective of a Solution**

#### 4.1 Overview

This chapter focuses on the description and analysis of the data collected to assess the existing project knowledge reuse (PKR) practices of the selected organization. All of the related data were collected using questionnaires distributed to employees working in the organization. Employees working as project managers, team leaders, and team members are involved in responding to the questionnaires. The responses obtained through questionnaires are supplemented with on the job observation. The analysis is done using Statistical Package for the Social Sciences (SPSS) version 24.0. Frequency, average and percentage values are used for discussion of the data collected. These measures are used for describing the data collected to investigate the existing PKR practices in the organization. The data gathered using the questionnaire is compiled, presented and analyzed using the tabular format as follow.

#### 4.3. Analysis of project knowledge reuse practices at INSA

This section presents and analyzes the data collected using the questionnaire regarding knowledge management reuse practices in the selected organization. For straightforwardness, the questions were categorized into six different categories (Strategy, Structure, Systems, Style / Culture, Staff, Skills, and Shared Values) based on the conceptual framework. The categories, the questions, and their corresponding responses are presented as follows.

### 4.3.1. Strategy

Assessing organizational strategy helps to gain top management commitment, knowledge management practices (project knowledge acquiring, project knowledge sharing, project knowledge using and reusing), awareness and understanding of project knowledge reuse in the organization. Table 4.1 presents summary of respondents' reply concerning strategy of project knowledge reuse.

	<i>Strategy</i>	<i>Strongly disagree</i>	<i>Disagree</i>	<i>Neutral</i>	<i>Agree</i>	<i>Strongly agree</i>	<i>Total</i>
1	Project knowledge reuse is aligned with organizational vision and mission.	2.9%	7.3%	33.6%	43.8%	12.4%	100%
2	The project knowledge reuse supports towards achieving the organization's mission.	2.9%	6.6%	16.8%	49.6%	24.1%	100%
3	The organization supports towards reusing existing knowledge and creating new ideas.	1.5%	9.5%	26.3%	48.9%	13.9%	100%
4	Project knowledge reuse contributes to achieve organizational goals.	2.2%	5.8%	17.5%	48.9%	25.5%	100%
5	Existence of documented Goals / objectives of project knowledge reuse in the strategy.	2.9%	19.0%	36.5%	36.5%	4.4%	100%

Table 4. 1 Organizational strategy towards PKR.

For questions categorized under strategy as shown by the above table most of the respondents agreed on the alignment of project knowledge reuse with organizational vision and mission in which 43.8% agreed, 12.4% strongly agreed. For the question whether project knowledge reuse supports towards achieving the organization's mission; most of the respondents (49.6% agree and 24.1% of

them strongly agreed). For the question whether organization supports towards reusing existing knowledge and creating new ideas, 48.9% agreed 13.9% strongly agreed. And 48.9% agree and 25.5% strongly agreed for the contribution of project knowledge reuse to achieve organizational goals. However for the question raised whether project knowledge reuse is aligned with organizational vision and mission, 43.8% of the respondents agreed and 12.4% of them strongly agreed, even though more than half of the respondents agree on this question, 33.6% of the respondents answered Neutral, 7.3% disagreed and 2.9% strongly disagreed. This indicates that the organization has tried to establish alignment of project knowledge reuse with organizational strategy but still this indicates there is more work is required in terms of engaging the employees to know and practice KM activities.

#### 4.2.2. Structure

Knowing the organization structure helps to identify whether using previous project knowledge is initiated or directed by top managers and whether there is a CKO which assists to facilitate knowledge storage, sharing, using and reusing. Summary of respondents comment on structure of organization for project knowledge reuse is presented in table 4.2 as follow.

	<i>Structure</i>	<i>Strongly disagree</i>	<i>Disagree</i>	<i>Neutral</i>	<i>Agree</i>	<i>Strongly agree</i>	<i>Total</i>
1	Projects are fully controlled by project managers.	13.9 %	35.8%	27.7%	15.3%	7.3%	100%
2	The existence of clear decisions from top management towards using previous project knowledge.	7.4%	19.9%	30.9%	38.2%	3.7%	100%
3	The organization practices tight control from top management/Project managers.	3.7%	22.8%	27.9%	39.7%	5.9%	100%
4	The organizations have technical team members to support project knowledge storage.	5.1%	15.3%	22.6%	41.6%	15.3%	100%

5	Necessary resources are available to facilitate project knowledge reuse.	13.1%	32.8%	24.1%	26.3%	3.6%	100%
6	CKO (Chief knowledge officer) is a strategic partner in the organization.	9.0%	13.4%	51.5%	22.4%	3.7%	100%

Table 4. 2 Organizational structure towards PKR.

As can be observed above from the analysis report for most of the question raised under this category most of the respondent answered neutral, for question whether projects are fully controlled by project managers, the existence of clear decisions from top management towards using previous project knowledge and for the question whether chief knowledge officer is a strategic partner in the organization; this indicates improvement. But for question whether the organizations have technical team members to support project knowledge storage, most of the respondent agreed (41.6% agreed and 15.3% strongly agreed) on the organizations having technical team members to support project knowledge storage.

#### 4.2.3. System

This questionnaire categories helps to assess whether the organization encounter problems when an employee leaves, whether the technological platform aids to reuse previous project knowledge and to get whether previous documents are suitable for reusing. Respondents reply concerning the organization system for knowledge management reuse is presented in table 4.3.

	<i>System</i>	<i>Strongly disagree</i>	<i>Disagree</i>	<i>Neutral</i>	<i>Agree</i>	<i>Strongly agree</i>	<i>Total</i>
1	The organization does not encounter any problems when an individual is left/leave the team tasks.	37.2%	38.7%	14.6%	8.0%	1.5%	100%
2	The system in the organization supports reusing previous best practice for another project.	5.8%	12.4%	18.2%	47.4%	16.1%	100%

3	There exist of funding support from top management.	6.7%	19.3%	35.6%	28.1%	10.4%	100%
4	The content of the project document contains all information clearly to be reusable by other projects.	13.1%	42.3%	21.2%	17.5%	5.8%	100%
5	The documentation of the projects is done carefully by giving attention.	17.5%	32.1%	21.9%	19.7%	8%	100%

Table 4.3 Organizational system towards PKR.

For questions categorized under the organizational system, 31.1% of the respondents disagreed and 17.5 % of them strongly disagreed for the question raised whether the documentation of the projects is done carefully by giving attention and for question number four which tests whether content of the project document contains all information clearly to be reusable by other projects; 42.3% disagreed, 13.1% strongly disagreed and 21.2% answered Neutral this indicates major improvement towards this issues. For question number one, which asks as whether the organization system in the organization supports reusing previous best project practices 47.4% of them agreed and 16.1% of them strongly agreed this shows that the organization is open toward reusing knowledge. On the other hand, most of the employees (38.7%) disagreed and 37.2% strongly disagreed for the question that claims organization did not encounter problems when a member left the team task. And for question number five, as shown from the table, 42% of the employees disagreed, 13.1% strongly disagreed and 21.2% of them answered "neutral" this again shows in order to knowledge continues the person working for the project must be present at all the time. The analysis of the system indicates that improvement is needed regarding making project knowledge suitable to be reused in terms of content and quality.

### 4.2.3. Style/culture

As Bock (1999) stated, culture or organizational style in a knowledge management enables and motivates employees to create, share, use and reuse knowledge. Table 4.4 summarizes respondents' reply concerning organizations style/culture for PKR.

	<i>Style/Culture</i>	<i>Strongly disagree</i>	<i>Disagree</i>	<i>Neutral</i>	<i>Agree</i>	<i>Strongly agree</i>	<i>Total</i>
1	The organization regularly captures and uses tacit knowledge of experts in order to reuse for future projects.	22.8%	35.3%	16.9%	22.8%	2.2%	100%
2	The organization provides a technology tool to keep the knowledge of employees so that it doesn't lose the knowledge due to staff turnover, retirements, etc.	3.7%	27.2%	16.2%	40.4%	11.8%	100%
3	The organization has a culture intended to promote knowledge sharing and reuse.	4.4%	28.5%	24.1%	33.6%	9.5%	100%
4	In the organization, there is a motivational scheme to encourage staff to share and apply shared knowledge for other similar projects.	16.1%	32.8%	21.9%	21.9%	7.3%	100%
5	I use IT tools for documenting my day to day tasks.	3.6%	24.8%	17.5%	40.9%	13.1%	100%
6	IT support in searching and accessing previous project knowledge in my organization.	23.4%	33.6%	19.0%	16.1%	8.0%	100%
7	I am aware of knowledge sharing and reusing the shared knowledge in daily work.	1.5%	18.4%	22.8%	47.1%	10.3%	100%

Table 4.4 Organizational style/culture towards PKR

As can be shown from the above table 22.8% of the respondents strongly agreed, 35.3% agreed and 16.9 of them answered neutral for question whether the organization regularly captures and uses tacit knowledge of experts in order to reuse for future projects this indicates that there is a gap in regularly sharing and using the shared knowledge, for question raised whether the organization provides a technology tool to keep the knowledge of employees so that it doesn't lose the knowledge due to staff turnover, retirements, etc., 40.4% of the respondent agreed and 11.8% strongly agreed this result shows there is a technology tool that support reusing project knowledge and 16.2% of the respondents answered neutral this indicates that this percent of employees don't know whether the existing tools support knowledge reusing or not, for question whether the organization has a culture intended to promote knowledge sharing and reuse, 33.6% of the respondents agreed,9.5% strongly agreed, 24.1% answered neutral , 28.5 disagreed and 4.4% of them strongly disagreed this analysis indicates that even if there is a culture to promote project knowledge sharing improvement is required. Question number four asks whether there is a motivational scheme to encourage staff to share and apply shared knowledge for other similar projects, 32.8% of the respondent disagreed, 16.1% strongly disagreed, 21.9% answered neutral, 21.9% agreed and 7.3%strongly agreed this shows that organizational motivation scheme is poor. And for the question which asks whether they use IT tools for documenting there day to day tasks and most of the respondent (40.9%) agreed 13.1% strongly agreed, 17.5% answered Neutral 24.8% disagreed and 3.2% of them strongly disagreed this indicates that even though around 57% of the respondent document their day to day task using IT tools, improvement is required. For question which raises whether IT support in searching and accessing previous project knowledge, 33.6% disagreed 23.4% strongly disagreed and 19% answered Neutral; This indicates that finding previous project knowledge using IT tools is poor. 47.1% agreed, 10.3% strongly agreed,22.8% answered neutral for aware of knowledge sharing and reusing the shared knowledge in daily work; which indicates most of them are aware of knowledge sharing and reusing the shared knowledge in daily work but still improvement is required.

As indicated by the analysis result, improvement is required in terms of captures and uses tacit knowledge of experts, promote knowledge sharing and reuse, motivational scheme, searching and accessing previous project knowledge using IT tools.

#### 4.2.5. Staff

The staff category helps to analyze trust among employees to share and use others idea, to know if there exist formal training regarding project knowledge reuse, project knowledge sharing, whether best practices used more than once and shared and used again by another employees. Figure 4.5 below presents organization staff for project knowledge reuse depicted by the respondents.

	<i>Staff</i>	<i>Strongly disagree</i>	<i>Disagree</i>	<i>Neutral</i>	<i>Agree</i>	<i>Strongly agree</i>	<i>Total</i>
1	There exists trust between project teams and other departments in the organization for documenting and reusing best practice.	16.1%	23.4%	37.2%	19.0%	4.4%	100%
2	Our organization provides formal training related to knowledge reuse practices.	17.6%	33.8%	26.5%	17.6%	4.4%	100%
3	Our organization encourages experienced workers to transfer their knowledge to new or less experienced workers.	10.21%	16.8%	17.5%	46.7%	8.8%	100%
4	At the end of the completion of a project, I share my experience and best practices so as to reuse it for the upcoming project.	9.6%	33.8%	22.8%	28.7%	5.1%	100%
5	I have reused my best practice for more than one project.	3.6%	27.0%	18.2%	39.4%	11.7%	100%

Table 4.5 Project knowledge reuse of organizational staff.

As table 4.5 shows for question whether there exists trust between project teams and other departments in the organization for documenting and reusing best practice, 16.1% strongly disagreed, 23.4% agreed, 37.2% answered Neutral. For the question raised whether there exist trust

between the project team; only 17.6% agreed and 4.4% strongly agreed this indicates that project team trust should be improved. 33.8% disagreed, 17.6% strongly disagreed and 26.5% answered Neutral for the question whether the organization provide formal training related to knowledge reuse practices, this indicates that training regarding knowledge reuse is in a poor condition.. 46.7% agree and 8.8% strongly agreed towards the question whether their organization encourages experienced workers to transfer their knowledge to new or less experienced workers. 9.6% strongly disagreed, 33.8% agreed and 22.8% answered Neutral for question which asks whether at the end of the completion of a project, employees share their experience and best practices so as to reuse it for the upcoming project; this indicates that most of the employees do not share their knowledge after the completion of a project. For the question which asks whether they have reused their best practice for more than one project; 39.4% of respondents agreed, 11.7% strongly agreed this indicates that even though almost 50% of them reuse their best practices for themselves the other 27% answered disagreed, 18.2% answered Neutral and the remaining 3.6% strongly disagreed; this shows improvement is needed.

The analysis indicates that employees use previous project knowledge for themselves but there is no mechanism sharing and enabling others to reuse the project knowledge beyond themselves. In addition there is lack of trust between employees.

#### 4.2.6 Skills

This questionnaire category helps to assess employees in the organization have communication and technical skills to share and reuse project knowledge. Here under table 4.6 presents response given by respondents in the reuse of project knowledge.

	<i>Skill</i>	<i>Strongly disagree</i>	<i>Disagree</i>	<i>Neutral</i>	<i>Agree</i>	<i>Strongly agree</i>	<i>Total</i>
1.	Project managers have personal skills towards reusing project knowledge.	5.8%	13.1%	27.7%	49.9%	3.6%	100%
2.	Project managers have communication skills in guiding team members in reusing project knowledge.	2.9%	14.6%	20.4%	55.4%	6.6%	100%
3.	I am rarely reusing the shared knowledge for a new project	6.6%	25.5%	24.8%	40.9%	2.2%	100%
4.	I have communication skill in sharing my experience with other team members to reuse it.	2.2%	13.1%	23.4%	52.6%	8.8%	100%
5.	I have technical skills for documenting and reusing my best practice.	-	15.3%	20.4%	50.4%	13.9%	100%

Table 4.6 Staff project knowledge and a skill reuse.

As table 4.6 shows for the question which asks if project managers have personal skills towards reusing project knowledge 49.9% agreed and 3.6% strongly agreed for the question raised regarding project manager's personal skills towards reusing project knowledge which indicates more than half of the respondents agreed (55.4% of the respondents agreed and 6.6% strongly agreed) for the question which asks whether project managers have communication skills in guiding team members in reusing project knowledge. The analysis of these two questions indicate project managers have personal and communication skills still improvement is required. 40.9% agreed, 2.2% strongly agreed and 24.8% were neutral for the question, whether the employee is infrequently reusing the shared knowledge for a new project this indicates that above 50% of employees are rarely reusing the shared knowledge. As the analysis indicate, for the question whether the employees have communication skill in sharing their experience with other team members to reuse it; most of the employees (52.6% agreed and 8.8% strongly agreed) and for question which asks whether employees have technical skills for documenting and reusing their best practice, 50.4% agreed and

13.9% strongly agreed. The last two question indicates that employees communication and technical skill for documenting knowledge. Generally, employees of the organization have communication and technical skills.

#### 4.2.7. Shared values

This category helps to identify whether employees have common understanding towards the benefits of reusing project knowledge. Summary of shared values of project knowledge reuse is presented in table 4.7.

	<i>Shared Values</i>	<i>Strongly disagree</i>	<i>Disagree</i>	<i>Neutral</i>	<i>Agree</i>	<i>Strongly agree</i>	<i>Total</i>
1.	Project managers have a strong belief in the benefits of reusing project knowledge.	2.9%	16.8%	29.9%	39.4%	10.9%	100%
2.	I have a strong belief in the benefits of reusing my project experience.	-	8.1%	11.0%	58.1%	22.8%	100%
3.	Team members are aware of the benefits of reusing project knowledge in the organization.	7.3%	33.6%	21.9%	30.7%	6.6%	100%
4.	Project managers encourage cooperation and reuse of previous best practice to achieve the project goal.	2.2%	14.7%	22.8%	49.3%	11.0%	100%
5.	I am motivated to reuse my previous experience and skill for the success of the project goal.	0.7%	8.0%	24.8%	50.4%	16.1%	100%

Table 4.7 Shared values in project knowledge reuse.

As shown in table 4.3.7 for question, project managers have a strong belief in the benefits of reusing project knowledge, 39.4% agreed, 10.9% strongly agreed this analysis does not make to conclude that project managers have a strong belief in the benefits of reusing project knowledge because 29.9% answered Neutral, 16.8% disagreed and 2.9% strongly disagreed this indicates improvement is required. Most of the respondents (58.1% agreed and 22.8% strongly agreed) for the question number which asks, whether project managers encourage cooperation and previous best practices; 49.3% agreed and 11.0 strongly agreed this again indicates improvement. Question number three asks for whether team members are aware of the benefits of reusing project knowledge in the organization and only 30.7% agreed and 6.6% strongly disagreed this again indicates improvement. The analysis of question number two and five indicates that the employees are aware of the benefit of reusing project knowledge and their motivation to reuse project knowledge. According to the analysis result, employees are aware and motivated to use previous project knowledge.

#### 4.2.8. Benefits of project knowledge reuse

The following table 4.8 presents respondents suggestions about the advantage of project knowledge reuse.

	<i>Project knowledge reuse</i>	<i>Strongly disagree</i>	<i>Disagree</i>	<i>Neutral</i>	<i>Agree</i>	<i>Strongly agree</i>	<i>Total</i>
1	I believe reusing project knowledge make the project team to be efficient in their work.	0.7%	4.4%	4.4%	40.1%	50.4%	100%
2	I believe reusing knowledge make the organization to reduce its budget and optimize its resources.	0.7%	5.1%	5.8%	35.0%	53.3%	100%
3	I believe reusing knowledge will bring advancement and innovation.	0.7%	6.6%	7.3%	32.8%	52.6%	100%

Table 4.8 Summery of project knowledge reuse.

As the analysis shows most of the employees agreed towards the advantage of reusing project knowledge. 40.1% agreed and 50.4% strongly agreed, this indicates, the respondents believe that reusing project knowledge make the project team to be efficient in their work. Most of the employees (35.0% agree and 53.3% strongly agree) think that reusing knowledge make the organization to reduce its budget and optimize its resources. And 32.8% agreed 52.6% strongly agree for the question whether employees believe reusing knowledge will bring advancement and innovation. In general, most of the employees understand and believe that reusing project knowledge make them to be efficient and effective.

#### 4.4. Findings from on the job observations

According to on the job observation, the current project knowledge reuse in INSA has been found to be in a poor condition, even if the organization tries to make it possible; the employees tend to work by their own than sharing ideas and using easy methods for recording and sharing every day's activity. As observed the project managers use tools like Ms-project which is good for recording day to day activities of the project but there is no means of sharing the acquired knowledge to other coworkers in a project management department. The project knowledge acquired remains on the mind of the employee who creates the knowledge. In case when employees leave the project the knowledge will be lost (Ismail et al), there is no mechanism of gaining any lesson learned, this kind of reports about the project missed as the project is closed. In INSA, intranet dedicated to the KM portal but some of the knowledge resources, stored in an explicit form on the portal are job descriptions, manuals, research documents, guidelines, and policy and strategy documents and digital library services. They are not well organized to support best practices of knowledge sharing, accessing and retrieval. Although it has not been actively utilized properly by the workers to widen the KM practices.

Discussions	Name	Rating (0-5)	Title	Version	File Size	Created	Document ID	Approved
Libraries	INSA Document		INSA Document	1.0		10/16/2018 4:13 AM		
Discussion Forum	INSA FORMS		INSA FORMS	1.0		10/16/2018 4:12 AM		
Organizational Documents	INSA Policy		INSA Policy	1.0		10/16/2018 4:10 AM		
INSA Thesis	INSA Procedure		INSA Procedure	1.0		10/16/2018 4:11 AM		
	KM Education	☆☆☆☆☆	Knowledge management	1.0	953 KB	12/30/2018 10:59 PM	DSFHVV3Z5DHY-17-30	1/1/2019

Organizational Documents  
 Folders  
 Content Type

Figure 4.1 KM portal (Source; INSA’s knowledge management portal)

As presented in the figure 4.1 above the knowledge management portal of the INSA contains only forms, policy and procedures.

Name	Rating (0-5)	Title	Version	File Size	Created	Document ID
የአሜሪካ የኃላፊዎች የጥናትና ምርመራ ስልጠና	☆☆☆☆☆	የአሜሪካ የኃላፊዎች የጥናትና ምርመራ ስልጠና	1.0	6677 KB	11/5/2018 12:54 AM	DSFHVV3Z5DHY-17-30
የአሜሪካ የአዎንታዊ ገቢዎች ልማት ማቆሚያ (IP)	☆☆☆☆☆	intellectual properties	1.0	579 KB	11/5/2018 12:56 AM	DSFHVV3Z5DHY-17-30
የአሜሪካ የአገልግሎት የአገልግሎት ልማት ስልጠና (Procedure)	☆☆☆☆☆	የአሜሪካ የአገልግሎት የአገልግሎት ልማት ስልጠና	1.0	1214 KB	11/5/2018 12:51 AM	DSFHVV3Z5DHY-17-30
የአገልግሎት ስርዓት ለማጠናከሪያ አጠቃቀም ስልጠና. New	☆☆☆☆☆	የአገልግሎት ስርዓት ለማጠናከሪያ አጠቃቀም ስልጠና	1.0	5351 KB	11/5/2018 12:53 AM	DSFHVV3Z5DHY-17-30
የከፊት ሀይል አጠቃቀም ስልጠና	☆☆☆☆☆	PowerPoint Presentation	1.0	1818 KB	2/25/2019 12:24 AM	DSFHVV3Z5DHY-17-30
የአሜሪካ የሥራ ስልጠና ስልጠና	☆☆☆☆☆	የአሜሪካ የሥራ ስልጠና ስልጠና	1.0	9199 KB	11/5/2018 12:56 AM	DSFHVV3Z5DHY-17-30
የአሜሪካ የሥራ ስልጠና ስልጠና	☆☆☆☆☆	የአሜሪካ የሥራ ስልጠና ስልጠና	1.0	15230 KB	11/5/2018 12:59 AM	DSFHVV3Z5DHY-17-30
BSC Manual	☆☆☆☆☆	BSC Manual	1.0	2940 KB	1/17/2019 3:34 AM	DSFHVV3Z5DHY-17-30
BSC training presentation	☆☆☆☆☆	BSC training presentation	1.0	3982 KB	1/17/2019 3:38 AM	DSFHVV3Z5DHY-17-30
INSA የጥናትና ምርመራ ስልጠና	☆☆☆☆☆	INSA የጥናትና ምርመራ ስልጠና	1.0	5593 KB	11/1/2018 3:43 AM	DSFHVV3Z5DHY-17-30
INSA የሥራ ስልጠና ስልጠና	☆☆☆☆☆	INSA የሥራ ስልጠና ስልጠና	1.0	1008 KB	11/1/2018 1:42 AM	DSFHVV3Z5DHY-17-30

Figure 4.2 KM portal (source; INSA’s knowledge management portal)

As shown in the figure 4.2 above the knowledge management portal of the INSA contains only manuals, procedures, are job descriptions, research documents, guidelines, and policy and strategy documents.

As indicated by figure 4.1 and 4.2 shows the contents of the INSA knowledge management portal. However, in order to use of previous project knowledge, the portal needs to include project documents, a motivation scheme, enable employees to upload and download project knowledge, enable access to project knowledge, and enable discussion.

#### 4.5 Gap Analysis

Based on the survey result presented above concerning factors that influence the reuse of project knowledge in the organization, table 4.9 presents the gaps identified, along with their descriptions.

No	Gap	Description
1	Most of the participants do not know whether their organization supports a knowledge reuse.	Organizational strategy should support knowledge reuse and organizational strategy towards knowledge reuse should be well recognized by employees.
2	Most of the respondents agree that there is no way of finding documented resources on electronic repositories.	The electronic repositories and physical archives should contain sufficient explicit knowledge of previous projects.
3	According to the analysis, the quality of the documented knowledge is poor.	The explicit knowledge should be of high quality.
4	Improvement is required; there is no standardization to prepare the documentation.	Reuse of explicit knowledge should be standardized by an official process and by benchmarking standards.
5	The commitment of PM seems relatively good when compared to other requirements but still improvement is required.	Management should be committed to the reuse of explicit knowledge.
6	Based on the analysis of the questionnaire, there exists a lack of trust.	In order to utilize project knowledge, there should be trust among employees to reuse the documents prepared by other coworkers properly and timely.

7	Based on the questionnaire analysis the culture of the organization towards knowledge reuse is poor.	Acknowledgement of reuse practice related to knowledge reuse influence positively people's intention to engage in such practice and giving more emphasis on reuse culture.
8	The analysis show that training regarding knowledge reuse is poor.	The organization should train project team members and should set reward systems regarding reusing project knowledge, influences positively their intention to participate in such a practice .
9	Most of the participants have positive attitude towards reusing project knowledge. However, still necessary requirements should be set.	Individual's positive attitude and personal effort on searching knowledge to avoid reinventing the wheel.
10	There is no mechanism of finding project knowledge by using IT tools.	As an enabler, IT should facilitate in documenting, searching and accessing project knowledge.
11	It can be said that the participants have awareness on the benefit of reusing knowledge but still there is a lack of commitment to apply it.	KM helps project managers and team members with tight time, limited experience and required risk reduction in projects, to have the right information and knowledge at the right time whenever they need.

Table 4.9 Summary of gap analysis

The gap analysis shows the need for a knowledge management platform that facilitate project knowledge reuse. The platform should facilitate proper documentation of project knowledge, enabling searching and fast access to knowledge. Table 4.10 describes the design requirement for proposing the project knowledge reuse framework.

No	Design Requirements
1	Alignment of organizational strategy with knowledge reuse practice.
2	Making clear management's commitment on KR to employees.
3	Leadership role to facilitate KR in all project teams.
4	Systematizing training on reuse importance of KR.
5	Facilitate proper project knowledge documentation.
6	Enabling searching.
7	Fast access to project knowledge.
8	Promoting a KR organizational culture.
9	Enabling a way of building trust among employees.
10	Developing motivational scheme.
11	Communicating to employees the value of KR.
12	Enabling KR a day to day activity for employees.
13	Availability of documented resources.
14	Having quality of documented knowledge.
15	Having Standardization to prepare the documentation.
16	Making clear commitment of leadership towards reusing documented knowledge and reusing knowledge.
17	Building trust among team leaders and/or between Project managers.
18	Enabling quality of documented knowledge.
19	Mechanizing CKO's to facilitate the above mentioned requirement.

Table 4.10 Design requirements for project knowledge reuse.

#### 4.7. Objective of the solution

The objective of the solution is to provide project based organizations with insight on project knowledge reuse by designing a project knowledge reuse framework. This is to foster project knowledge reuse within the case organization, so that the organization will be able to successfully

retain project knowledge for reuse purpose. This in return decrease the chance of losing project knowledge and project rework.

The general objective of the proposed framework is to enable project knowledge in the INSA to be reusable by enabling project knowledge to be easily uploaded, downloaded, and searchable and make it easier to gain project document for reuse purpose in order to reduce project rework. This will have tremendous effect on the company to:-

- Facilitate sharing project knowledge
- Enable access to project knowledge
- Facilitate creation of project knowledge

## Chapter Five

### Designing a Project Knowledge Reuse Framework

#### 5.1. Overview

Ajmal & Koskinen (2008) suggested that because of the growing complexity of projects scope, an increasing number of technical and social relationships and interfaces must be taken into account by project managers in adapting knowledge and experiences from the daily work of a company and from earlier projects. Also project team members frequently need to learn things that are already known in other contexts, they need to acquire and assimilate knowledge that resides in organizational memory. Their effectiveness in doing this determines their personal effectiveness, the project's effectiveness and ultimately the company's effectiveness. Usually, knowledge from past projects is accumulated in an individual's minds, documents or repositories. People with knowledge about past performed projects assigned to similar current projects, where their knowledge can be shared to benefit project implementation. Because of the fact that this project-created knowledge is initially held only by project team members, it is necessary to identify, capture, and make this knowledge available to the organizational memory of the company.

According to Ajmal & Koskinen (2008) project based organizations require a clear understanding of the sorts of knowledge that should be included in an effective knowledge management system. By referring Conroy & Soltan (1998) study, they have mentioned three “knowledge bases” in project implementation:

- An *organization* knowledge base, which includes the knowledge specific to organizations and environments in which the projects are implemented;
- A *project-management* knowledge base, which includes the knowledge of the theory and application of project management; and

- A *project-specific* knowledge base, which includes specific knowledge acquired within the implementation of a particular project. Based on this definitions this study only covers the project specific knowledge.

## 5.2. The Proposed Framework

The researcher used literature reviews and McKinsey 7S Model for maturity assessment as the basis for the proposed project knowledge reuse framework. The proposed framework is proposed based on identified gaps, the framework aligned success factors for reusing project knowledge with KM tools. Fig. 5.1. Shows the proposed project knowledge management framework for Information Network Security Agency (INSA).

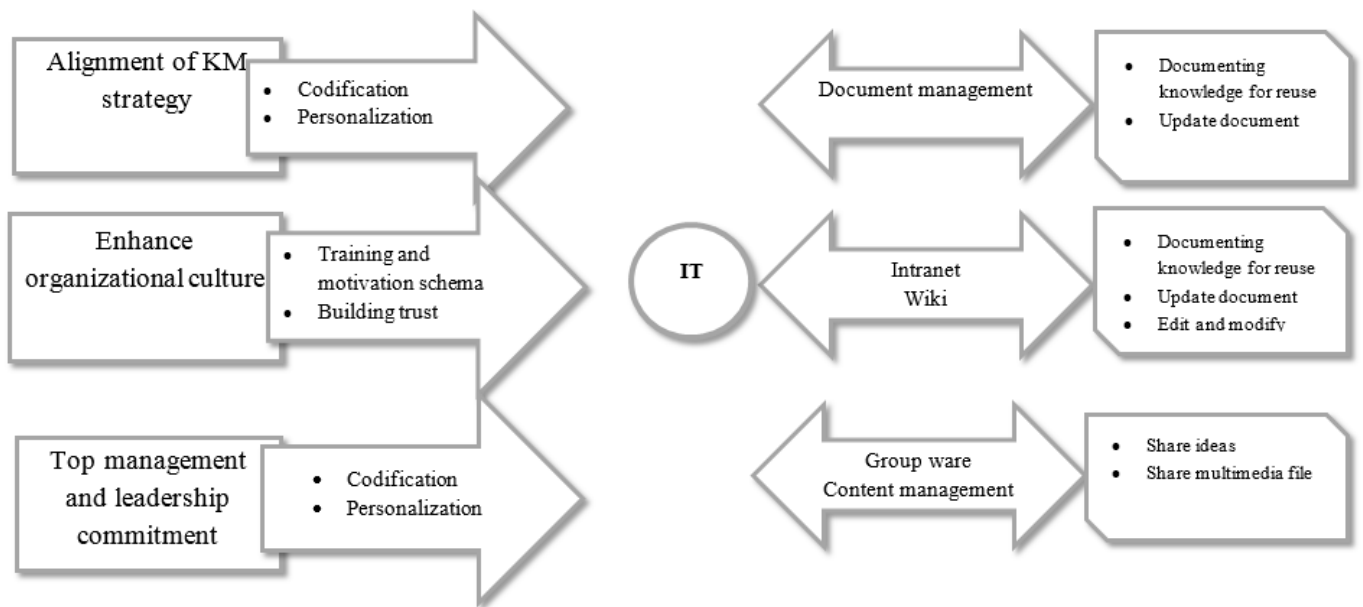


Figure 5.1. The proposed project knowledge reuse framework

The proposed framework integrates project knowledge reuse success factors with IT (knowledge management tools) in order to enhance project knowledge reuse. Using KM tools such as document management, intranet, wiki, and group wear content management helps to maintain the success

factors; in return it enables for documenting, updating, edit, modify, share project related ideas and share multimedia file which enhances project knowledge reuse.

### 5.2.1. Elements of the proposed framework

The following elements are included in the proposed project knowledge reuse framework.

#### ✓ Make clear alignment of KM strategies

According to Fong (2005), two project knowledge management strategies such as personalization and codification strategies can be adopted by organizations to manage knowledge within the projects and both of strategies are needed for a comprehensible project work support.

*In the case of personalization strategy,*

- ✦ The knowledge is tied to persons who developed it and is shared by personal interaction, such as dialogue, workshops or meetings;
- ✦ The ‘Soft’ items - stories, memories of incidents, details about decision processes, lessons learned and experiences from given projects;
- ✦ A well-defined set of “meta-knowledge” which is used to determine how and when the knowledge or content should be applied;

*On the other hand, codification Strategy is concerned with*

- ✦ Codifying the knowledge and storing it in databases.
- ✦ The ‘Hard’ project data - database records, documents, standard operating.
- ✦ The procedures, project definition, activities, history and results.

✦ A knowledge base - which contains the content or knowledge that is of value to the organization.

### ✓ Enhancing organizational culture

According to Schein (1984) organizational culture is defined as a pattern of norms, values, beliefs, and attitudes that influence behavior within an organization.

- It is a system of shared assumptions, values, and beliefs, which governs how people behave within an organization.
- These shared values have a strong influence on the people in the organization and dictate how they dress, act, and perform their job.
- The “personality” of the organization that sets it apart from other organizations.
- Provides a sense of identity to its members.
- Helps legitimize the management system of the organization.
- Clarifies and reinforces standards of behavior.

An organizational culture that is based on a commitment to truth and inquiry empowers individuals to reflect on their actions, consider how these actions can contribute to problems, recognize the necessity for change, and perceive their own roles in the change process (Senge, 1990). In terms of project management, such “double-loop learning” (or “generative learning”) is likely to occur only if the project design encourages team members to question institutional norms (Ayas & Zeniuk, 2001). Organizational culture thus has the potential to constrain or facilitate knowledge creation and transfer within an organization.

According to Wang (2001), a professional culture shapes a professional community by ensuring that the members of the profession think and behave as the profession requires. Because a profession is not limited to a particular organization (or even a particular industry or nation), its

professional culture exists across boundaries. To achieve harmony in these circumstances, a project requires a strong directional culture, as illustrated in Figure 5.2

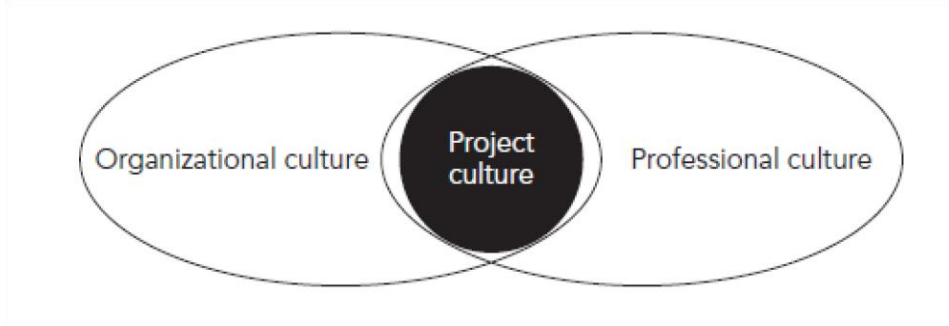


Figure 5.2 project culture (Adapted from Ajmal 2017)

- ✓ Top Management and leadership commitment towards reusing documented knowledge.

According to Ajmal & Koskinen (2008), knowledge sharing and reusing in project-based organizations has a higher probability of succeeding if top management and leadership will assess and identify the organization's core culture, and align the project with it.

Stolovitch, Pershing, & Keeps (2006) noted that, the culture must function in line with the organization's culture in which management within the organization should support and promote KM processes and underline their importance for the whole organization and every individual, also leaders should establish knowledge sharing and reusing the shared knowledge in their own activities by providing:

- Well defined processes for storing and accessing knowledge.
- Attention and resources should be given.
- Training of employee based on competencies.
- Employee evaluation on sharing their ideas and using ideas of others.

### ✓ Building trust among team leaders and/or between Project managers

As described by Stolovitch, Pershing, & Keeps (2006) people must be comfortable to communicate their work problems with their management and they have added that senior management and project managers need to encourage, motivate and reward their employees in order to provide trusting culture where employees feel safe to discuss their mistakes and share, use and reuse knowledge.

### ✓ Training and motivation scheme

In order to enable employees with skills to carry out KM processes, training is required to teach them about the benefits, the ways how KM activities can be performed and which tools to use and make it effective by continuously monitoring employees to determine if they have performed KM activities and encourage them to participate in KM process.

According to Davenport (2005), People induce knowledge to be a power and no one is willing to give it up and as a solution to this problem he suggested that in order to overcome this problem, people's attitude and behavior needs to be changed by giving emphasis on organizations need to provide incentives for the employees who are willing to share knowledge without hoarding it in order for them to collaborate, share, use and reuse the knowledge, (Cameron,2002) stated that many projects often fail because:

- No incentives to promote sharing knowledge and insight among employees;
- Little time or attention is given to identifying lessons learned from past project failures and successes.
- Organization hires and promotes individuals based on technical expertise alone.
- Management is reluctant to talk about projects that did not work well.

✓ Knowledge management tools (IT) to facilitate knowledge reuse

According to Ghani (2009) KM practitioners use a wide range of IT tools to share, create codify, reuse knowledge. Therefore, there is requirements of KM tools, which can collect, catalogue, organize and share knowledge embedded in various forms of documents and media.

KM tools described in the proposed framework:

- ✓ Document management System- for managing documents in terms of documents; search, edit distribute, retrieve, archive the project knowledge.
- ✓ Intranet: for the purpose of sharing information and computing resource among employees and to facilitate group work.
- ✓ Xowiki: allows to edit and modify any part of the article.
  - This KM tool is incorporated to the framework based on the evaluation; participants suggested the use of incorporating wiki with the suggested framework.
- ✓ Content management system- for managing multimedia file.
- ✓ Group ware: To share the know-how of employees.

An organization must have knowledge storage and retrieval processes to ensure knowledge that has been gained previously is available for current and future use. The purpose of the knowledge storage and retrieval process is to store knowledge and to enable the retrieval of relevant knowledge when it is needed. Moreover, the process must ensure that the stored knowledge does not get lost or become corrupted and that no unauthorized access is gained to the organization's knowledge base.

Access restrictions must be implemented to protect the privacy of the individuals, employees and customers by an organization.

## ✦ Access to knowledge

In order for knowledge to be available for reuse in organization it needs to be accessible, and Lindlöf (2014) pointed out that accessibility is a major factor for reuse to take place. At specified organization, there are some aspects that make the accessibility to the knowledge difficult; the fact that the documents are only prepared by using Ms-word and printed and stored in the shelves of the project manager and when the document is needed its only available if the project manager or the person who prepared the document is available; otherwise there is no way of accessing the document and even if the document is accessed the quality and the content of the documents is poor, as the questioner analysis indicated. Inorder to mitigate this problem by using the km portal of the organization project knowledge should be uploaded and easily accessed by granting access permission and the system should also be separated from information and include only the most important aspects of knowledge to enable easy access and a smaller amount of knowledge.

Another problem that makes project knowledge reuse difficult for the organization is the leave of project managers before the completion of a project. Many times, there are few project managers and team members that stay more than one project within the same department and the internal staff turnover results in a lack of accumulated knowledge within people's minds since very few have experienced several projects within the same area of the organization. If the knowledge is not documented well in a way that could be easily accessed, it will be hard to build a knowledge repository. There is also a risk of knowledge being lost when a staff leaves or transfer, when experienced employees leave the project management department, creates a problem related to the accessibility of knowledge regarding the project. A highly experienced employee might be able to know exactly how to solve the encountered problems, the risk, and the way to mitigate the risk, and, due to the internal staff turnover employees with such experience within the same area are rare at the organization and the only way to solve this is by reinventing the wheel.

To mitigate the above mentioned problem the organization should strive to use a Content Management System, such as Share Point in order to:-

- Ensures centralized management of content storage
- easy access
- Ensures check in/check out, document control, single editor
- Provide workflow
- Assist in the capture of standard metadata, Comments, capture business issues.

#### ✦ Search ability and access to Knowledge

Another requirement is the search ability, Alavi & Leidner (2001) the databases often have a rather malfunctioning search algorithm resulting in that in cases where the knowledge itself might be fairly well-structured, it is hard to find because there is a need to sentence words just right to locate what you are looking for. To mitigate this the design ought to include:-

- Taxonomy/Classification: Creates a hierarchy for document storage
- Use standard Document Names
- Documenting perfect knowledge.

# Chapter Six

## Demonstration and Evaluation

### 6.1 Overview

This chapter presents the demonstration of the proposed project knowledge reuse framework. Demonstration is the process of using the artifact to solve one or more instances of the problem (Peppers, 2007). This chapter then presents the evaluation result for the project knowledge reuse framework. The following figures shows the prototype used to demonstrate the suggested framework.

#### ➤ Login Page

The login page (see figure 6.1 below) authenticates the authorized employee who has an account for the project knowledge reuse system of INSA's.

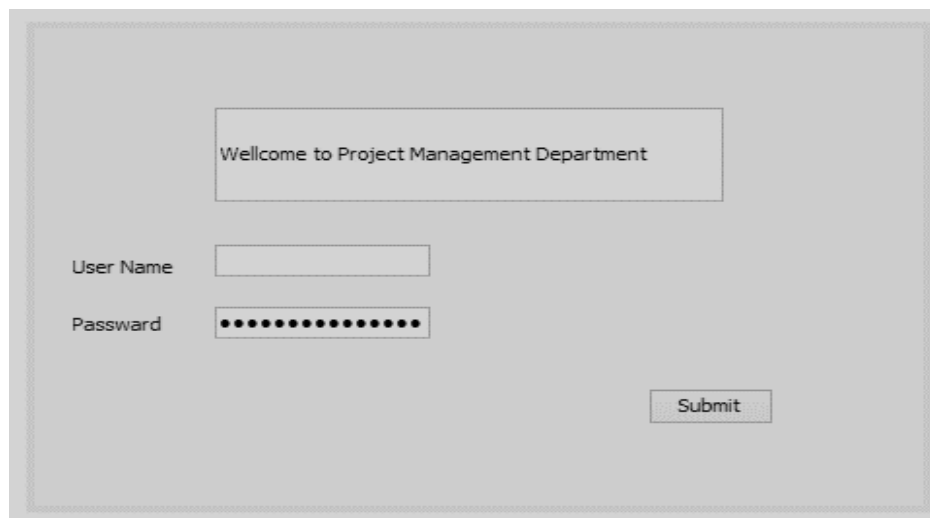
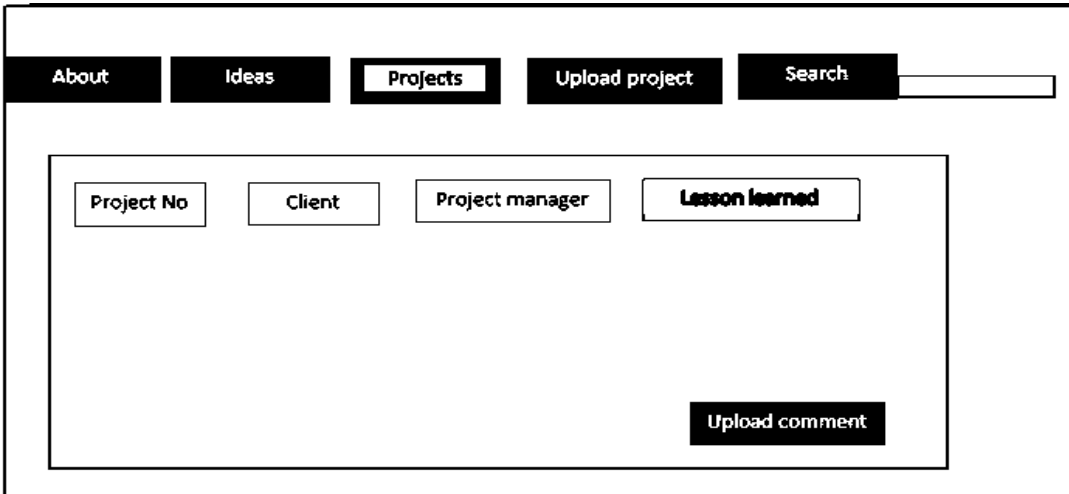


Figure 6.1 User interface to KM portal

➤ Projects upload Page

As shown in figure 6.2, this page enables to upload comments regards issues or projects,. To attach a given project, the page allows to upload comments by unique project number, client or project owner, the project manager, and the lesson learned from the project.



The screenshot shows a web interface for uploading project comments. At the top, there is a navigation bar with five items: 'About', 'Ideas', 'Projects' (which is highlighted), 'Upload project', and 'Search'. Below the navigation bar, there is a search input field. The main content area contains four input fields for 'Project No', 'Client', 'Project manager', and 'Lesson learned'. At the bottom right of this area is a black button labeled 'Upload comment'.

Figure 6.2 Interface for uploading comments about project

➤ Project Download page

This is also an interface for download projects, as presented in figure 6.3. To download about the project, users can access by unique project number, client or project owner, the project manager, and the lesson learned from the project document.

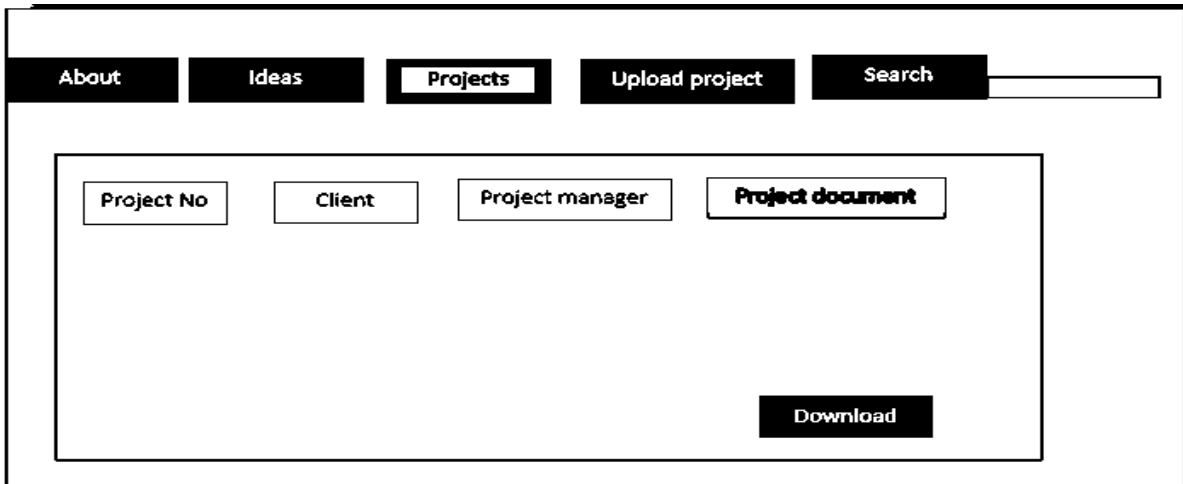


Figure 6.3 Interface for download project

➤ Ideas Page

This page allows the employee to create new idea about a specific project. It consists the title and explanation of the suggested idea as shown in figure 6.4.

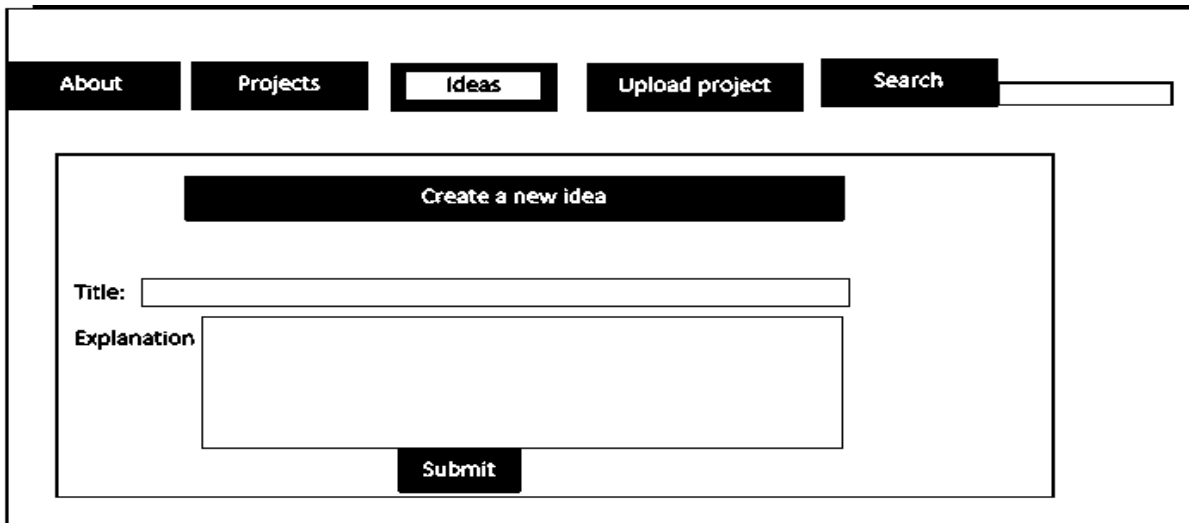


Figure 6.4 Interface for creating new ideas

➤ Upload project page

As shown in figure 6.5 this page enables employees to upload a project by including the project name, unique project number, the project manager, the project current status.

The screenshot shows a web interface for uploading a project. At the top, there is a navigation menu with five items: 'About', 'Projects', 'Ideas', 'Upload project', and 'Search'. The 'Upload project' item is highlighted. Below the navigation menu is a form with four input fields: 'Project Name', 'Project no', 'Project manager', and 'Project status'. Below the input fields are two buttons: 'Upload' and 'Submit'.

Figure 6.5 Interface for uploading project

➤ Search

The search page enables the employee to search project document by entering a key word

The screenshot shows a web interface for searching projects. At the top, there is a navigation menu with five items: 'About', 'Projects', 'Ideas', 'Upload project', and 'Search'. The 'Search' item is highlighted. Below the navigation menu is a search input field and a search button.

Figure 6.6 Interface for searching projects

➤ Discussion forum

Discussion forum enables employees to discuss share, and make use of the shared knowledge.

The diagram shows a web interface for a discussion forum. At the top, there is a navigation bar with five buttons: 'About', 'Ideas', 'Projects', 'Discussion Forum', and 'Search'. To the right of the 'Search' button is a small rectangular input field. Below the navigation bar is a large rectangular frame containing a form for creating a post. The form has four labeled input fields: 'Subject', 'Posted by', 'Posted date', and 'Body of the forum', each followed by a horizontal text box.

Figure 6.6 Interface for Discussion forum.

### 6.3 Evaluation

As stated by Hevner et al. (2004), the design science addresses research through building and evaluation of design artifact that are created to meet the identified business needs of the organization environment”. Artifact evaluation is an important part of the development process to make sure that whether the developed artifact can bring observed improvement and works in a real environment or not.

The researcher selected the illustrative scenario from design science evaluation method. It is because the illustrative scenario are used for the framework type artifact, (Peffer et al, 2012). Illustrative scenarios applies the artifact in a synthetic or real world situation to demonstrate its utility. The researcher selected an illustrative scenario evaluation methods because, according to Peffer et al, (2012) illustrative scenarios are used for framework type artifacts and applies for the artifact in a real world situation to validate its usefulness, and other relevant quality attributes.

The evaluation data was collected using questionnaires and interviews. The evaluation was conducted based on four elements; utility, consistency with organization, the content of framework and, the usefulness of the framework. In addition interviews was conducted regarding use and easiness of the PKRF with selected project managers and employees from knowledge management department of the organization. Twenty one participants were selected randomly among project managers, team leaders, team members and employees from knowledge management department. The evaluation result of the questionnaire is presented as follow.

### 6.3.1. Utility of the proposed framework

According to Peffers et al, (2012) when we consider utility of the artifact we are referring to its usefulness, content, and ease of use. Fig 6.7 presents evaluation result of the utility of the proposed framework.

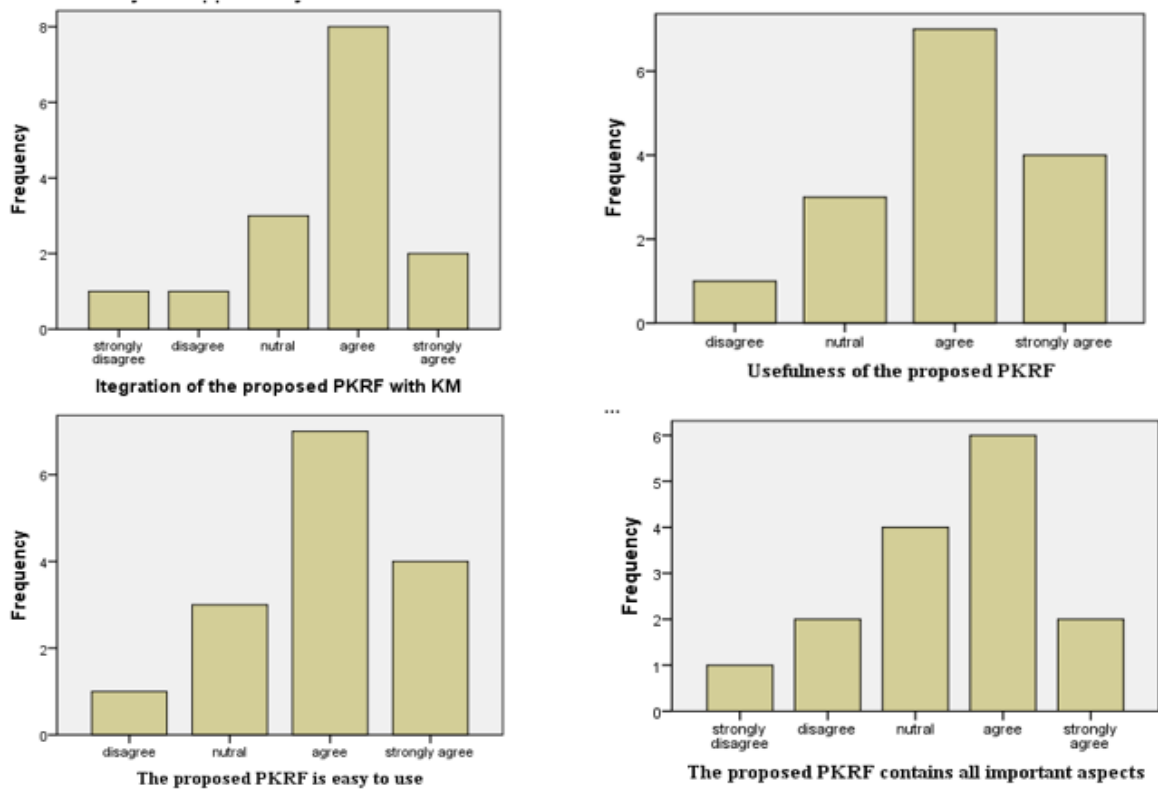


Figure 6. 7 Evaluation result for utility and applicability of the proposed framework

As shown from the graph most of the respondents agreed in terms of the proposed framework integration with KM, its usefulness, ease of use and the content.

### 6.3.3. Content of the framework

The content of the framework is described in terms of the artifacts of clearness, correctness and completeness. Summary of the evaluation result of content of the framework is presented in figure 6.9 below.

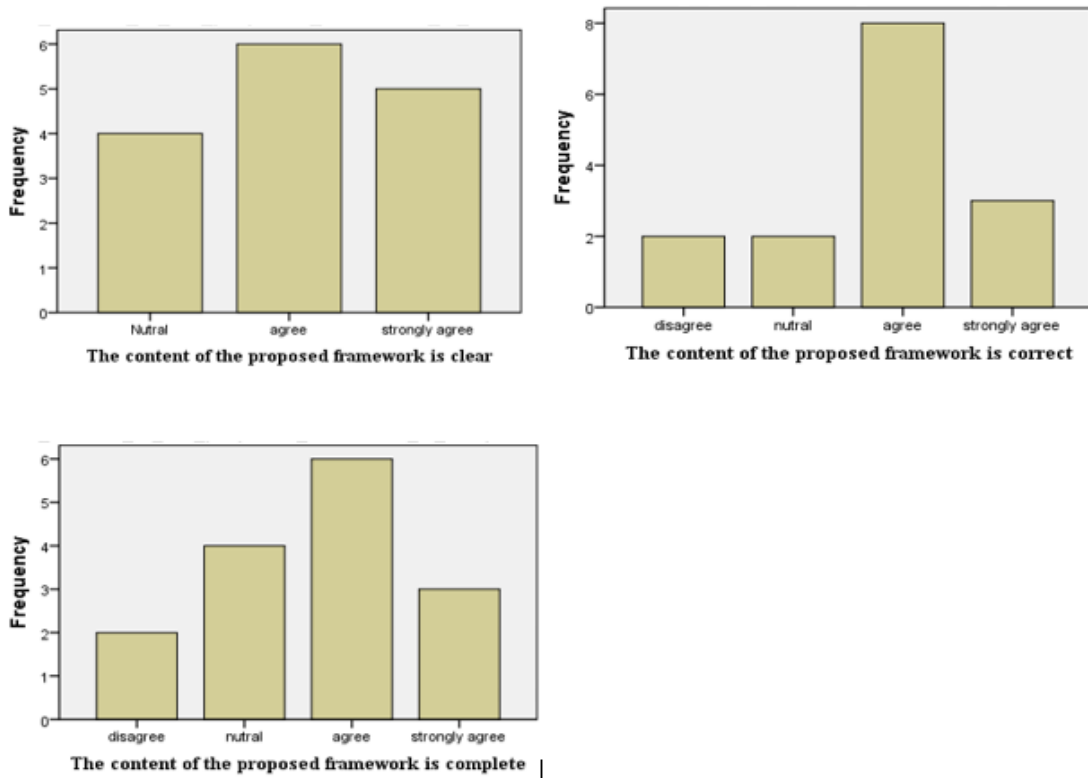


Figure 6.8 Evaluation result for content of the framework

As shown from the above figure 6.9 most of the respondents agree on the suggested framework clearness, correctness and completeness.

#### 6.3.4. Framework usefulness

The usability of the artifact is conducted by end users with its content and aim. Figure 6.9 below presents the result of the framework.

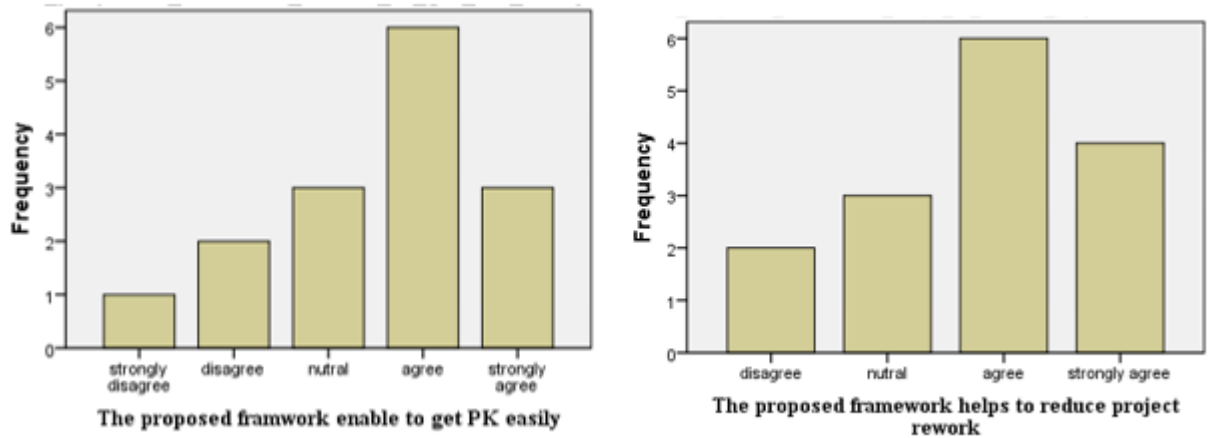


Figure 6.9 Evaluation result for framework usefulness

As shown from the above figure 6.9 most of the respondents agree on the artifacts' content and its aim. The evaluation data collected using interviews with selected employees of project management department in relation to benefits and ease of use is explained below.

As the research followed design science methodology the researcher iterates the artifact design as suggested by the evaluators. In which the wiki and the discussion forum tools are added to the first framework design in order to enable the users with the project knowledge update, share and discuss different ideas.

Even though most of the evaluators agree on the utility, content and usefulness, of the proposed artifact some of the respondent disagree on this issues. Based on the evaluators, the study lack to

incorporate, notification via mail; when there is notification about project work they have to be notified through the organizations' e mail; all project members should be subscribed when somebody creates a new discussion idea. They have also added if the it consists a mechanism for storytelling.

#### **6.4. Benefits of the proposed PKR system for INSA**

The proposed PKR system has multiple benefits. Respondents mentioned that the proposed system have a great benefit for INSA project management department. According to their response, INSA can decrease project failures and its organizational performance through the effective implementation and use of the proposed system.

*A senior project manager explained that:*

*The PKRF enables the reuse of project knowledge easily. But the security of the system need to be considered in order for the organization get to the intended benefit.*

*Chief knowledge officer further stated that:*

*The proposed PKRS helps the project management department to gain lesson learned ideas more easily and share and use project related concepts; hence, there is a need to apply the system.*

*A project team member*

*It should be implemented because it will be helpful to use previous project related ideas and learn from them. In addition, it will be easier to access project documents.*

*Another employee from PMD stated*

*The advantage of the proposed PKRS will enable to uphold any project management issues*

*or risks with its respective solution almost all project managers go through. If anyone of the employee needs to use how they have mitigated the issues or risks, he/she did not have to go from scratch they only need to search different ways of handling the issues or they can get different ideas more easily.*

*A project team leader also commented that*

*Since different projects knowledge of the employee is placed on the system the top management will not concern about employee turnover and loss of project knowledge.*

## **6.5. Easiness of the PKR System**

The simplicity of PKRF encourages employees to facilitate project knowledge reuse activities. The respondents agreed that the proposed system is very intuitive and easy to use.

As senior project manager says:

*This system is really simple to use and intuitive. Any employee could easily share his/her ideas, access to project documents, share lesson learned, and use for current projects. This system is very convenient.*

*A project team member assured that:*

*The proposed system prototype is good and easy to use.*

*A project team member added that:*

*The proposed system prototype has the capability of project knowledge reuse. It is because of that the system is very simple and intuitive enough.*

According to the respondents, the prototype looks easy to use and encourage employees to participate for project knowledge reuse. Most respondents agreed that the proposed system design should contain the knowledge base, discussion forums, blogs, individual and group chatting rooms, reward system (that can identify and display who participate more every week). Some respondent also recommended that a system design should have modern security system like cryptography technology to prevent sensitive knowledge such as configuration codes, passwords and system security problems and its solutions.

Respondents also suggested that the new PKRS might face unacceptability by the top management. Therefore, awareness creation must be undertaken. They have also pointed out Knowledge gap, cost, time are the big challenges.

## 6.6. Finding of the study

This study revealed that, it's hard to get access to project knowledge. Even though the document is found the content is in poor condition, it is not done by giving attention. In addition there is no mechanism to share project related concepts. Moreover the questionnaire analysis indicated that there is no means of motivating employees for using KM activities.

This research found that reusing project knowledge enable to decrease project rework; in return make the organization to be efficient and effective. Moreover, the research identified success factors for project knowledge reuse and proposed a project knowledge reuse framework that mitigates project rework in the INSA.

There have been valuable researches regarding knowledge management activities for different government sectors including banking and agriculture sectors but there is no research conducted on the application of knowledge management for project related sectors so this research paper helps for future researchers as a reference.

## CHAPTER SEVEN

### Conclusion and Recommendation

The ability to integrate and apply the specialized knowledge by organization members is fundamental to a firm to create and sustain a competitive advantage. (Grant, 1996). The objective of the proposed PKRF is to support upload project knowledge, share lesson learned, share ideas, make ease of project knowledge accessibility and application of knowledge in organization. Knowledge and knowledge management are complex and multi-faceted concepts. Thus, effective design, development and implementation of KMS require a foundation in user requirements from the respective organization.

#### 7.1. Conclusion

The research investigated the practice of project knowledge reuse among employees of the Information Network Security Agency. Project knowledge reuse at the selected organization needed for improved processes, the temporary nature of projects requires engaging useful KM practices for undertaking issues such as knowledge leakiness and project rework.

The general objective of this research is to propose knowledge management framework to improve project knowledge reuse, so that an organization will be able to successfully retain knowledge management practice and decrease chances of project rework. To achieve the general objective of the research attempted to answer the following research questions:

- What is required from a knowledge management system in order to enable project knowledge reuse?
- What are the requirements for designing knowledge management reuse framework?
- How to evaluate the designed knowledge management reuse framework?

This study followed design science research methodology (DSRM). Accordingly, based on problem identification, a framework is designed for project knowledge reuse at INSA. The framework is demonstrated practically and evaluated by the users. In order to answer the research questions, the research methodology for this thesis is developed based on the guidelines presented by Peffers et al., (2007) and consists of six main steps.

First methodological step of this research is to identify the problem, the researcher defined the research problem in the INSA and justified the value of the proposed framework as a solution. The problem is identified based on the survey result in addition to on the job observation. Also an extensive literature review was conducted, aiming to identify the factors that are proposed in literature. Then the gap analysis is done for the organization under study. The analysis includes the assessment of the current situation in the INSA regarding reuse of project knowledge. The assessment is done through questionnaires and on the job observation. The assessment reveals the areas for improvement in current project knowledge reuse in the organization. After analyzing the gap, the functional and nonfunctional requirements and the appropriate design is developed based on the areas of improvement that identified by the gap analysis. Furthermore, the solution generated by proposing project knowledge reuse framework and finally, the proposed framework evaluated, the evaluation is done by participating project managers, team leaders and knowledge management expert within INSA. Then the suggested framework was evaluated in terms of its utility, usefulness and content. Based on the analysis result the suggested framework was accepted by the employees. Even though most of the evaluators agree on the utility, content and usefulness, of the proposed framework. On the first iteration of the evaluation the researcher added the wiki and the discussion forum in addition They have commented, the study lack to incorporate, notification via mail; when there is notification about project work they have to be notified through the organizations' e mail; all project members should be subscribed when somebody creates a new discussion idea. They have also added it would be better if it consists a mechanism for storytelling. This issues were not included in the suggested framework for time constraints. In general the objective of the objective of the research was achieved.

## 7.2. Recommendation

Based on the finding of the study, the following recommendations are given as a way forward for further investigation.

- The researcher recommends other project based organizations to manage their knowledge effectively by using knowledge management tools.
- Employees in project based organization need to understand use of knowledge management for managing projects effectively.
- Top managers need to assess reason behind project delay and should incorporate knowledge management for the solution.

## 7.3. Future work

- Similar research question can be addressed using multiple case study, which would allow collecting primary data from a larger number of interviews and questionnaires and incorporating email notification and storytelling mechanisms which was not included in this work.
- As the study is limited to develop a prototype other researchers could evaluate the suggested framework by developing platform based on the suggested framework.
- Other researchers need to develop comprehensive framework in in respect to our country project management in terms of the quality of the project knowledge, content and lesson learned.

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## Appendix A. Questionnaire

### Declaration

Thank you for participating in this questionnaire. This Research is been conducted for academic purpose only and any data or information given will be treated with utmost confidentiality, the result will be analyzed and reported collectively. As such no finding will be attributed to any of the participant as an individual. Please provide your honest opinion.

### Part 1: Demographic Profile

Please circle on the number beside your response to each of the questions.

<b>1. Your gender?</b>			
1. Male	2. Female		
<b>2. Your age group?</b>			
1. Less than 23 years	2. 23-30 years	3. 31-40 years	4. 41-50 years
5. Above 50			
<b>3. Educational Status?</b>			
1. Bachelors	2. Masters	3. Doctorate	
<b>4. Your experience in this organization.</b>			
1. Less than 3 Years	2. 3 -8 Years	3. 9-15 Years	4. Greater than 15 Years
<b>5. Your practice in using and reusing knowledge acquired from experience for new Project.</b>			
1. I never reused project Knowledge	2. less than 2 Years	3. 3-5 years	4. Greater than 5 years

Part 2: Please put <sup>✓</sup> mark depending on the degree to which you agree with the statements.						
1. Strongly disagree		2. Disagree3. Neutral		4. Agree		5.Strongly agree
No.	Question	1	2	3	4	5
<b>A. Strategy</b>						
1	Project knowledge reuse is aligned with organizational vision and mission.					
2	The project knowledge reuse supports towards achieving the organization's mission.					
3	The organization supports towards reusing existing knowledge and creating new ideas.					
4	Project knowledge reuse contributes to achieve organizational goals.					
5	Existence of documented Goals / objectives of project knowledge reuse in the strategy.					
<b>B. Structure</b>						
6	Projects are fully controlled by project managers.					
7	The existence of clear decisions from top management towards using previous project knowledge.					
8	The organization practice tight control from top management/Project managers.					
9	The organizations have technical team members to support project knowledge storage.					
10	Necessary resources are available to facilitate project knowledge reuse.					
11	CKO (Chef Knowledge officer) is a strategic partner in the organization					
<b>C. System</b>						
12	Documentation can do lessons for the transfer of expertise for new members.					

Part 2: Please put <sup>✓</sup> mark depending on the degree to which you agree with the statements.						
1. Strongly disagree		2. Disagree3. Neutral		4. Agree		5.Strongly agree
No.	Question	1	2	3	4	5
13	The organization do not encounter any problems when any individual is left/leave the team tasks entrusted to him.					
14	The system in the organization supports reusing previous best practice for another project.					
15	There exist of funding support from top management.					
16	The content of the project document contain all information clearly to be reusable by other projects.					
17	The documentation of the projects is done carefully by giving attention.					
<b>D. Style / Culture</b>						
18	The organization regularly captures and uses tacit knowledge of experts in order to reuse for future projects.					
19	The organization provides a technology tool to keep the knowledge of employees so that it doesn't loss the knowledge due to staff turnover, retirements, etc.					
20	The organization has culture intended to promote knowledge sharing and reuse.					
21	In the organization, there is a motivational scheme to encourage staff to share and apply the shared knowledge for other similar projects.					
22	I use IT tools for documenting my day to day tasks.					
23	IT support in searching and accessing previous project knowledge in my organization.					
24	I am aware of knowledge sharing and reusing the shared knowledge in daily work.					

Part 2: Please put <sup>✓</sup> mark depending on the degree to which you agree with the statements.						
1. Strongly disagree		2. Disagree3. Neutral		4. Agree		5.Strongly agree
No.	Question	1	2	3	4	5
<b>E. Staff</b>						
25	There exists trust between project teams and other departments in the organization for documenting and reusing best practice.					
26	Our organization provides formal training related to knowledge reuse practices.					
27	Our organization encourages experienced workers to transfer their knowledge to new or less experienced workers					
28	At the end of completion of a project I share my experience and best practices so as to reuse it for upcoming project.					
29	I have reused my best practice for more than one project.					
<b>F. Skills</b>						
30	Project managers have personal skills towards reusing the project knowledge.					
31	Project managers have communication skills in guiding team members in reusing project knowledge.					
32	I am rarely reuse the shared knowledge for new project					
33	I have communication skill in sharing my experience for other team members to reuse it.					
34	I have technical skills for documenting and reusing my best practice.					
<b>G. Shared Values</b>						
35	Project managers have a strong believe in the benefits of reusing project knowledge.					

Part 2: Please put <sup>✓</sup> mark depending on the degree to which you agree with the statements.						
1. Strongly disagree		2. Disagree3. Neutral		4. Agree		5.Strongly agree
No.	Question	1	2	3	4	5
36	I have a strong believe in the benefits of reusing my project experience.					
37	Team members are aware of the benefits of reusing project knowledge in the organization.					
38	Project managers encourages cooperation and reuse of previous best practice to achieve the project goal.					
39	I am motivated to reuse my previous experience and skill for the success of project goal.					
<b>H. Project Knowledge Reuse</b>						
40	I believe reusing project knowledge make the project team to be efficient in their work.					
41	I believe reusing knowledge make the organization to reduce its budget and optimize its resources.					
42	I believe reusing knowledge will bring advancement and innovation.					

## Appendix B: Demographic analysis of the respondents of questionnaire

This section of the survey describes the demographic analysis of the respondents in order to understand the employees who participate in filling the questionnaire for this research. Respondents were requested to fill their sex, age, educational level and work experience in the organization. Accordingly, the profile of the respondents is presented as follows:

<b>Gender</b>					Cumulative Percent
		Frequency	Percent	Valid Percent	
Valid	Male	89	65.0	65.0	65.0
	Female	48	35.0	35.0	100.0
	Total	137	100.0	100.0	

Table 1. Participants gender

As can be seen from table 1, 89 (65%) of the respondents are male employees whereas the remaining 48 (35%) are female employees.

<b>Age group</b>					Cumulative Percent
		Frequency	Percent	Valid Percent	
Valid	Less than 23 years	4	2.9	2.9	2.9

	23-30 years	87	63.5	63.5	66.4
	31-40 years	42	30.7	30.7	97.1
	41-50 years	4	2.9	2.9	100.0
	Total	137	100.0	100.0	

Table 2 participant's age group

As shown from the above table 2, 30.7% of the total respondents are above the age of 31-40 and 2.9% of the respondents are above age 41 and 63% of the total respondent fall between age 23-30 and 2.9% under the age of 23 years old.

<b>Educational status</b>					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Bachelors	106	77.4	77.4	77.4
	Masters	30	21.9	21.9	99.3
	Doctorate	1	.7	.7	100.0
	Total	137	100.0	100.0	

Table 3 Respondents educational status

As table 3 indicates 77.4% of the total responders have a bachelor degree, 21.9% possess masters degree and .7% with a doctorate degree.

Experience in the organization					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Less than 3 Years	61	44.5	44.5	44.5
	3 -8 Years	70	51.1	51.1	95.6
	9-15 Years	6	4.4	4.4	100.0
	Total	137	100.0	100.0	

Table 4 Respondents experience in the organization

The work experience of the respondents across the organization presented in table 4 above. Out of the 137 respondents who answered this question, 44.5% of the employees have an experience of fewer than 3 years. Whereas 51.1% of the respondents' have experienced between 3-10 years and 4.4% of the employees have 11-15 years of experience.

## Appendix C: PKRF evaluation criteria

Put a number (1-5) for your evaluation in the corresponding box of evaluation criteria according to the following: (1) strongly disagree, (2) disagree, (3) neutral, (4) agree, and (5) strongly agree

Criteria	1	2	3	4	5
Utility					
The proposed framework can integrate with KM					
Usefulness of the proposed framework					
The proposed framework is Easy to use					
The proposed framework contains all important aspect					
Consistency with organization					
The proposed framework fits with Project Management Department of the organization					
The proposed framework is harnessing with recent technology					
Content of the proposed framework					
The content of the proposed framework is clear					
The content of the proposed framework is correct					
The content of the proposed framework is complete					
Usefulness of the proposed framework					
The proposed framework enable to get project knowledge easily					
The proposed framework helps to reduce project rework.					
The proposed framework enhance awareness about PKR					
The proposed framework enhance project knowledge acquisition, use and reuse.					

If you have any comments regarding the content, usefulness and utility of the proposed prototype.

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## **Appendix D: PKRF evaluation Checklist**

1. What are the benefits do your department (project management department) and the organization get from this Project knowledge reuse framework?
2. Does the project knowledge reuse framework create easy access?
3. Is project knowledge reuse framework intuitive and user friendly?

## **Appendix E: Observation Checklist**

1. The day to day practice of employees regarding project knowledge reuse?
2. Are employees exchange project knowledge in formal way or in an informal way?
3. How do employees managed their project files?
4. What are the technological means to facilitate project knowledge reuse among employees?
5. Is there a means to promote best practices of using previous project knowledge?