ADDIS ABABA UNIVERSITY

COLLEGE OF NATURAL AND COMPUTATIONAL SCIENCES

SCHOOL OF INFORMATION SCIENCE

DESIGN AND DEVELOPMENT OF PROJECT KNOWLEDGE MANAGEMENT SYSTEM FOR ADDIS ABABA SCIENCE AND TECHNOLOGY AGENCY

By

YIRGA MEKONNEN BIRHANU

September, 2021

ADDIS ABABA

ADDIS ABABA UNIVERSITY

COLLEGE OF NATURAL AND COMPUTATIONAL SCIENCES

SCHOOL OF INFORMATION SCIENCE

DESIGN AND IMPLEMENTATION OF PROJECT KNOWLEDGE MANAGEMENT SYSTEM FOR ADDIS ABABA SCIENCE AND TECHNOLOGY AGENCY

A Thesis Submitted to School of Graduate Studies of Addis Ababa University in Partial Fulfillment of the Requirements for the Degree of Master of Science in Information Science and Systems (*Information Systems Specialization*)

By: Yirga Mekonnen Birhanu

Advisor: Lemma Lessa (Ph.D.)

September, 2021

Addis Ababa, Ethiopia

ADDIS ABABA UNIVERSITY

COLLEGE OF NATURAL AND COMPUTATIONAL SCIENCE

SCHOOL OF INFORMATION SCIENCE

DESIGN AND IMPLEMENTATION OF PROJECT KNOWLEDGE MANAGEMENT SYSTEM FOR ADDIS ABABA SCIENCE AND TECHNOLOGY AGENCY

By: Yirga Mekonnen Birhanu

Name and Signature of Members of the Examining Board

Name	Title	Signature	Date
1. Lemma Lessa (Ph.D.)	Advisor	_____	_____
2. Dereje Teferi (Ph.D.)	Examiner	_____	_____
3. Million Meshesha (Ph.D.)	Examiner	_____	_____

DECLARATION

This thesis has not previously been accepted for any degree and is not being concurrently submitted in candidature for any degree in any university.

I declare that this thesis entitled "***Design and Implementation of Project Knowledge Management System for Addis Ababa Science and Technology Agency***" is a result of my own investigation, except where otherwise stated. I have undertaken the study independently with the guidance and support of my research advisor. Other sources are acknowledged by citations giving explicit references. A list of references is appended.

Signature: _____

Yirga Mekonnen

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

Advisor's Signature: _____

Lemma Lessa (Ph.D.)

ACKNOWLEDGEMENTS

First of all, I would like to forward my deepest love to the almighty God for giving me the patience, wisdom, knowledge and strength to complete this study successfully.

Next, I would like to recognize the worthy inputs of Dr. Gashaw Kebede and Dr. Lemma Lessa, my advisors, for their commitment and patience in guiding, assisting and encouraging me from the beginning of my work. Thank you for your advice because had it been not for you this paper would not be the way it is now.

I am also indebted to my beloved family, especially my wife :Rodas Mamo and my daughter: Hemen Yirga who has been with me always and supporting and encouraging me while I was not giving you ample family time due to my study. Last but not least, I would like to thank my mother: Yeshi Teshome, my father: Mekonne Birhanu for your kind understanding, encouragement and patience. Mom and Dad thank you for telling me how strong and wonderful I am since my childhood! My brothers: Girma Mekonnen: my sister: Aynalem Mekonnen thank you for your support in every aspect of my life.

Yirga Mekonnen
September, 2021
Addis Ababa, Ethiopia

ABSTRACT

Knowledge Management plays an important role especially in project based organization to help them accomplish their mission effectively. However, project knowledge is manually managed at Addis Ababa Science and technology Agency /AASTA/, a project based government organization under the Addis Ababa city administration. As a result, the project related knowledge is not easily available, accessible and usable by the stakeholders. The general objective of the research, thus, is to explore factors hindering effective management of project based knowledge and then propose a project knowledge management system to improve the practice of using project knowledge within the organization in order to increase chances of project success.

A case study research strategy is adopted considering AASTA as a case. Data was collected using questionnaire, and document review. This strategy helped to identify AASTA's current project management practice with the areas of possible improvement. Subsequently a project knowledge management system is designed based on design science research methodology (which integrates problem identification, objective, design, demonstration, evaluation).

This study has significant implications for the AASTA and other stakeholders. It has identified and analyzed the causes and impacts of poor management of project knowledge. The study also indicated that top management, project managers, team leaders and project team members should consider using previous project knowledge. Finally, a project knowledge management system framework is proposed for AASTA in order to mitigate the problem. Then a prototype is proposed to demonstrate the proposed project knowledge management system with components of the framework.

The study findings are not generalizable to other contexts. It is because that this study is a qualitative type of research and only focused on the AASTA context. The study recommends a framework and prototype for the concerned bodies of AASTA which must be implemented for effective management of project knowledge and also validated the prototype by different experts in the works at directorate, team leader and expert level, and obtain positive feedbacks. The study also recommended to the need to conduct further study in the area of project knowledge management on the public sectors with in Addis Ababa City Government.

Keywords: *Knowledge, Knowledge Management, Project Knowledge, Project Knowledge Management system*

Contents

List of Tables

List of Figures

List of Acronyms

AASTA	Addis Ababa Science and Technology Agency
ICT	Information Communication Technology
KMF	Knowledge Management Framework
KM	Knowledge Management
PBO	Project Based Organization
PK	Project Knowledge
PKMS	Project Knowledge Management System
PM	Project Manager

CHAPTER ONE

INTRODUCTION

1.1 Background

National borders no longer barriers to the globalization of organizations and thus the global market is becoming more available, and an increasing number of organizations are choosing to expand operations (Bolisani & Handzic, 2014; Cunningham & Ferrell, 2015). In this context, knowledge is seen as an important contributor to improve service delivery and increased productivity, which then becomes an influential differentiator for global organizations (Powell & Snellman, 2004). Globalization implies that the knowledge on the market is reachable by any organization. Governmental organizations therefore need to redefine their Knowledge Management (KM) strategies to gain competitive advantage over their peers, that is, by effectively managing the knowledge that resides in-house (Schneckenberg et al., 2015; Hung, 2012).

The main Goal of the Addis Ababa City Administration is to ensure all stakeholders have access to government services equally and in an equitable way. To this end, the vision, which is set by Addis Ababa Science and Technology Agency (AASTA) is investigating Addis Ababa, which has transformed the lives of its citizens via the use of innovative technologies. The essential tasks we must conduct in order to attain this objective and become competent in the year of Growth and Transformation Plan II (GTP II) are to solve ICT difficulties and develop paperless government offices.

As a result, a well-organized PKM system has become important to implement the key role of ICT infrastructure and service projects for the municipal government in line with Good Governance, Health, Education, Agriculture, Trade and Industry...etc. services with standards.

As knowledge is unique, intangible, difficult to copy, and rare, it has strategic value, becoming a vital resource and a new economic currency (Ragab & Arisha, 2015). Knowledge, like any other value, should be held and developed in order to grow. To this end, knowledge management (KM) is necessary. KM is a multifaceted discipline (Alavi & Leidner, 2001), and over the years,

KM systems have been developed under different lens: looking deeply at activities such as creating, retaining, and transferring (Alavi & Leidner, 2001; Argote, McEvily & Reagans, 2003), exploring individual characteristics, perceptions, and behaviors (Connelly, Ford,

Turel, Gallupe, & Zweig, 2014); and considering as a unit of analysis organization (Lancini, 2015), group (Jamshed, & Majeed, 2019), and individual (Topping, 2016).

KM has been identified as a critical issue for the performance of each structure and the success of each project (Alavi & Leidner, 1999; Koskinen & Pihlanto, 2008; Kotnour, 2000; Nonaka & Takeuchi, 1995). Due to the growing importance of PM practices, lecturers and practitioners develop a series of PM methodologies and standard from the end of 1990 to help organizations improve their project performance (Kerzner, 2005; Project Management Institute, 2012).

KM studies in organizations have been conducted since the 1980s, while KM research in project areas has been around since the early 2000s (Koskinen, 2000; Lytras & Pouloudi, 2003). Due to the nature of the projects, KM in project-based organizations (PBOs) is not the same as operating enterprises (Kasvi, Vartiainen, and Hailikari, 2003).

As Lindner and Wald (2011) pointed, we consider that contributions are limited in the specification of mechanisms that are used to manage knowledge together with projects. As an IT-based Organization, Addis Ababa Science and Technology Agency (AASTA) is aimed at ensuring the safety and utilization of its residents through the development of quality and safe technology infrastructure and electronic services, promoting problem solving research and innovation, the management of project knowledge is promoted as an important and necessary factor for organizational survival and maintenance of competitive strength in the city administration. Therefore, the rationale behind this research is to propose organizational Project Knowledge Management System (PKMS) for the AASTA, which enables the organization to manage and transfer its project knowledge effectively.

1.2 Statement of the Problem

In an organization in which various types of projects are managed, the efficient utilization and management of knowledge resources is important to tackle the intensive knowledge required in relation to projects. Organization may not be able to efficiently manage the knowledge created from each persons and projects due to the fact that their main focus is on immediate deliverables from each project tasks. In addition, the various challenges confronted in a project environment and general nature of projects limits the application and value of knowledge management. In such situation, knowledge will be hidden or lost at some point and a rework is required, which in turn has an implication on project cost, time, quality and consequently on project performance (Srikantaiah, 2010). It also results organizational

knowledge fragmentation and loss of organizational learning (Dalkir, 2013). Problems in projects may not be solved quickly and the tendency to make repeated mistakes also increase without good management of knowledge (Koskinen & Pihlanto, 2008). In addition, it created a gap on employees to get new and updated experiences and skills while performing their project work, especially for novice and newly appointed project members.

As mentioned 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. Studies of KM in project environments have emphasized the difficulties of learning from Projects not only within individual projects, but also across and between projects (DeFillippi, 2001). As an instance, project group contributors are disbanded or go away after task of completion and this imposes numbers of troubles inclusive of "Reparative activities", "leaking of knowledge" and "reworks" which emerge as foremost demanding situations in projects and project- based organizations (Ajmal, Helo, & Kekale, 2010; Desouza & Evaristo,2006).

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 (Dwivedi, A. N., Bali, R. K., & Naguib, R. N. G. 2003, September), Knowledge management practice on different organization such as Enabling Knowledge Sharing in the Work place of commercial bank of Ethiopia (Temtim, 2013), knowledge management in education sector (Rahel & Ermias, 2011), designing a knowledge management system Framework for knowledge sharing, the case of Addis Ababa land holding registration and information agency, (Eshetu, 2017) and designing a knowledge reuse framework for project based organizations (Mekdes, 2020). As to the researcher knowledge, the development and implementation of knowledge management system in project based organizations still needs an improvement and further study.

Referring to some of the aforementioned 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.

AASTA has been in ICT-Based Service for years with many kinds of information technology based projects implemented on different offices under the city administration of Addis Ababa. It has, thus, acquired a lot of experience, insights, skills, and expertise in the process. Both tacit and explicit knowledge have been generated from the projects implemented at AASTA. However, the accessibility of the Project knowledge resources does not match up with the rich experience of the AASTA, because the knowledge that is found in the minds of technical employees and specialists are of high quality and essential, but it cannot be easily accessed since it is not captured and codified to be shared within the Agency. The Project knowledge found in the documents, which are produced and distributed to different departments are not well organized in a manner to be easily accessed by those who seek it. In short, from observation and other evidences AASTA does not have any formal way of managing its Project knowledge, and thus it does not know adequately what it has under its disposal nor does it access efficiently what it knows to have in the various offices under its structure. Some of the negative consequences of this state of PKM at the agency are replication of works that have already been done in the various offices scattered in the city, failure to exploit lessons learned from projects executed in the agency, failure to complete projects based on the goal and time frame, failure to fulfill their clients and stakeholders need, bad reputation, project cost overruns, demotivation of the project team, sustainability risk to the organization, failure to access and utilize its own existing knowledge, and resources .

Therefore, this research aims to design PKM system architecture and test a prototype of the system for the AASTA. The proposed system is expected to provide a comprehensive knowledge base of projects, lessons learned, expertise developed, experiences and insights gained and so on related to ICT related projects executed at AASTA. In view of the above-mentioned problem statement, this study attempts to answer the following research questions:

1. What is the status of PKM practice in the AASTA?
2. What PKM system is developed for AASTA to ensure the proper usage of its Project knowledge resources?

1.3 Objective of the Research

1.3.1 General Objective

The general objective of this research is to develop PKM system for the AASTA to ensure the proper usage of its project knowledge resources.

1.3.2 Specific Objectives

- Review available PKM system architectures and solutions that can be used as a basis to build a PKM System
- Assess the current practices, resources, constraints and requirements related to PKM in the AASTA
- Design and develop a PKM system for AASTA
- Demonstrate and evaluate the PKM architecture and prototype system

1.4 Scope and limitation of the study

The scope of the research is limited to the design and implementation of PKMS for AASTA. While the research tries to design the PKM architecture for the agency, the testing of the architecture is done using just a prototype system. The target groups for the study consist of individuals in directorates, team leaders and senior expert position who have worked for more than 3 years for AASTA.

The primary data for this research was collected through a questionnaire which was prepared in the Google form online data collection tool and the questionnaire link was attached with emails which were sent to respondents. This method has the advantage of obtaining data more efficiently in terms of finances, time, resource and availability of respondents. The questionnaire has two parts. Part I deal with background information like: gender, age, and experience in AASTA and educational qualification. Part II contains 35 questions which were divided into eight parts: - organizational strategy, organizational structure and system, organizational culture and staff, shared values, skills and benefits of PKM (See Appendix A). A total of 65 research questionnaire were distributed by email and 61 (93.8%) respondents returned.

Much qualitative research typically relies on face-to-face interaction for data collection through interviews, focus groups and field work. Since there is a global pandemic issue, which is COVID-19 the researcher change the first data collection method which is face to face interview into 5-point Likert scale questionnaires.

1.5 Significance of the study

The study is important to transform AASTA into an organization where the production, sharing and retention of Project knowledge are effective and efficiently used to improve service quality and achieve organizational goals. It will encourage all the staffs from the head office to woreda levels to make use of the available information technology to mainstream PKM. The research will also create the platform for the agency to learn from the projects it has been involved in and utilize the lesson for better organizational performance and project implementation. The study can contribute toward building the AASTA's capacity to ensure improved project and program implementation on the city government level. Other organizations can also use the system as problems of PKM are a common problem in the majority of government offices in the country.

Furthermore, this research have a great contribution for knowledge management theory by validating existing claims on knowledge sharing. In addition, this study has a significant contribution of extending existing knowledge management theories to be generalizable to developing economies. In this regard, it is hoped that this study would make a significant contribution towards the existing body of knowledge in the field of project knowledge management specifically for those researcher who have an interest in studying on knowledge management.

1.6 Organization of the thesis

This research is organized into six chapters. The first chapter 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, knowledge management, project and project management, project-based organizations, project knowledge management, project knowledge management strategy, project knowledge management architecture and frameworks and 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, sampling size and sampling techniques, data collection methods and method of data analysis and interpretations. The fourth chapter focused on the data presentation and discussion. The fifth chapter also provided the proposed the new PKMS design prototype and design. The six chapter presents demonstration and evaluation of the proposed prototype. The last chapter presented conclusion, recommendations, future research and challenge of the study.

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 and project management, project-based organizations, project knowledge 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, knowledge management architecture and frameworks and related works review are provided so as to identify the research gap the study attempts to explore.

2.1. Definition of Knowledge

In business world, it has been changing from the era of natural resources to the era of knowledge. The world is moving away from the natural resources to an era of knowledge which based on research and development, skills and education (Friedman, 2005; Gulbranson & Audretsch, 2008). The basic economic resource is no longer capital, natural resources as well as labor but knowledge (Jelenic, 2011; Khan, 2014). Knowledge has been considered as one of the most important and highly valued asset and commodity (Bhojaraju, 2005; Hegazy & Ghorab, 2014). Schultze and Leidner (2002) also stated that knowledge has become the main source in organizations. Besides, knowledge and the capability to create and utilize knowledge are seen as a center to transform the global economic. Knowledge has been emerged as main key source of economic growth of organizations in global economy as it is the basis of innovation (Carneiro, 2000; Kakabadse et al., 2003).

Marwick (2001), describe Knowledge includes both the experience and understanding of the people in the organization and the information artifacts, such as documents and reports, available within the organization and in the world outside'. It is also "data and/or information that have been organized and processed to convey understanding, experience, accumulated learning, and expertise as they apply to a current problem or activity" (Turban et al, 2006).

Gasik (2011) defines knowledge by dividing knowledge in to 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

Additionally, Knowledge can be referred as information possess in the people's minds or people's experience and understanding (Marwick, 2001; Alavi et al., 2005). It contains information that is ready and can be used in making decisions and actions (Chang & Lin, 2015). Anand and Walsh (2016) claimed that knowledge contains information, skills and expertise. The main purpose to share the knowledge is to make the knowledge visible is to show the role of knowledge in organizations and encourage employees to foster behaviors such as knowledge sharing and build the knowledge repository infrastructure (Merlo, 2016). Notwithstanding, knowledge without a proper management can be obsoleted and useless (Ansari et al., 2012; Karimi & Javanmard, 2014). Thus, organizations need to implement and apply a series of processes for them to manage their knowledge (OuYang, 2014).

2.2 Knowledge and Knowledge Management

2.2.1 Role of knowledge in organizations

Everyday life of any person or group consists of numerous decisions and selections for which obtaining applicable knowledge and growing new one is essential. Knowledge is quite a broad phenomenon and its knowledge is dependent on the location in which it's far carried out and goals of articulation. As a reference point, it's miles viable to locate the origins the word "knowledge" in Latin where "know" derives from "noscere" and "ledge" can also have originally meant "process" consequently knowledge can be seen as the "capability for effective action" (Senge et al., 1999, p. 4).

The literature distinguishes extraordinary sorts of understanding: procedural and declarative, esoteric and exoteric, shallow and deep (Courtney, 2001, p.23) with explicit vs. tacit typology being the most typically used. Explicit knowledge is formal and systematic,

expressed using a system of language, symbols, regulations, gadgets, or equations, which make it viable to share and communicate to others in the form of quantifiable records, written processes, everyday standards, mathematical models, and many others. (Nonaka, 1991; Nemati et al., 2002, p.145). Tacit know-how, at the contrary, is difficult to formalize and talk to others, considering the fact that its miles pretty private, includes ideals, views, and intellectual fashions (Nonaka, 1991, p.98; Nemati et al., 2002). Being deeply rooted in movement and a person's commitment to a specific context, it includes subjective knowledge, insights and intuitions, and partially technical abilities, so-known as "knowhow".

Information is a crucial resource for organizations: they utilize various types of current knowledge in all of their actions, while also relying on their own factual knowledge and constantly generating new ones (Nonaka, 1994, p. 31). As a result, companies are taken into consideration dynamic and evolving systems of information manufacturing, studying and alertness.

Within such knowledge based view of an enterprise, knowledge and the ability to integrate gathered knowledge inside the context of required obligations is seen as a crucial competitive advantage (Kogut & Zander, 1992; Grant 1996; Spender 1996; Conner & Prahalad, 1996, referred to in Linder & Wald, 2011, p. 877). Due to the multifaceted nature of knowledge and the variety of its administration, managing knowledge in the desired manner is a challenge for an organization.

According to Skyrme and Amidon (1997, p. 27), systematic control of expertise led to measurable commercial enterprise benefits, which includes introduction of modern products and services, better customer services, faster time-to-marketplace, stepped forward efficiency, decrease prices, etc. Furthermore, agencies must combine strategic issues with knowledge development in today's volatile environment (Nonaka, 1988, 1994, cited in Nicolas, 2004, p.21). This clarifies why one of new procedures to the organization strategy is called the learning approach (Mintzberg et al., 1998, stated in Nicolas, 2004, p.21).

Management is closely linked to the academic learning process. In organizations, this process is seen as a response to program deviations, reflection and the use of non-recurring strategies or exploiting positive experiences in the future (Milton, 2010, p. 2). Therefore, knowledge is lessons, derived from experience (good and bad). In addition, a study is considered a study in which something changes as a result of it (Milton, 2010, p. 15). However, real-life examples show that this is not always the case: often one organization organizes a task already

performed by another person or by other parts of the organization. This can cause time loss and other resources, but can also have serious side effects (Terzieva, 2014, p. 1087). This is why the concept of lessons learned as an important factor in assessing the importance of information management in an organization.

It is also important to understand the flow of the learning process. Milton (2010, p. 23) proposes a simple learning loop that includes three main steps in learning a lesson: identifying, performing and institutionalizing. The first step described is the process of revision, analysis and general practice. After that, the lesson needs to be accompanied by action if it is to be considered as a subject. If a learned subject needs change, it will be necessary to take action, make changes and correct or apply something. All this process must be guided and controlled in order to be aligned and not to dissolve among other activities.

To summarize, knowledge developed and collected in an organization is a strategic asset on both a global and operational level, as described above. Organizations nowadays prefer to invest more effort into integrating different KM approaches and practices in order to satisfy information needs and boost efficiency and effectiveness.

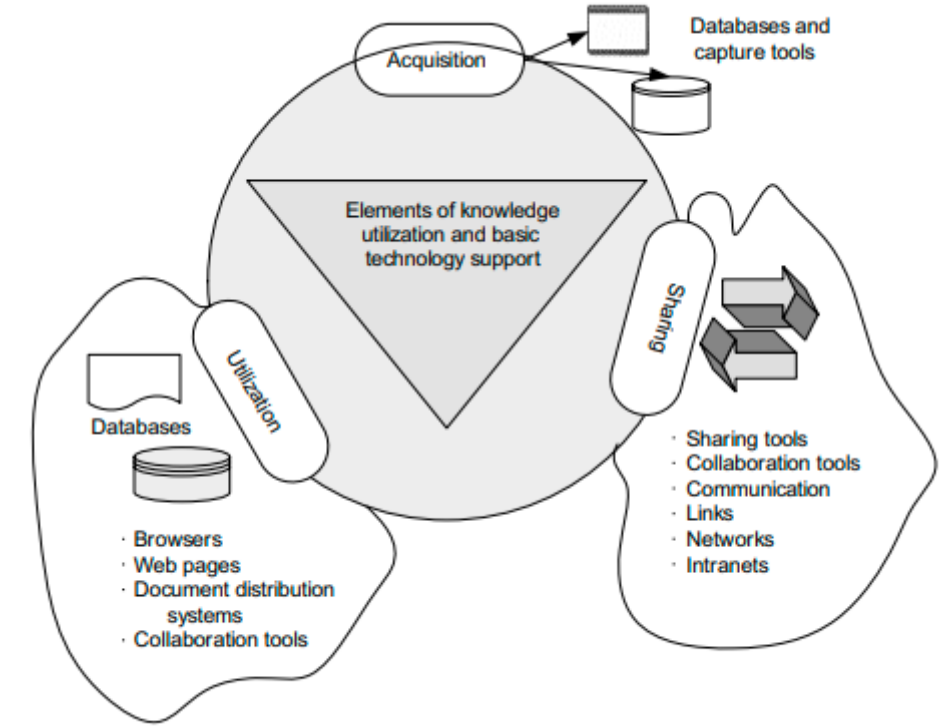
2.2.2 KMS Life Cycle

The construction of KM can be seen, according to Serrano Filho and Fialho (2006), as a life cycle that begins with a master plan and a justification and ends with a structured system for attaining the requirements of KM for the whole organization. A knowledge team representing the ideas of the company and a knowledge developer with experience in the capture, projection, and implementation of knowledge guarantees a successful system.

However, before construction of a KMS, there becomes necessary, according to Tiwana (2002), the definition of the principal sources from which flow the knowledge to form the system. Thus, three basic steps are involved in the process of knowledge management and learning. In summary, these three stages comprise the following (Tiwana, 2002).

- **Acquisition of knowledge**. The process of development and creation of ideas, skills, and relationships.
- **Sharing of knowledge**. This stage comprises dissemination and makes available that which is already known. This focus on collaboration and on collaborative support is the principal factor, which differentiates KMS from information systems.

- **Utilization of knowledge.** The utilization of knowledge gains prominence when learning is integrated into an organization. Any knowledge which is available and systematized in the organization can be generalized and applied, at least in part, to a new situation. Any available computational infrastructure which supports these functions can be utilized.



Source: Tiwana (2002) p. 72.

Figure 1: Stages of utilization of knowledge and their IT functionalities

2.2.3 Knowledge Transfer

Knowledge transfer can be defined as applying knowledge acquired in one situation to another (Singley and Anderson, 1989). The exchange of knowledge can occur at various levels in an organization: Between individuals, from individuals to explicit sources, from individuals to groups, between groups, within groups, and from the group to the organization. Knowledge transfer channels can be informal or formal, personal or impersonal. In management and individual psychology literature, knowledge transfer has received much attention and several mechanisms for knowledge transfer have been described (Argote et al., 2000). These mechanisms include movement, training, communication and observation of personnel, technology transfer, replication routines, patents, scientific publication and presentation, interaction with suppliers and customers, alliances and other forms of inter-organizational relationships. Even though a growing number of executives, consultants and

management theorists have proclaimed that knowledge constitutes a major competitive advantage for organizations, many organizations have not achieved their knowledge management objectives. Knowledge transfer is not a simple process since organizations often do not know what they know and have poor systems for locating and retrieving the knowledge that resides in them. The factors which affect effective knowledge transfer in organizations and projects are: Information technology, systems and procedures and organizational culture (Karlsen, & Gottschalk, 2004).

- **Information technology.** IT can support all forms of knowledge transfer, but has mostly been applied to informal, impersonal means (such as discussion databases) and formal, impersonal means (such as corporate directories). One innovative application of technology for knowledge transfer is the use of intelligent agent software to develop interest profiles of the members of an organization in order to determine which members might be interested recipients of point-to-point electronic messages exchanged among other members. IT can increase knowledge transfer by extending the individual's reach beyond the formal communication lines. Computer networks and electronic bulletin boards and discussion groups create a forum that facilitates contact between the person seeking knowledge and those who may have access to the knowledge. Employing video technologies can also enhance transfer.
- **Systems and procedures**. Knowledge is only valuable if it is appropriate, accurate and accessible. Successful knowledge management and transfer require necessary systems, methods and procedures. According to Seng et al. (2002), these systems and procedures constitute a framework for knowledge transfer, i.e. identifying what a user wants or needs to know, how knowledge should be created, collected, stored and shared and the responsibilities for the process. This framework should also include a clear organizational plan on knowledge transfer, e.g. a procedure instructing all project managers to write an experience report at the end of the project.
- **Culture.** Organizational culture is increasingly recognized as a factor in promoting intellectual assets. According to Long and Fahey (2000) there are several ways in which culture influences behavior central to knowledge creation, sharing and use. First, culture – and subcultures in particular – shapes assumptions about what knowledge is worth exchanging. Second, culture defines the relationships between individual and organizational knowledge, determining who is expected to control specific knowledge, as well as who must share it. Third, culture creates the context for

social interaction that determines how knowledge will be shared in particular situations. Fourth, culture shapes the processes by which new knowledge – with its accompanying uncertainties – is created, legitimated, and distributed in organizations.

2.2.4 Knowledge Capturing

According to Stan, (2016), there are five KM methodologies that can be used to capture knowledge.

Exit Interview: is a tool used to capture the knowledge of departing employees. Many firms conduct exit interviews, but these are usually focused purely on personnel factors. Exit Interviews can be part of a KM strategy and have knowledge capture as their focus.

Knowledge Harvesting: is a tool used to capture the knowledge of experts and make it available to others. Knowledge Harvesting converts expertise into knowledge assets. The organization can be protected from expensive personnel losses and defections, and from the unavailability of expertise when and where needed. A Retention Interview can be used for this.

Knowledge Jam: is a process for bringing out know-how via a facilitated conversation between knowers and seekers, with a built-in step to circulate or translate what was learned. Knowledge Jam helps to surface tacit knowledge, and puts it to work using the disciplines of facilitation, conversation, and translation.

Knowledge Modeling: also known as Knowledge Capture and Modeling (KCM), is a process of creating a computer-interpretable model of knowledge or standard specifications about a kind of process, facility, or product. It is a cross-disciplinary approach to capture and model knowledge into a reusable format for purpose of preserving, improving, sharing, substituting, aggregating and reapplying it.

Retrospect: is a structured and facilitated knowledge capture meeting at the end of a project, involving as many of the project team as possible. It is a quick and effective way of capturing knowledge before team disbands. If a member from the next team to undertake a similar business challenge participates in the discussion, a retrospect for one team can serve as a peer assist for the next one.

2.2.5 Knowledge Management in organizations and its importance

KM is generally regarded as a systematic technique for creating, obtaining, and disseminating, leveraging and using expertise to retain competitive gain and to reap

organizational objectives (Nicolas, 2004, p. 20). However, several authors have offered KM different kinds of definitions, and none of them are really correct or incorrect. The correct definition of KM varies by organization, and KM programs are typically linked to organizational goals and intended to achieve specific outcomes, such as improved performance, competitive advantage innovation, lesson learned transfer, and the general development of cooperative applications (Terzieva, 2014, p. 1087).

There is no doubt that knowledge management contributes significantly to organizational success (Duffield & Whitty, 2015, p.311), as one of the goals of knowledge management is to ensure that the right knowledge is available in the right forms to the right entities at the right times for the right costs (Duffield & Whitty, 2015, p.311; Holsapple, 2008, p.837). A business enterprise (Machuca & Martinez, 2012, p. 1297) sees considering "what every person within the business enterprise As a prerequisite for gaining enduring competitive advantages, companies must know what they know and how they use what they know. Furthermore, as the world rapidly moves toward a global knowledge society, KM skills are becoming increasingly important to decision makers' competitiveness (Holsapple, 2001, p.1).

To achieve these goals and make use of the knowledge available, companies should integrate KM efforts and activities into a scheme and strategies that will allow them to successfully collect, retain, and communicate various forms of knowledge generated within an organization. Many companies apply for information and communication technology (ICT), which is used to aid KM processes and is referred to as understanding management systems in the literature (Aidemark, 2007; Thierauf, 1999; Alavi & Leidner, 2001). Even though in this case the primary reason of KMS is stated as to leverage organizational KM behaviors (Wang & Wang, 2016).

Siemieniuch and Sinclair (2004) have developed a framework for organizational readiness for knowledge life cycle management (see figure 2). The authors examined how knowledge was created, captured, utilized and retired within the organizations. They also identified fourteen steps in order to be ready for knowledge life cycle management. These steps include below:

a) Building trust through leadership;

b) Identifying roles;

c) Establishing ownership (that is, process and content) policies for knowledge;

d) Identifying security policies to identify the leakage and ensuring the appropriate usage of knowledge;

e) Creating generic processes and procedures;

f) Altering the processes and current infrastructure;

g) Identifying reward policies;

h) Performance evaluation on knowledge management;

i) Developing measurement for knowledge sharing;

j) Identifying communities of knowledge;

k) Developing an activity-based costing approach;

l) Creating "stretch-targeting process";

m) Enhancing project review procedures for knowledge; and

n) Building dynamic knowledge databases.

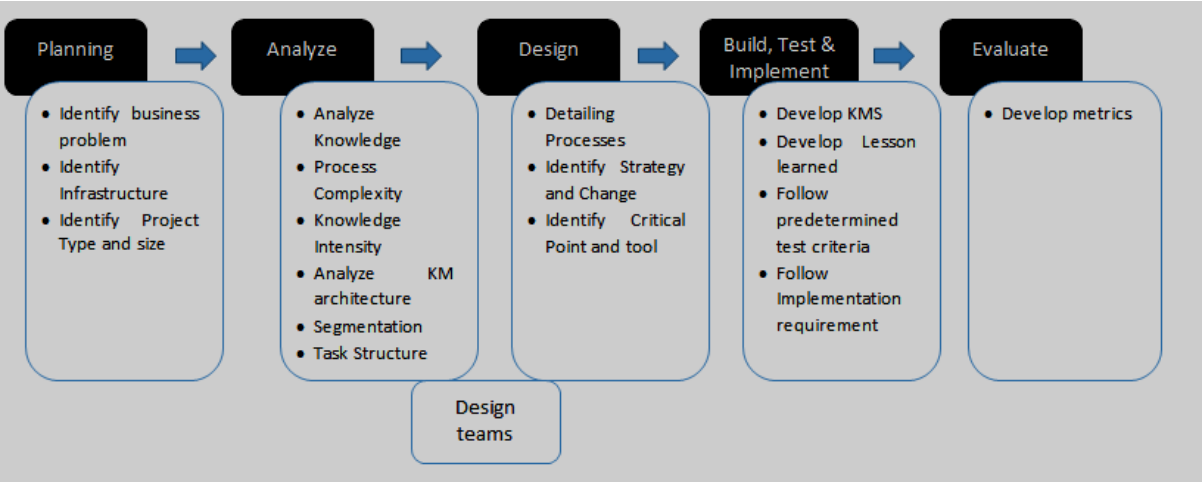


Figure 2: Proposed model for knowledge management system development life cycle, (Siemieniuch and Sinclair, 2004)

2.2.6 Knowledge Management Systems

Some definition of Knowledge management systems (KMS) has been proposed by some researchers. Alavi and Leidner, (1998) defined KMS as class of information systems that have evolved from the need to enable systematic organizational learning and memory by facilitating the coding and sharing of knowledge across organizational entities that previously may have had little occasion for interacting; which means, it is class of information systems applied for managing organizational knowledge. It also helps to facilitate the capture, storage, and sharing of knowledge using information technology by simplifying various knowledge

management processes such as knowledge creation, storage/retrieval, transfer, and application.

KMS would consist of hardware, software, people, and organization environment around it. KMS has its own characteristics several KM initiatives rely on IT as a significant enabler. Rusli and Mohd et al. (2005) also define Knowledge management system as a collection of computer based information system applied to managing organizational knowledge. KMS are applications of the organization's computer-based communications and information systems (CIS) to support the various KM processes. They are typically not technologically distinct from the CIS, but involve databases, such as "lessons learned" repositories, and directories and networks, such as those designed to put organizational participants in contact with recognized experts in a variety of topic areas.

A significant difference between many knowledge management systems and the organization's CIS is that the KMS may be less automated in that they may require human activity in their operation. While information systems typically require that humans make choices in the design phase and then operate automatically, KMS sometimes involve human participation in the operation phase. For instance, when a sales database is designed, people must decide on its content and structure; in its operational phase, it works automatically. When a "lessons learned" knowledge repository is created, people must make all of the same design choices, but they must also participate in its operational phase since each knowledge unit that is submitted for inclusion is unique and must be assessed for its relevance and important. KMS are complex socio-technological solutions, providing opportunities for users to create knowledge assets and to share them while interacting with other agents. On the other hand, KMS are recognized to be one major enabler for KM processes within organizations (Antonova and Nikolov, 2009). KMS provide the basic KM infrastructure within organizations, enabling knowledge workers and organizations to better access and use existing knowledge resources.

2.2.7 Lessons learned information system

A lesson learned is reliably defined as the learning gained from the process of performing a project (PMI 2013). It is worth mentioning that lessons can be identified at any point of the project life and by any party or stakeholder involved on the project. Since there can be numerous individuals (professionals and tradesmen) and teams involved on a project, it is therefore essential that the process of identifying, documenting and accessing lessons learned

be effectively and efficiently managed. There exist various efforts on lesson learned information systems such as the SuperBase based on relational database (Kartam 1996). The work by Eken et al. (2015) also based on relational database, explored leveraging dispersed information retrieval using web services. Mobile applications communicating with Cloud services such as windows Azure hosting Web applications and relational databases have also been proposed (Ferrada et al. 2014; Ferrada et al. 2016).

The main activities common to these lesson learned systems, as also suggested in the literature (Rowe and Sikes 2006) are to identify, document, analyze, store and retrieve the lessons learned (see figure 3). Although, the approach for combining these activities may differ in terms of order and structure in companies, they group them into three components; Users; Repositories and Quality assurance. The two main interactions of the users and quality assurance team with the repositories are to store and retrieve lessons learned information. The ease and speed with these actions are executed as and when needed goes a long way to determine the efficient functionality of the system and how knowledge can be diffused and ultimately utilized. Systems that are technological outdated, unfriendly to operate and relatively slow in response discourage project stakeholders from committing their time and efforts.

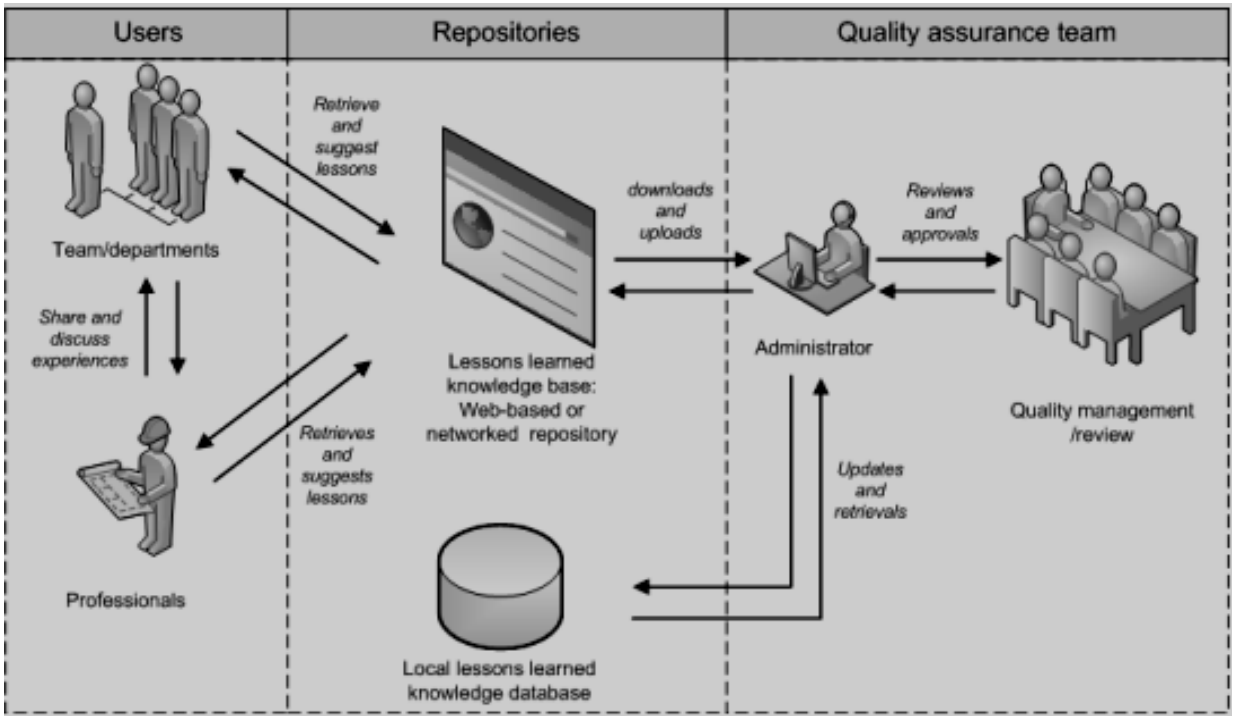


Figure 3: Lesson learned information system (Rowe and Sikes 2006)

2.2.8 Projects and Knowledge Management

Projects are temporary structures that consist of a group of people with a variety of professional skills who are tasked with achieving a certain goal or completing a specified task within budget and time constraints. This perspective informs the project's temporary and multidisciplinary nature, which primarily contributes to establishing the possibilities as well as the challenges for producing knowledge and constructing learning action (Sydow et al., 2004). Although project-based organizations' success may rely on dispersed teamwork and the actions of relatively autonomous project managers (O'Dell and Grayson 1998), coordination within and across organizations is often necessary to ensure that knowledge gained in one project is stored for use in other projects or that project-based organizations perform well.

According to Kasvi et al. (2003), all projects have a large number of potential outputs, which aren't necessarily all intentional all of the time, but must go through particular procedures that need specific knowledge. To give an instance a product brought to an internal or external customer, and the project knowledge related to the product, its assembly and use contain three types of knowledge: (one) technical knowledge concerning the product, its parts and technologies, (two) procedural knowledge concerning usage of the product and acting in a project, and (three) organizational knowledge concerning communication and association. Members of the project are not just geographically but also organizationally dispersed. They come from varied backgrounds and speak a variety of languages. A firm might, for example, bring in personnel from providers, customers, and colleges to extend a new product's appeal. Projects, on the other hand, are time-limited, and the people concerned, and the lesson learned out, are dispersed while the project ends. Often individuals alternate even at some stage in a project. Sometimes it is difficult to find people who have been involved in a project from its beginning. In an environment of employees' empowerment and information devolution which is typical of project organizations, which results in organizational knowledge fragmentation and loss of organizational learning.

One of the major challenges of project management is the insignificant and twisted accumulation of knowledge. The content and sophistication of the knowledge created vary, as well as the potential of organizations to make use of it. KM in a project can be classified into 4 organizations of activities (Kasvi et al, 2003):

- Knowledge creation- like collection, combination and refinement:

- Knowledge administration- like storage, organization and retrieval :
- Knowledge dissemination- within and outside the project and
- Knowledge utilization and production- like integration into product-sand decisions, and application in other projects.

2.2.9 Knowledge Management System Architecture

Even though several models related to knowledge management technologies have been developed, not many could be used directly to meet the objective of this paper. For example, the seven-layer knowledge management system architecture (Tiwana, 2000) which mirrors the OSI Model used in data communication is not easily understandable by non-technical consultants. The knowledge management reference model (Abou-Zeid, 2002), which is a conceptual framework for developing technology solutions, addresses the concerns of the technologists rather than those of the consultants. The KM spectrum (Binney, 2001) and the Ovum KM Tools Architectural Model (Woods, 1998) are comprehensive in scope but lack actual deployment examples and obscure references to the fundamental knowledge management processes.

Drawing from the models described above, (Chua, 2004) proposes a three-tiered knowledge management system (KMS) architecture, shown in Figure 4. The KMS architecture identifies three distinct services supported by knowledge management technologies. They are infrastructure services, knowledge services and presentation services.

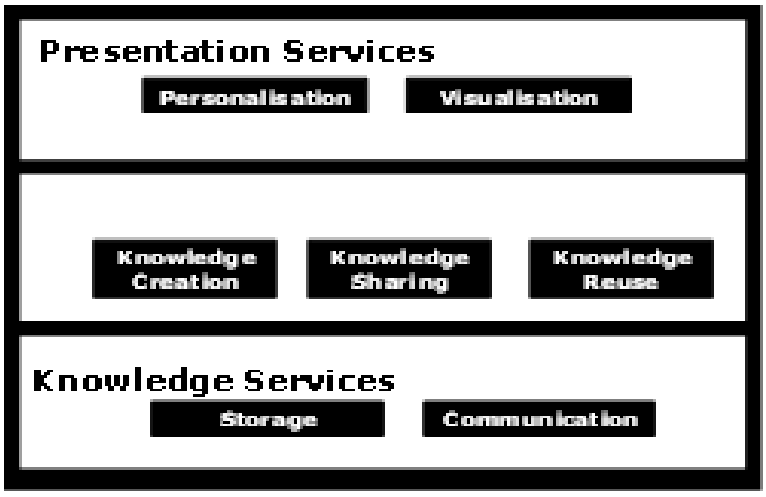


Figure 4: Knowledge Management System Architecture (Chua, 2004),

Sureephong (2007) proposed knowledge management system architecture for industry cluster, which is, adopts from three-tier KMS architecture (Chua, 2004) which identifies three distinct services supported by knowledge management technologies.

- Collaboration services: refer to the basic technology platform and features needed to implement KM. The two main infrastructure services provided by technology are storage and communication. Storage is also known as knowledge repository such as drawings, audio, video or multimedia documents. The knowledge server, which allow user to build content, create references and establish links among documents, is technology that support KM processes, particularly knowledge creation and knowledge reuse. On the other hand, communication is related to collaboration and sharing activities in the cluster. This communication services are designed by specification output from communication model of Common KADS. They could support communication between users (ex. email) among user (ex. synchronous meeting and asynchronous discussion forum) and workflow management
- Knowledge services: intended to help achieve the goals of KM directly. Three primary goals are to promote the process of generating new knowledge, encourage the flow of knowledge among organization members and ensure the ease of access to knowledge repository (Martin, 2000). First, knowledge creation: is capability to capture and codify knowledge held by experts. Domain experts or knowledge engineer did this process with the knowledge elicitation techniques provided by Common KADS. Second, knowledge sharing: is an important goal of KM technologies that support the knowledge sharing process, which is collaborative tools, such as shared spaces, calendaring, workflow management service, etc. Third, knowledge reuse: is a synonym with “information retrieval” in the information management literature. The emerging technology aim to provide enhanced search capabilities as user’s needs and automatic generation of meta-data (Marwick, 2001). Technologies that support knowledge reuse process are content management system (CMS) or concept mapping.
- Presentation services: concerned with enhancing the interface between the user and the information/knowledge source. Personalization involves gathering user information and delivering the appropriate content and service to meet the specific need of a user (Bonett, 2001). This service refers to the rule that determine how users and content are matched, based on their attributes and values. Visualization helps users had better

understand the information and knowledge available by making subject-based browsing and navigation easier (Marwick, 2001).

- Cluster Development Service: concerned with facilities for CDA to analyze and assess collaboration and sharing in the system. Technologies that support these services are social network analysis (SNA), accounting system, user's activities tracking, etc. Cluster visualization helps CDAs to visualize their cluster character such as social network map, cluster map, etc. Collaboration accounting shows the quality of communication and sharing by taking account from users' activities via KMS.

The proposed architecture by Sureephong (2007) consisted of three parts; knowledge system, ontology, and knowledge engineering. The knowledge system part interacts with users (Cluster Development Agency (CDA), cluster members, knowledge engineers, and administrator) and includes collaboration tools, repository, user's database, content management, etc. In the presentation service, CDA's tools are included for helping CDA to facilitate the cluster, such as social network analysis, cluster mapping. Knowledge acquisition part focused on supporting knowledge engineering process. During the manipulation stage, when user accesses the knowledge based, the ontology can support task of KM as well as searching. The knowledge based and the ontology is linked one to another via the ontology module. In the maintenance stage, knowledge engineers or domain experts can add, update, revise, and delete the knowledge or domain ontology via knowledge acquisition module.

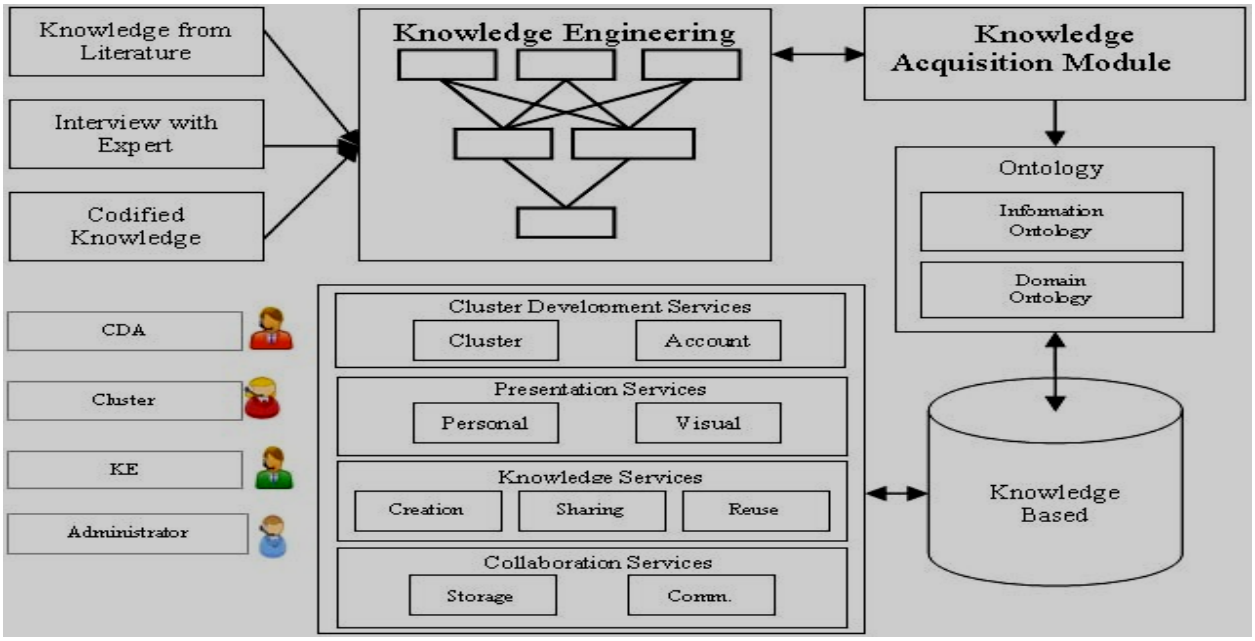


Figure 5: Knowledge management system architecture for the industry cluster (Sureephong, 2007)

According to Ismail et al. (2009), even though the extensive literature on knowledge sharing, little is known about how individuals share knowledge, especially in a project environment. They proposed a theoretical framework, which indicates that providing appropriate motivators and removing relevant inhibitors to sharing knowledge and experience would result in more efficient and effective sharing of knowledge in projects which, in turn, would lead to an increased probability of project success. The model suggests that there are significant relationships between effective project knowledge sharing practice and project success. The model was based on Nonaka's Knowledge Conversion Model and focuses on the socialization of tacit knowledge, which is currently a gap in most project environments.

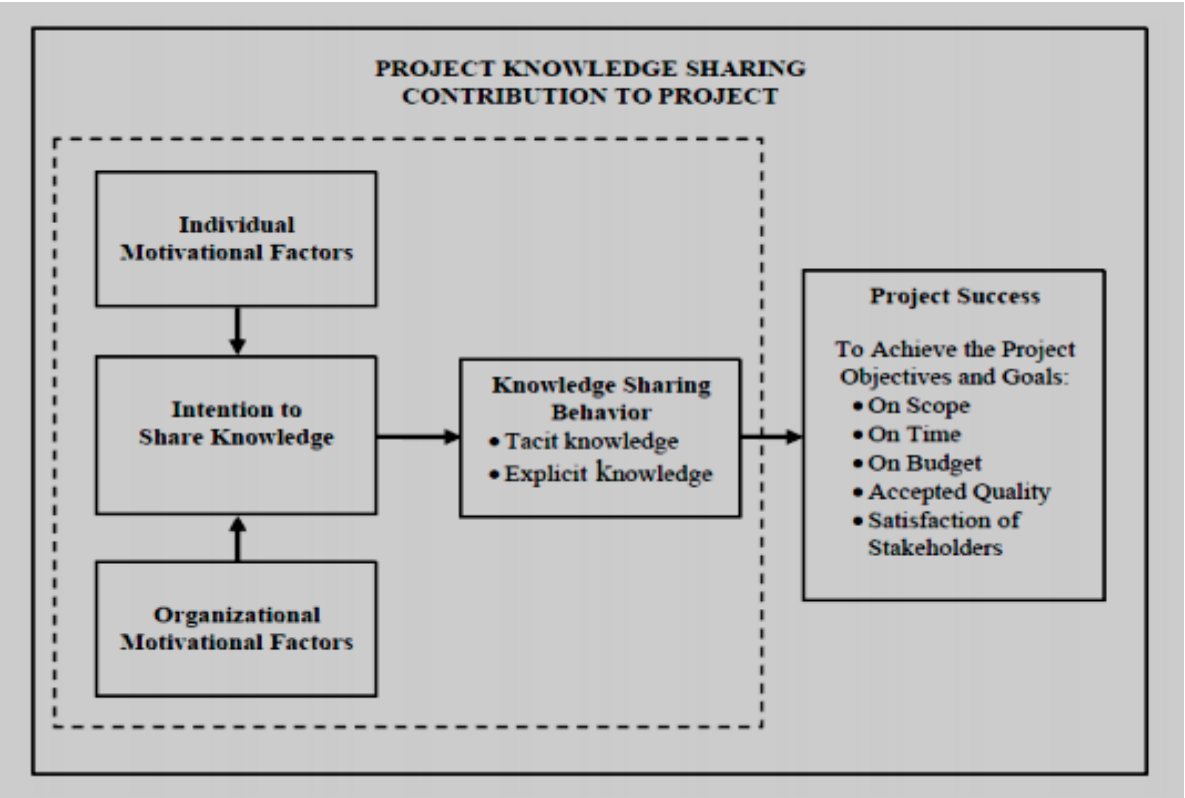


Figure 6: Framework for PK sharing contribution to project (Ismail et al. 2009)

2.3 Project and Project Management

2.3.1 Project Management definition and general concepts

A project is a temporary effort to create a unique product or service, and has clearly characterized beginning and finishing dates, a particular scope of work to be performed, a budget, and a indicated level of execution to be accomplished (Lewis, 2000). From the definition of a project we are able to see the primary important characteristics of a project: it's limited in time, so it's temporary, and it's unique, what doesn't mean that projects can't be similar, but it implies that no project is precisely the identical as the other, because

every project contains a unique product or service that's created with available resources. Consistent with this definition, every project represents a chance to accumulate new knowledge for people, and for the organization.

The tasks involved in projects require the knowledge and competence of project leader and team members (Campbell, 2008; Lierni & Ribière, 2008). It combines the knowledge and skills of domain specific experts and coordination capability of the project manager as well as the collaboration of other stakeholders to bring the desired outcome. Projects are managed with the discipline of project management, which applies knowledge, skills, tools, and techniques to project activities to meet project requirements and stakeholder expectation (PMBOK, 2013).

Project has its own lifecycle, which is a collection of logical phases that maps the life of a project from its initiation to the closing phase in order to define, build, and deliver the product of a project (Marchewka, 2003). Each phases of the project requires the art and science of experts' knowledge, skills and management for better integration of knowledge and achieve good results.

On the opposite hand, project management methodologies usually define standard project phases, processes, templates or actions that are repeated within the course of various projects. Documenting decisions and assumptions regarding resources, time, quality requirements, costs etc., may be thanks to store and share important information: Why the project idea exists, or what problem is it answering to? What are the products or the deliverables of the project visiting be? Who will participate within the project, and the way will people performing on the project be organized? When will the project happen and which are the deadlines? Additionally, in the end, experience enhances the definition of project management best practices.

As increasingly companies recognized the preferences of utilizing project management, capturing best practice to be ordinary.. Perhaps the most important change in how people viewed project management was the belief that completed projects could provide business value instead of only deliverables. Completing projects within the normal triple constraints of your time, cost, and scope isn't necessarily success if the deliverables don't bring business value to the corporate.

Businesses changed the traditional perception of project management. Business cases for projects now include a benefits realization plan and often are accompanied by a detailed

description of the business value expected at the conclusion of the project. Project selection practices and the building of the project portfolio of projects are now predicated on the desire to maximize benefits and business value. Project that were once considered pet projects for the benefits of a single individual are being removed from the queue and replaced with projects that can benefits organization as a whole (Harold, 2018).

In AASTA projects originates from expertise, technical specialist who by virtue of their experience and or study findings regarding problems of good governance in different offices will give useful information, which may lead to the implementation of new solutions or systems which improves the way service is delivered to each citizens. Sometimes requests from offices within the city administrations also good sources of projects for the agency. Projects get a permission to go ahead after the budget related issues are solved and confirmed so that the project can go based on its schedule and deadline. All the information technology related projects controlled by AASTA but the team can be organized by mixing different knowledge disciplines both from AASTA and from site representatives means the one in which the project is implemented. A well Prepared project description, Project Proposals, original and revised contract information and client acceptance documents Original and revised project plan and schedules ,design documents ,Final Project report, deliverables as appropriate , audit report, lesson learned reports and copies of all status reports are be parts of deliverables in each project.

The importance and the necessity of an efficient utilization of knowledge in organizations increase (Grillitsch, Müller-Stingl and Neumann, 2007). It is a matter of indisputable fact that individuals learn from experience, especially if they repeat similar activities because they begin recognizing different situations and that they find out how to avoid or the way to face different situations. KM enables project team members to scale back rework and squeezes the time that it takes to plan project execution (Ajmal, 2009). Sharing lessons learned and advanced practices, after all is usually recommended as a key to helping others excel in project management (Ireland, 2007).

However, experience shows often that managers not always are alert to the training processes and organizations face challenges on their tasks to project effectiveness. They could also be a part of the difficulties is blamed on the character of tacit knowledge, or other could also be found within the quantity of KM methods and practices that organizations adopt. In the later paragraphs we present photography of how organizations actually turn into action PKM.

.

2.3.2 Project Success

There are often doubts about which persons and criteria actually define project success. What does project success mean? Is there more than one way to evaluate project success, and should the same rule apply to all projects? Gray (2001) argues that the project success concept has been ambiguously defined in the project management literature. This assessment is in support of Baccarini (1999), who found that a review of the project management literature provided no consistent interpretation of the term project success.

Project success has traditionally been represented in the form of a triangle, showing cost, time and quality targets. Most project managers see their job as successfully completed when they finish the project on time, within the budget, and according to specifications. It should, however, be noted that since different stakeholders (the owner, developer, users, the general public, etc.) Have different expectations to a project, their criteria of project success also differ (Jan, 2004). The success framework suggested by Atkinson (1999) cover all this different perspectives. This framework, called "the square root," seems to cover success criteria suggested in the research literature (Baccarini, 1999; DeLone and McLean, 1992; DeLone and McLean, 1997; Kerzner, 1987; Pinto and Slevin, 1988; Wateridge, 1995). The first criterion is cost, time and quality, which traditionally has been the easiest way to measure project success (Shenhar et al., 1997). The second success criterion is the information system, the third is benefits for the client organization and finally the fourth is benefits for the stakeholder community. Jan (2004) added a fifth success criterion in which the focus is on system implementation. Hence, Jan applies the following five success criteria for IT project success:

- **Project performance**: This is the traditional evaluation criterion for project success, consisting of time, cost and quality. The project has to be completed within the time schedule and within the financial budget, and the technical requirements have to be fulfilled.
- **Project outcome:** This measurement is concerned with an evaluation of the information system itself. Important dimensions include system maintainability, reliability, validity and information-quality use.

- **System implementation:** This is a criterion concerned with successful introduction, installation, training, use, and modification of the new information system. Important dimensions include actual use and user acceptance.
- **Benefits for the client organization:** Important dimensions of this success criterion are improved efficiency and effectiveness, increased profits, achieving strategic goals, and organizational learning.
- **Benefits for the stakeholders:** Important dimensions of this success criterion are satisfied users, social and environmental impact, and personal development.

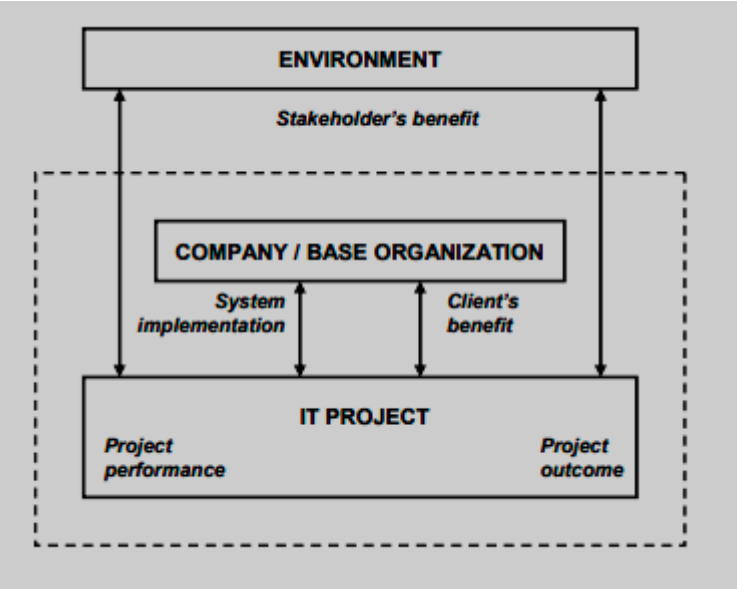


Figure 7: Success Criteria for IT projects, (Jan, 2004)

From the above figure we can see that, project performance and project outcome are success criteria that are internal to the project. Systems implementation and benefits for the client are success criteria that are internal to the organization. Benefits for the stakeholders are success criteria that are external to the organization.

2.4 Project Based Organization

It refers to a variety of organizational forms that involve the creation of temporary systems to effectively manage the project tasks (Sydow et al., 2004). The PBO is one in which the project is the key unit for production organization, innovation, and competition. It comprises of people with diverse knowledge, experience and skills who come together to solve a common problem or project tasks. In this type of organization, new and proven ideas and thoughts are combined to serve as a source of product, service and business models with a new competitive value (Kodama, 2007). They are mainly engaged on project activities during the lifespan of the project rather than

routine or continuous operation, which they are likely the characteristics of functional or service organization. PBO has a substantial interdependence of different kinds of knowledge and skills, the complexity and unpredictability of many tasks and problems, and the time delimited nature of project goals and, often, of employment. Though, there are also significant variations in the kinds of products and services offered by PBOs, and the inputs used.

Project-based organizations face challenges that may not commonly encountered by other type of organization (Fong, 2005). Because projects are temporary in nature and extended frequently, it is difficult to properly organize the knowledge flows in the organization. Beside that projects operate in a geographically scattered manner, and the teams are organized specifically for the project and often separated upon its completion. It creates fragmented knowledge reside in the organization and has influence on effective knowledge transfer among project staff and team. Fong (2005) explained this difficulty situation on creating the right KM culture and locating knowledge assets, so that accessing and internalizing previous knowledge and learning over the lifetime of a project as well as across project boundaries becomes problematic.

KM 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 are capable to use and apply this knowledge in future projects. Launching an effective PKM 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).

A project fulfills its goal within time and money limits, i.e., project constraints. The differences between an ordinary functional organization and a project organization can be described below in table 1.

Parameters	Functional organization	Project-based organization
Operations	Continuous operations	Temporary arrangement
Emphasis	Emphasis on working processes	Emphasis on goals
Working environment	Stable	Dynamic
Organization hierarchy	Inflexible, hierarchic	Flexible, non-hierarchic
Decision making	Centralized decision-making	Decentralized decision-making
Political system	Bureaucratic	Adhocratic

Table 1: Functional vs. project-based organization (Loufrani-Fedida, & Missonier (2015).

However, division between functional and project-based organizations is not clear-cut at all. According to Lundin (2000), functional organizations (i.e., permanent organizations) and project-based organizations (i.e., temporary organizations) are bonded more closely than present theory indicates). This is, the functional organizations appear to be growing more objectified and the project-based organizations growing more routinized, i.e., taking on characteristics from the functional organizations.

In Addition, Bredin (2008) also recognized a set of common features that better allows defining and understanding the nature of project-based organizations.

- **Knowledge intensity**: Since a PBO performs most of its core activities in projects, the project form is the most effective for carrying out its operations. Studies show that this organizational form stems from the rising of the knowledge economy and need to integrate knowledge resources in a fast and flexible way in order to reach a defined goal in a certain time. Therefore, project-based organizations are characterized by a high level of knowledge intensity, since competence and skills of employees have more importance than other inputs, and the majority of employees are highly qualified, and the work involves complex problem solving. (Bredin, 2008)
- **Cross-functionality:** The specific nature of projects implies the creation of cross-functional teams, which integrate competencies across functional lines; indeed they include members that have different specialties and different competence bases.

Therefore, a project-based work system requires a focus on cross-functional work in projects instead of functional departments for carrying out core activities. Cross-functionality can lead to the creation of decentralized team working and relatively autonomous project managers - thus, it is indispensable a high level of coordination (Bredin, 2008).

- **Temporality**: In a project-based organization, project work is routine rather than the exception, even if each project is unique and operations are not standardized. Thus, members carry out most of their tasks in time-limited temporary projects. According to Packendorff (2002), individuals working by projects experience a long-term trajectory consisting of a long series of projects. The temporary nature of projects involves the encounter of high variety of new different people and the creation of new relationships whenever a new project started. Hence, it requires coordination and adaptability in order to manage the resources, which are always changing (Bredin, 2008).

- **Tension between permanent and temporary systems and logics**: A project-based organization is considered as a permanent organizational framework in which temporary projects are embedded. In this regard, according to Sydow (2004), it is pivotal to recognize the contextual embededness of temporary systems in the more permanent and - above all - the related inherent tension between permanent and temporary systems and logics in such organizations. Indeed, on the one hand, projects can lead to the integration of different competencies across functional lines. Moreover, they enable the organization to concentrate its activities towards achieving the goal of the project within the set amount of time and to sustain a high level of organizational flexibility required to face the changing needs of the external environment. Instead, on the other hand, as it is shown in the study of Hobday (2000), if a PBO does not master functional coordination, it is inherently weak in coordinating processes, resources and 62 capabilities across the organization as a whole. Therefore, project-based organization have to deal with the dilemma of the conflicting needs of the temporary projects and the permanent organizational setting that defends long-term development as well as routines and inter-organizational coordination (Bredin, 2008).

- **Heterogeneity in employment relations:** In PBOs, the relationship between employees and the organization is quite peculiar, since people are employed by the

organization and not by individual projects. Thus, their relationship is supposed to go beyond the single project. Still, being 'employed' does not necessarily equals having a permanent employment contract in the PBO. Indeed, as Whitley (2006) assesses, sometimes PBOs may rely on external individuals for performing a specific task, while all the other activities are carried out by a permanent team of workers. Therefore, the workforce in project-based organization is usually divided in two categories: 'permanent' employees and 'temporary' employees such as consultants, self-employed professionals and others with temporary contracts. Conclusively, the specific features of project-based organization demonstrate the importance of managerial skills for handling the project and an excellent system of human resources management (Bredin and Söderlund, 2013).

2.4.1 Challenges in Project based organization

The project-based form of organizing is not a panacea though, as it entails a number of distinct challenges. Specifically, the temporal character of projects poses strong challenges to long-term organizational learning, knowledge management and innovation (Davies and Hobday, 2005; DeFillippi, 2001; Keegan and Turner, 2002; Prencipe and Tell, 2001; Sydow et al., 2004). Additionally, a multi-project environment creates conditions for a fierce competition over limited organizational resources (Engwall and Jerbrant, 2003), tensions with line functions due to incompatibility of the permanent and temporary organizational logics and principles (Arvidsson, 2009), and psychologically stressful work conditions (Palm and Lindahl, 2015; ZikaViktorsson et al., 2006). On top of it, the complex political landscape of a project-based organization can jeopardize implementation of new management practices and thus hinder organizational renewal (Bresnen et al., 2004).

Project teams often start solving problems anew rather than learning from the experiences of previous projects. According to Scarbrough et al. (2004) this "re-inventing the wheel" represents a lost opportunity to improve performance from one project to the next. In addition, organizations seem to only partly adapting management behavior based on lessons learned, and learning in projects is at best transferred though individuals moving to new projects or through personal networks (Swan et al., 2010; Williams, 2003). Many project managers view lessons learned as a valuable and important exercise, but do not have enough time to manage them (Kotnour, 2000).

Project-based companies will tend to suffer from certain weaknesses, e.g., bring about company-wide development and learning (Hobday, 2000) and difficulties in linking projects to firm level business processes (Gann and Salter, 2000). Furthermore, projects typically comprise a mix of individuals with highly specialized competences, belonging to different functionally differentiated worldviews (Dougherty, 1992) making it difficult to establish shared understandings, a common knowledge base.

Indeed, project-based companies tend to be, not only strongly decentralized, but also quite loosely coupled (Orton and Weick, 2010). This also applies to the knowledge dimension. Relevant pieces of knowledge are distributed (Tsoukas, 2012) into a multitude of local settings and a great extent of knowledge resides in individual members. Governance in such a context must take into account the organisation's fundamental dependence on its knowledgeable individuals, and its potential weaknesses in dealing with issues of company integration and development.

2.5 Project Knowledge Management

Project Knowledge Management (PKM) could be a management of knowledge in project situations and thus, the link between the principles of KM and PM (Frey et.al, 2009). KM and PM components are exceptionally comparable. PM components incorporate framework, individuals and apparatuses and KM components incorporate individuals, innovation and organizational components (Awad and Ghaziri, 2004; Lewis, 2005).As components are similar, this allows for components from both disciplines to be placed on top of each other, so they can merge and work in combination with each other as shown in figure 8 below.

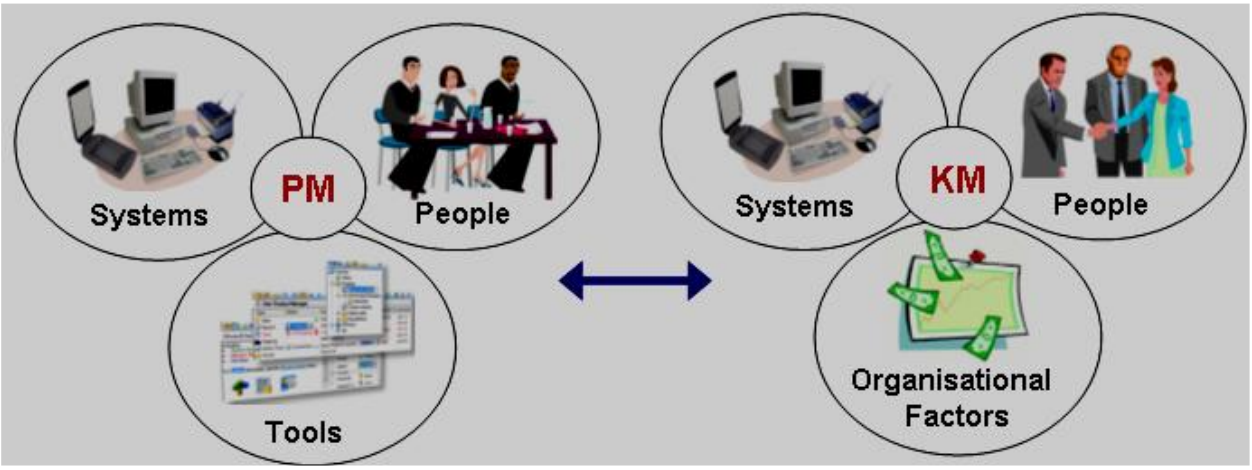


Figure 8: Knowledge Management and Project Management components, (Polyaninova, 2011)

The ability to manage knowledge on projects includes the capacity to create, absorb and share project-related information, which is a big part of organization's culture ***(****Polyaninova*, 2011***)***. Using gained knowledge to learn from the failures and successes in previous projects is vital for long-term sustainability and competitiveness of the organization ***(****Polyaninova*, 2011***)***. Although project basing is often conceived as an appropriate way of organizing for innovation, the research on project-based learning consistently highlights the problems involved in attempting to capture, share and diffuse knowledge and learning (Bresnen et.al, 2004). Effective KM in the project environment is about creating the kind of organization that promotes the creation and sharing of knowledge and which must exceed multiple cultures in order to produce a single project culture that makes use of collective experience and information to benefit future projects (Ajmal, and Koskinen, 2008).

The growing complexity of project work means that 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 ***(***Polyaninova, 2011). Project team members regularly have to learn things that are already known in other circumstances. In effect, they have to amass and integrate knowledge that exists in organizational memory. Their efficiency in doing this determines their personal effectiveness, the project's success, and ultimately, the company's effectiveness (Ajmal and Koskinen, 2008). Typically, knowledge from past projects is collected in an individual's mind or documents and repositories. People with knowledge about previous performed projects assigned to similar projects where their knowledge will be shared to learn project implementation and widen overall organizational knowledge base.

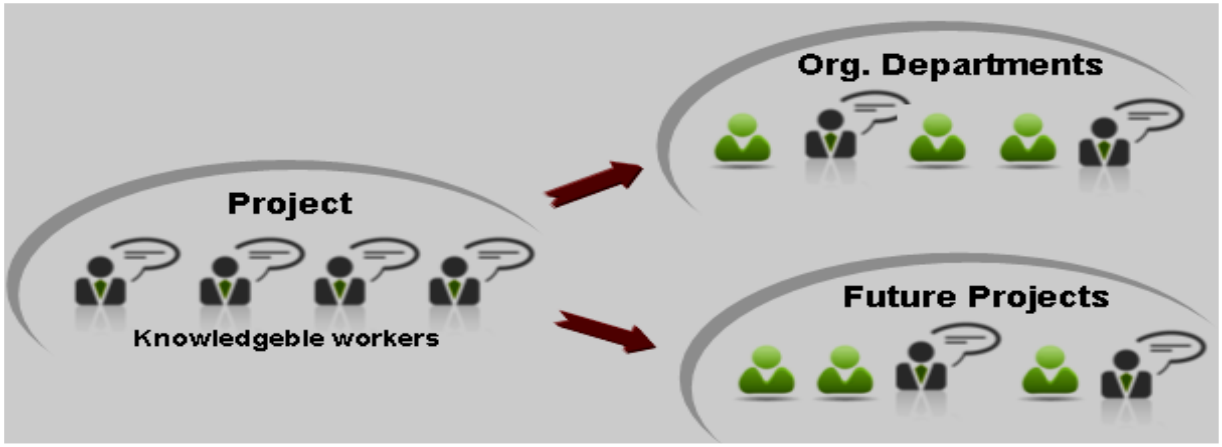


Figure 9: Project knowledge workers and knowledge spread, (Polyaninova, 2011)

Effective PKM encourages project-oriented organizations and individuals with data required for way better choice making as well as save time and assets utilization on the projects by sensible sum. In numerous cases 'successful project completion is based on collected knowledge and person and collective competence' (Kasvi and Hailikari, 2003). On projects the formation and transfer of knowledge is done for the following aims (De Long & Davenport, 1997):

i. Capturing and reusing structured knowledge**:** The knowledge from project or project phases, such as project proposals, reports, implementation documentation or software code can be used to reduce the time and resources needed to produce a new output.

ii. Capturing and sharing "lessons learned" from practice**:** Captures more experiential knowledge that must be interpreted and adapted by the user in a new context.

iii. Embed knowledge in project's products and processes**:** Seeks to enhance or create new knowledge-intensive products, services, and processes.

iv. Identifying sources and networks of expertise**:** Includes making expertise more visible and accessible to employees. The aim is to facilitate connections within the projects between those people who possess knowledge and those people who need knowledge.

v. Structuring and mapping knowledge needed to enhance performance: Project efforts, like new product development or process redesign are reduced by making clear the specific knowledge that is needed at particular stages of the project.

vi. Sharing knowledge from external sources: Unstable business environment increases the importance of organizational intelligence systems. The electronic information innovations combined with increasing complexity, specialization, and speed of market changes has lifted up the knowledge component of these systems.

There are four methods to administrative learning from involvement that creators recognize: instinctive method, coincidental method, review method and planned method (Mumford, 2009). The intuitive method is when learning from meeting isn't a conscious process and individuals who use this method accept that learning is somewhat natural, something that normally happens in spite of the fact that involvement but for them it is difficult to define what exactly they have learned. In this case knowledge selected up by experience is tacit and creates boundaries to all the advantages that may be accomplished by sharing it with others.

The incidental method on its way is characteristic for explaining learning that by chance in conditions out of the familiarity, which happen incidentally.

The retrospective method instead, is the one where persons learn from experience though memorizing and examining what happened and debating the significances from something that occurred. Very often this method is provoked by mistakes, just as it is with the incidental approach, but individuals who use the retrospective method are ready to learn from both positive and negative know-hows and make conclusions that later can serve as lessons for them or for others. According to this method, it is very valuable writing down what has been learned in order to save it.

The fourth method is the prospective one. If with all the three previous methods of learning is seen though looking back to the past, the prospective method focuses on considering forward and planning to learn in future. The learning procedure starts with planning to learn, trying to implement the plan, revising it later and then making decisions on the lessons learned. A distinctive situation where we can see this method to learning is a course, but we should recall that very often lessons learned in a course are not that simply turned into practice.

For this study the researcher used the idea of a retrospective method to enhance a full view of the situation and lets managers and experts challenge their point of view with others, hear what they have to say and record new information that individuals have gained through their work on the project and what lesson learned from their past project experience. To overcome the limitations in current Project practice on the capture and reuse of knowledge, it is necessary that learning from a project be captured while it is being executed, and presented in a format that will facilitate its reuse during and after the project.

2.5.1 Knowledge Process in Project Management

A project is defined by the Project Management Institute (PMI) as "A temporary endeavor undertaken to create a unique product, service or result" (PMI, 2011, p. 17) and the field of PM, developed from different fields of application including construction, engineering and defense, is defined by PMI as "The application of knowledge, skills, tools, and techniques to project activities to meet the project requirements" (PMI, 2011, p. 20).

Projects always produce new knowledge, including technical, procedural and organizational knowledge (Kasvi, Vartiainen & Hailikari, 2003). An important conceptual difference emerging from the cross-project learning literature is the difference between process and product knowledge. Process knowledge was found to be more valuable for cross-project

learning due to its generic nature, despite the fact that it tends to be tacit and context-sensitive, making it hard to transfer. On the other hand, product knowledge, due to its project specific nature, tends to be less valuable for cross-project learning (Bresnen et al, 2005; Newell et al, 2006). Thus, the challenge of KM in project environments is the creation, administration, dissemination and utilization of newly generated knowledge (Kasvi, Vartiainen & Hailikari, 2003) and exploitation of the knowledge gained in historical projects has the potential to improve the key dimensions of projects - quality, cost and schedule (Durbin & Wheeler, 2002; Owen, Burstein, & Mitchell, 2004; Fernie, Green, Weller & Newcombe, 2003).

However, organizations usually risk losing the valuable knowledge created during the project due to a number of common attributes of project environments: project teams typically disassemble at the end of a project; people often change during the project, project team members are often geographically dispersed and have different backgrounds (Kasvi, Vartiainen & Hailikari, 2003). This, in turn, leads to risks such as repeating mistakes, resource wastage and others.

For this reason and others, both academic studies and professional project management organizations recommend capturing the valuable project knowledge and helping the organization acquire it, in one form or another. For example, the PMI recommends on officially capturing "lessons learned" of projects "so that they become part of the historical database for both the project and the other projects of the performing organization" (p. 167) and the literature confirms that it is by far the most common learning oriented activity in project environments (Disterer, 2002). Lessons learned are typically gathered as part of a project "post mortem" review and different scholars have proposed defined processes for optimizations of post mortem sessions (Birk et al, 2002; Collier et al, 1996).

While projects' lessons learned are typically stored in an electronic format and placed in a shared location, there is no evidence in the literature of a successful utilization of this knowledge in future projects. Julian (2008) identified four barriers for an effective use of lessons learned practices:

1. Team members' belief that their project is too unique to have its lessons learned applied to other projects.
2. Time pressures that reduce or eliminate formal time for learning and reflection.

3. "Political" fears related to the need to "point fingers" at other team members as part of the lessons learned capture.
4. Tendency to defer learning and reflection activities until the close of the project.

Alternatively, joint work among communities of practice has proven to be more effective than technological approaches (Newell 2004, Prencipe & Tell, 2001), which can take the form of debates, brainstorming session, mentoring etc (Liebowitz & Megbolugbe, 2003). However, often the limited time span of the project does not allow for creation of a sufficient level of trust among the project team that is necessary for transfer of tacit knowledge (Nicholas, 2001). In addition, senior managers play in cross-project facilitation through creation of connections between project teams (Cleland, 1988; Brensen et al., 2003; Newell et al., 2006).

2.5.2 Knowledge Management in Projects

A few studies have tried to capture the use of knowledge management in project environments (Kasvi et al., 2003; Jagadeesan & Ramasubramanian, 2002; Disterer, 2002; Kotnour, 1999). Even though they have all been entitled to a certain company, these studies have not made any attempt of dividing projects into categories. Disterer (2002) puts knowledge management into the project context, and states that the responsibility for transferring knowledge and experience from the temporary project organization to the permanent organization is assigned to the project management. The knowledge transfer refers to the transfer of both the project result and about the lessons learned throughout the project. The transfer of the knowledge about the project result could be documentation-based (e.g. technical documentation, drawings, etc.) or process-based (e.g. training). On the other hand, Distester (2002) also states that the lessons learned cannot be transferred in the same way as the knowledge of the project result. Hence, two different types of knowledge management strategies should be used in a project, one used to capture knowledge about the project result, and one used to capture knowledge and experience about procedures and events in the project. To capture the knowledge and experience about procedures and events, Distester (2002) suggests that in the project management there should be tasks designated to identifying and securing knowledge. Distester (2002) further argues that, for an organization as well as for a project manager, to be able to manage complex projects, it has to manage and use knowledge from the permanent organization and from other projects. This is depicted in figure 10 below.

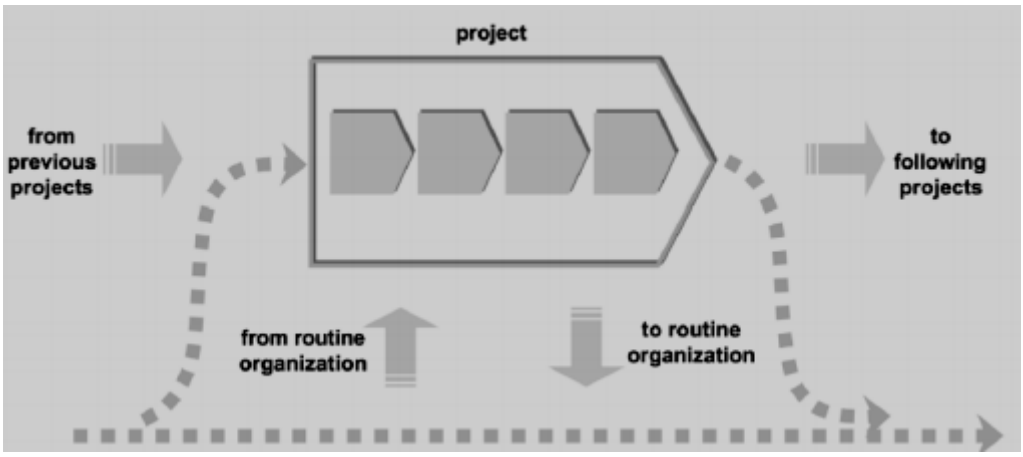


Figure 10: Knowledge between project and the permanent organization (Disterer, 2002:515)

Distester (2002) concludes that the tasks of project management need to be supported by tasks of knowledge management to strengthen the reuse of knowledge. Brooks and Leseure (2004) show through their research that good project management practices correlate with good knowledge management practices. They state that in their research they made the experiences that where knowledge reuse was a problem, there was also a problem with the overall project management.

2.5.3 Implementation of Project-Based KM

Modern organizations have to react fast and be flexible to innovative and interdisciplinary questions. Therefore, organizing by projects is on a strong increase, because projects are accepted to be learning intensive organizational forms. But the boundaries between projects and the permanent organization are strong barriers for knowledge and experiences gained in projects (Disterer, 2002, p. 512). This temporary nature of projects is considered by most scholars as the biggest challenge for project-based knowledge sharing. Focus on different stages of project-based KM process Based on the review of recent literature, Disterer (2002, p. 513) argue that most researchers see project closing as the most important phase to identify and capture new knowledge and to prepare the knowledge for transfer to other projects. One of the most popular forms to capture the result of such reflection is so called “lessons learned”, a special documentation that describes in full and in detail the process of identification and the solution of specific and minutely explained problems, which can be used as examples for following projects (Disterer, 2002, p. 512). Another documentation tool highlighted by Disterer (2002, p. 513) for project knowledge is represented by project profiles, which cover project characteristics and summaries. Employees are granted access to the profiles and can browse through them or search for a particular one.

In addition, many researchers also suggest firms to define some organizational responsibilities for transferring knowledge and experiences from projects. This is supported by an example that SAP recently introduced full time positions called “project experience managers” in order to anchor knowledge and experiences from projects to the organization (Blessing & Görk, 2000, cited in Disterer, 2002, p. 513). Earlier studies had a slightly different focus, for instance Ayas (1997, p. 64) suggested that in order to enhance corporate learning with project management, a number of learning tools should be proposed as an integral part of the integrative approach. Therefore, the focus was mostly on learning tools, including project audits and ‘lessons learned’ database, as major supportive mechanisms, which are necessary and useful for developing skills and capabilities to confront new and different issues in future projects. The leading role of tools as major facilitators in project-based KM stays topical also in some later studies. Terzieva (2014, p.1090) lists possible methods and practices for knowledge transfer used in project management activities, including networks, interactive PM trainings, storytelling, coaching and mentoring programs, etc. - for tacit knowledge, and PM software tools, networks, intranets, portals, FAQs and many others – for explicit knowledge. Based on the findings of the quantitative study in different organizations Terzieva (2014, p.1094) argues that explicit knowledge management methods are more common, with shared folders, drives, status reports, intranets, portals and shared networks as well as PM documentation templates being the most popular tools.

Application of tacit knowledge management tools, on the contrary, was not that common and mostly performed through after action reviews, project status reviews, project post-mortems, and sometimes via networks and coaching and mentoring programs. Apart from being concentrated on tools, many authors focus only on knowledge capturing. For example, Chirumalla (2016, p.4989) suggests that the need to capture lessons learned is a continuous and major target when dealing with lessons learned. Ideas with similar primary focus on capturing were developed by Ekrot et al. (2016, p.155) who suggest measuring a formal lesson learnt system in project-oriented organizations through two main processes:

1. Capturing: Lessons learnt are captured and documented throughout the project; they are sorted and processed in a methodical manner; and they are discussed in project meetings at specific milestones. And the project team is given enough time to complete this process;;
2. Sharing: Lessons learned are distributed across divisions after project completion; the most important are frequently converted to standards and/or routines; and lessons

learned from previous projects are offered to the project team at the start of a project. And, despite the fact that the sharing process is acknowledged, knowledge application continues to be overlooked.

2.5.4 Factors for Project-Based KMS

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 (Liyanage 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.

Mas-Machuca and Martinez Costa (2012, p. 1305) also identifies KMS implementation in PBOs has three groups of critical facilitating factors for project-based KMS:

- **Strategic factors**: top management support, organizational structure, incentives to encourage knowledge sharing; alignment of KM strategy with corporate strategy;
- **Cultural factors**: corporate culture which is based on the values of trust, transparency, honesty, collaboration, professionalism, flexibility and commitment);
- **Technological factors**: measurement, business process, technological infrastructure. It is important not to overestimate the importance of technological factors. Technology accounts for only 10% of the knowledge management solution, according to Maqsood and Finegan (2009, p.306), with the remaining 90% relating to human capital. There is a shift away from a people, process, and technology-focused strategy to a more aligned and balanced one (O'Dell & Hubert, 2011, p.54). However, it is important to note that in a temporary project environment there must be IT systems effectively supporting communication, storage and retrieval of knowledge (Linder & Wald, 2011, p.887).

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); and 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 has 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).

Wiewiora1, Trigunarsyah, 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 Wiewiora1, 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 Project Knowledge Management Strategies

Two strategies can be adjusted by administrations to manage PK (Fong, 2005). Both strategies are required for fully understandable project work. Administrations can allow capturing and sharing of accumulated knowledge within the projects and group by using systematization or personalization strategies.

2.6.1 Personalization strategy

Where personalization approach is used, the knowledge sharing is attached to the person who develops the knowledge, and the knowledge is shared through direct communication. Personalization has the inherent flexibility of transmitting tacit knowledge and allows for

discussions and exchanging interpretations that may lead to the development of new knowledge as a knowledge sharing mechanism (Prencipe and Tell, 2001).

Personalization approach is defined by Prencipe and Tell, (2001) as, the knowledge that is tied to individuals who developed it and is shared by personal communication, such as discussion, seminaries or conferences. It is a a well-defined set of meta-knowledge, which is used to control how and when the knowledge or content should be applied. Personalization knowledge-sharing approaches are more suitable for organizations conducting tasks or encountering difficulties that are exceptional in nature (Boh, 2007).

2.6.2 Codification Strategy

Where codification approach is used, knowledge is captured and kept so it can be accessed and used by the entire organization. Codification can be a good way to store huge amounts of knowledge and to produce an organizational memory for all staffs (Goodman and Darr, 1998). Codification strategy defined by: Codifying the knowledge and storing it in records;

- 'Hard' project data - database records, documents, standard operating procedures, project definition, activities, history and results;
- A knowledge base which comprises the content or knowledge that is of importance to the organization;

Codification knowledge-sharing approaches are more appropriate for administrations conducting tasks or encountering difficulties that are more standardized and routine in nature (Boh, 2007). Since the aim of the research is to design and implement a PKMS, the researcher uses this strategy for project knowledge codification.

	Codification	**Personalization**
Formal	• Database of project abstracts • Database of resumes and self-classifiedexpertise categories • Lesson learned reposito-ries • Staff Directory • Project Directors Manual • File sharing system for prior project pro-	• Monthly meetings to keep colleagues informed aboutother projects • Senior staff as project and program reviewers • Project Directors brown bag meetings for sharingexperiences • Meetings • Brown bag presentations to allow others to learn aboutspecific projects • Sharing of common researchers across projects

	posals • Meeting minutes • Proposal Manual • Announcements of new project awards, new staff, new presentations and publications, andnewsworthy information	that arein similar domains to ensure they have adequate overview of all projects within the same domain area • Mentor-protégée and Buddy relationship
Informal	• How-to Manuals (e.g., for data collection) • Telephone conversations documentation	• Brain-storm with other colleagues • Broadcast e-mails to specific groups to request forcertain information • Informal project debriefs • Referrals to experts or other colleagues who have beeninvolved in prior projects and proposals • Informal one-on-one office visits for more personalcommunication • Hallway conversations and informal lunch-timeconversations • Imitation of colleague behavior • Role playing

Table 2: Formal and Informal Knowledge-Sharing Mechanisms Used by Research, Inc (Wai Boh, 2003)

2.7 Project Knowledge Management Architecture

PKM refers to a systematic arrangement of events for organizing and distributing knowledge, developing and training teams, and applying and maintaining technologies to ensure that important and filtered information is being appropriately used by and accurately shared across staffs (Linman, 2011).

The importance behind PKM is that we can apply knowledge transfer methodologies throughout the project management lifecycle to use the information collected from previous projects and make current project be managed more efficient, and benefit from better project performance. While project knowledge transfer lets us to find and share proper information across teams, managing project knowledge also means optimizing the use of the information in current project. That is one more aspect of the importance.

If the project team suffers from a lack of efficient knowledge transfer, then this situation leads to wasted activity and poor project performance. Without clearly shared goals, tasks and other information it is hard to do things efficiently. In a number of cases, the team will

fail with performing roles and assignments as there are no information management practices implemented to share and distribute project data (Linman, 2011).

PKM is a separate discipline within project management that tries to determine the optimum approach for people in a performing business to accumulate and share knowledge. In practice, project knowledge management entails a range of activities such as training, learning, and development.The logic of managing project knowledge is grouping the various project processes and relocating the knowledge in order to develop a system that aids in the organization of project information and simplifies the team's access to and use of project data. We may use existing expertise in terms of entire projects by using project knowledge transfer protocols, and then connecting personnel with the organization's existing information technology space to save time and deliver current projects faster and with better outcomes (Linman, 2011).

There's no denying that project knowledge management (PKM) is critical to successful project planning and execution. . Today in complicated and complex projects there is a high probability of losing initiative directions by teams, which are not focused on the critical activities. This results in impaired performance and wasted efforts. Meanwhile, implementing a system for managing project knowledge transfer helps to avoid misleading and focus teams on the right initiatives.

PKM also a knowledge management practiced in project situations. It creates the link between the ideas and principles of knowledge management and project management. PKM includes two fundamental viewpoints: the inter-project and intra-project point of view. Depending on the size and structure of a project, subprojects—or inter-project constellations—could exist inside a project.

Because of this, a clear differentiation between the two perspectives is not always possible. Love, Fong, and Irani (2005) made a valuable contribution by setting the base for understanding knowledge management in project environments. In their work regarding the role and processes of knowledge management in project environments, they set a particular focus on knowledge management in the context of cross-functional and international project teams as well as on the role of (organizational) learning in projects. These findings are regarded as state of the art in research and literature.

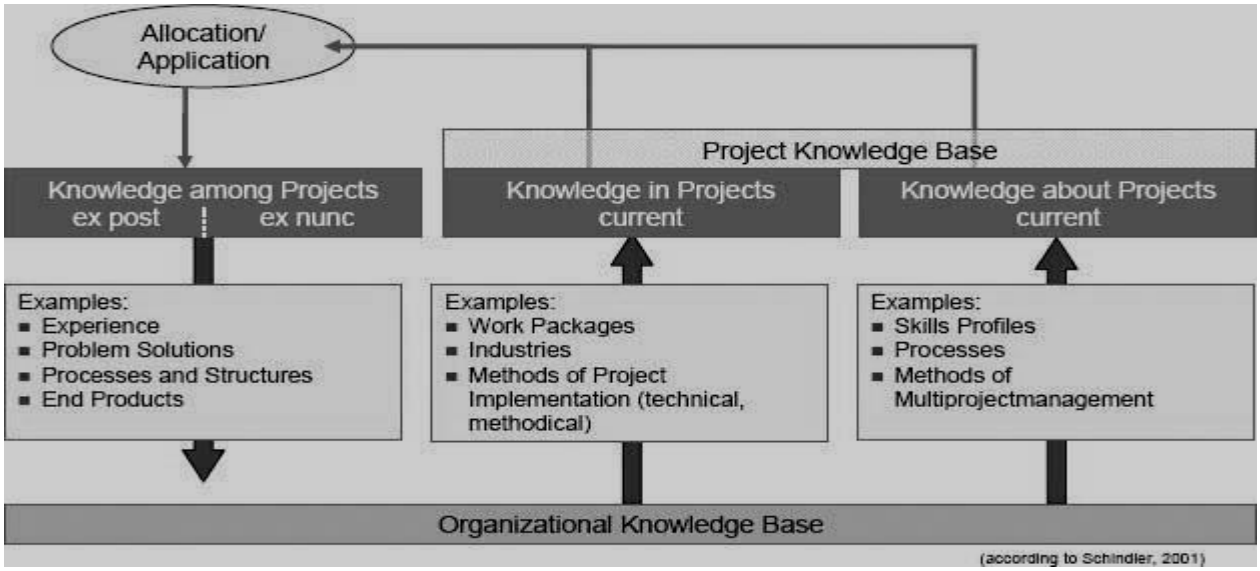


Figure 11: Schematic diagram of types of knowledge-flows in project context (Schindler, 2001)

In the context of different research activities, Schindler, (2002) built a framework of PKM and identifies three major types of knowledge in project environments: knowledge about projects, knowledge within projects, and knowledge from/between projects (see Figure 11). Knowledge within projects is closely linked to the project management methodology and the communication practices in projects. Both are strongly dependent on the project manager and the individual project management style. Knowledge about projects denotes an overview of the project landscape (the projects being conducted or having been conducted) in a company or a division of a company. The knowledge transfer from and between projects can be referred to as expert knowledge, methodological knowledge, procedural knowledge, and experience knowledge. Knowledge from and between projects contribute to the organizational knowledge base. Figure 12 below shows the knowledge elements within the different categories of project knowledge. The examples show that knowledge in, knowledge about, and knowledge from projects can belong to different types of knowledge: explicit and implicit, special, procedural, relational, and methodological.

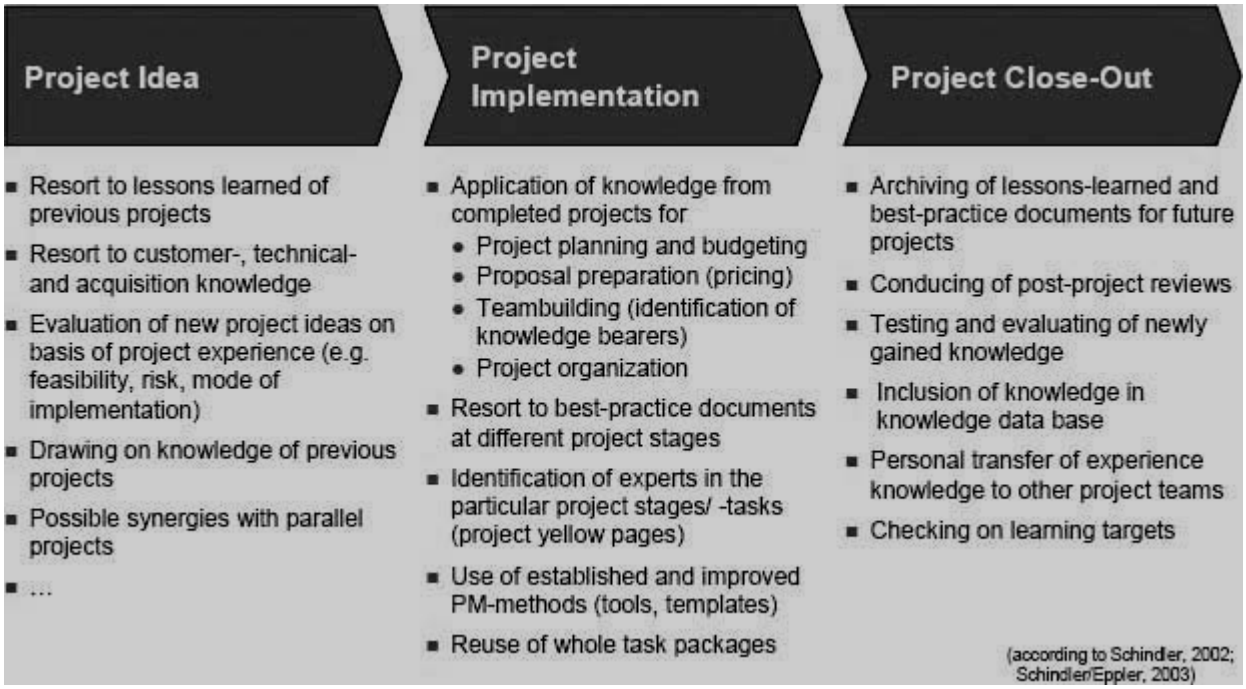


Figure 12: Options of securing knowledge along the project phases (Schindler, 2002)

It can be assumed that relevant types of knowledge differ along the project life-cycle. Experience from subsequent projects, information about the buying team, and knowledge about technology and markets are examples of knowledge pieces that are of particular importance for the acquisition and early phases of the project. Knowledge about existing technical solutions, experience from scheduling, and the application of tools might be more interesting at the stage of project conduction.

Ayas (1996) proposed a structural approach to PM learning based on the Organizational Learning Theory and the social nature of situated, tacit knowledge. She proposed a project network structure model utilizing social networks as a means of converting tacit knowledge to explicit knowledge among team members. She claimed, "The project network structure enables effective learning with project management because it enhances knowledge creation and improves the quality of information transfer within and between projects" (p. 1). In subsequent research, Ayas claimed that her model was proven successful in reducing the cost and schedule of product development projects (Ayas & Zeniuk, 2001).

Kasvi, Vartiainen, and Hailikari (2003) examined program and project KM frameworks utilized by the Finnish government and concluded that the observed KM practices were weak and unsystematic. Based on a series of interviews and questionnaires they proposed the following high-level guidelines for KM in project environments:

1. Identify KM as a critical project competence.

2. Ensure that the projects themselves are systematically managed as a pre-requisite for an effective KM.
3. Ensure that team members feel that they gain personal benefit from experience documentation and perceive its utility (Landes & Schneider & Houdek; 1999).
4. Manage both substance and context knowledge throughout the whole project process.

According to the research framework Ghodsypour & O'Brien (1998), eight types of knowledge are basic in PBOs. To rate the significance of each knowledge type, study forms were disseminated among the eight members and, in the long run, seven completed forms were returned. During four stages of the project life cycle, respondents were asked to rank the following eight forms of knowledge from one to eight, the most important ones. An Analytical Hierarchy Process (AHP) was used to examine research responses after gathering data and inserting it into MS Excel sheets. This approach investigates complex information in multi-criterion choice through hierarchical decomposition using a weighted matrix.

After determining the overall rank of eight forms of knowledge without taking project phases into account, another study was conducted to ascertain the overall rank of each type of information. As shown in Table 3, the AHP approach was used to assign appropriate weights to each entity, after which their weighted percentages were calculated and ranked.

Types of Knowledge \Project Phase	Individual Rank				Total weighted	
	Initiation	Planning	Execution	Closing	Rank	Percentage
Procedures	2	2	1	8	3	8.78%
Technical	1	5	6	2	3	8.78%
Legal and statutory	4	1	5	3	3	8.78%
Suppliers	5	4	3	4	4	10.81%
Costing Knowledge	7	6	4	3	5	13.51%
Project Management	4	4	7	7	6	14.86%
Knowledge of who knows what	6	8	3	6	7	15.54%
Knowledge about client s	8	7	8	5	8	18.92%

Table 3: Types of knowledge in Project Phase and their rank, (*Shahram et al, 2014)*

2.8 Knowledge Management Frameworks

Knowledge management framework is a sequence of activities designed with for specific output. These activities are put together in a framework to produce desired result, which should be aligned with organizational strategies and goals that gives an advantage over and above the competitors.

In this research selected comprehensive framework has been reviewed as an empirical study. These are selected because they are among the very few comprehensive frameworks available with relatively complete and detailed information for review, and are mostly cited frameworks when a unified or integrated framework is concerned. These KMFs are assessed based on the three aspects that have been identified by Lai and Chu (2000). According to Lai and Chu (2000) KMF, at a minimum, consists of knowledge resources, knowledge management activities, and knowledge influences.

2.8.1 Heisig's (2009) The GPO-WMw-Framework

Based on the results from his study, other empirical data, several KM case studies and KM projects with industrial companies and public administration, the author has developed and refined a three layered KM Framework, called the GPO-WMw-Framework. This Framework aims to embed KM into organizational practices with supporting actions in six critical enablers.

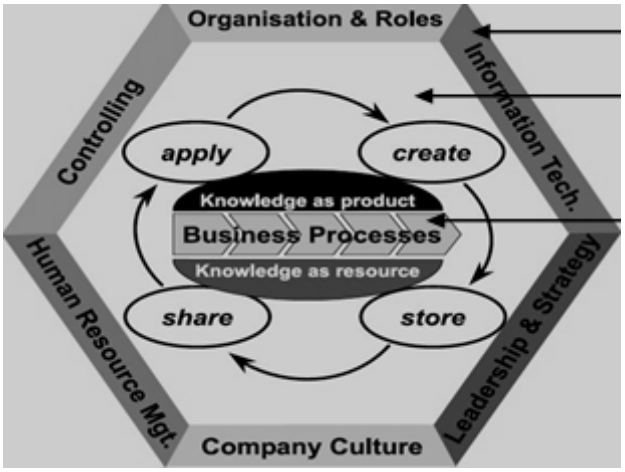


Figure 13: Heisig"s The GPO-WMw-Framework (Heisig, 2009, p. 15)

The framework has identified the following three layers (see Figure 13 above):

- **Business focus**. The business process is the context of application and generation of specific domain knowledge and its tasks are the central object for analysis and design. KM has to demonstrate its benefits for the key processes of an organization not

only from the management perspective but also from the perspective of the knowledge workers‘‘‘‘ performing these tasks on a daily basis.

- **Knowledge focus**. The systematic handling of knowledge could be described with (at least) four core activities: create, store, share and apply. These KM activities form an interlinked process. Knowledge is understood as a resource applied in the business process and by-product generated within the business process. This product could be reused by the same or another business process inside or outside the organization. Knowledge itself could appear in different forms. The organization has to determine which forms contribute most to their strategic and business objectives.
- **Enabler focus**. Successful and sustainable KM is influenced by the following key enablers: Culture, Organization and roles, Strategy and leadership, Skills and motivation, Controlling and measurement and Information technology. Practical experiences showed that a proper KM assessment related to these six design areas should be carried out at the start of any KM initiative. Successful implementation generally requires adequate measures within each of these areas.

2.8.2 The CEN framework (CEN, 2004)

This European KM Framework, designed to promote a common European understanding of KM, show the value of the emerging KM approach and help organizations towards its successful implementation. The Framework is based on empirical research and practical experience in the field from all over Europe and the rest of the world. The Framework addresses the most relevant elements of a KM approach and aims to serve as a point of inspiration and as a reference basis for all types of organizations aiming to improve their performance through dealing with knowledge in a better way. The Framework is considered as a starting point for developing, if appropriate, an organization-specific framework that serves best the needs of a particular organization’s KM approach.

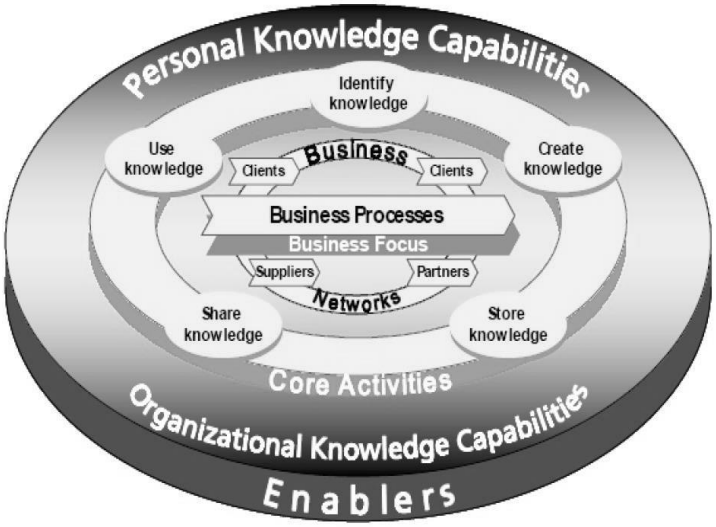


Figure 14: Knowledge Management Framework: A European Perspective (CEN, 2004, p. 7)

According to Pawlowski and Bick (2012), the CEN framework shows a clear process orientation, aiming at describing core business processes as well as knowledge-related processes. It extends those processes by enablers: knowledge capabilities on an organizational (e.g., vision, strategy) and individual level (such as skills, competences, methods, tools). This framework has created a common terminology and structure as well as guidelines around those.CEN (2004) is the framework created in the European standardization community and it is one of the major frameworks currently used in practice. It provides a common terminology and frame of reference for organizations involved in knowledge management.

2.8.3 Lai and Chu's (2000) KM Framework

Lai and Chu (2000) divided KM into a comprehensive theoretical framework that consists of seven steps: initiation, generation, modeling, repository, distributing and transfer, use, and retrospect. Initiation stage is concerned with understanding requirements for knowledge and or the recognition of strategic capabilities and knowledge domain. As depicted on figure 15 below, generation is concerned to identify what knowledge exists in the organization, who owns it, and what is needed to gather and import knowledge from outside or learning from existing knowledge. Modeling phase is concerned with justifying the generated knowledge. Repository stage is necessary in order to maintain the explicit knowledge and facilitate further sharing.

According to Lai and Chu (2000), it is important to have a repository for maintaining all critical knowledge. Distributing and transferring phase is concerned with how to distribute knowledge to other people. The next phase is the use of the knowledge that describes how to develop knowledge in order to produce commercial value. Finally, retrospection stage includes examination of the process, performance of KM and detecting if new knowledge was created in order to keep pace with knowledge creation and management in a changing environment.

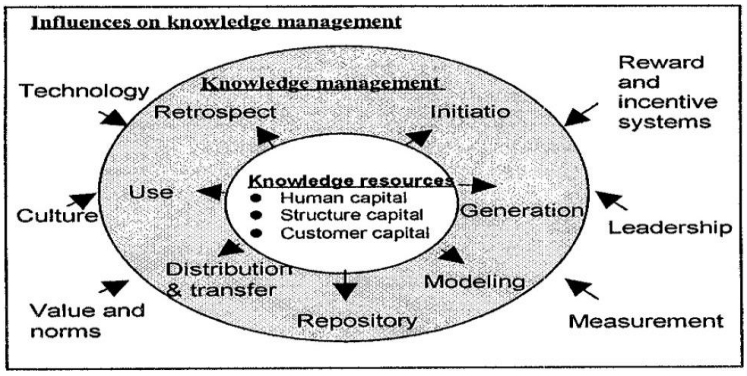


Figure 15: Lai and Chu"s Knowledge Management Framework (Lai & Chu, 2000, p. 5)

2.8.4 Karemente et al., (2011) 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 as shown in Figure 16. 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 inters- 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, p. 48), it has been observed that particular attention be paid to organizational influences without which the success of KM becomes doubtable.

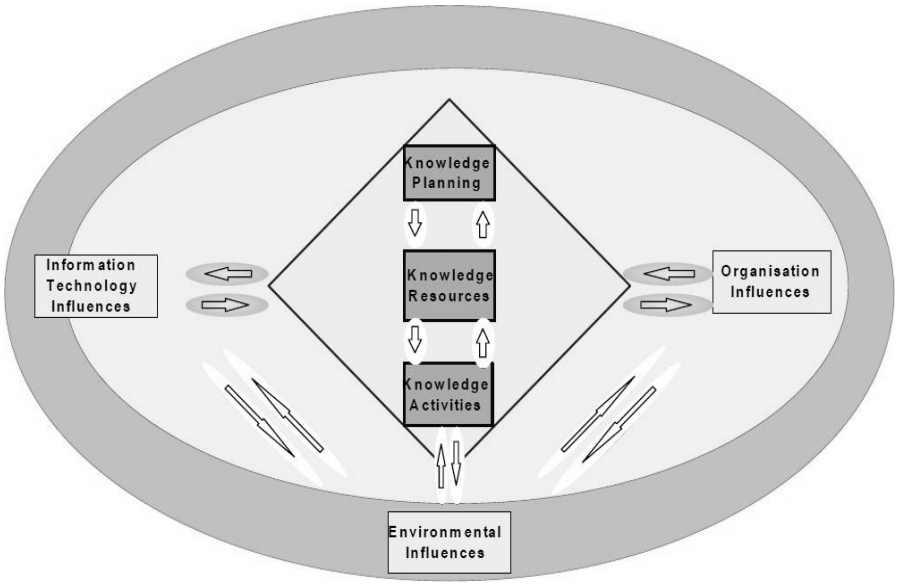


Figure 16: Comprehensive Knowledge management Framework.

Source: (Karemente et al., 2011, p. 46)

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, p. 51), 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.

2.8.5 Pawlowski and Bick's (2012) Global KMF

The main goal of the Global KMF (GKMF) is to identify and relate global influence factors for distributed knowledge management projects in global settings. It also aims at providing a base for research (as an analysis tool) and practice (as a guideline for development). The GKMF framework development is based on a combination of frameworks, including CEN (2004) and Heisig"s GPO-WMw-Frameworks, and an analysis of influence factors, barriers and challenges in global settings from different literatures.

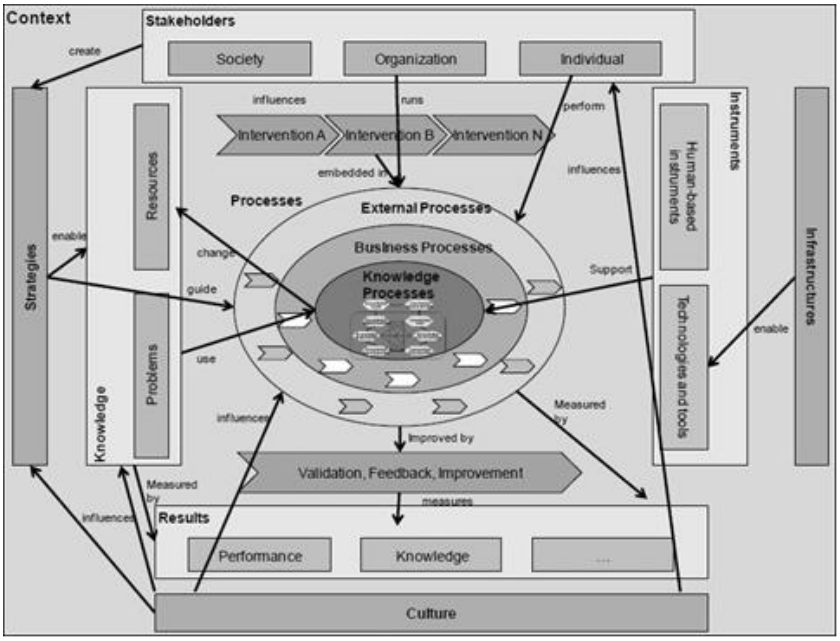


Figure 17: Global Knowledge Management Framework (GKMF). (Pawlowski and Bick, 2012)

The core of the framework is described by processes on three levels: knowledge, business and external processes (Figure 17). Business processes denote the core processes of an organization. The core business processes are supported by embedded knowledge processes which enable knowledge management within and outside the organization. In the global context, those processes are highly related to external processes with stakeholders who are distributed across the globe. These processes are also accompanied by interventions and supporting processes.

The category ”stakeholders“ describe characteristics of participating stakeholders. This can be related to individuals, organizations or societies. The sub-category ”context“ describes the context or environment in which knowledge management takes place. In most cases, it relates to organizations or society as well. The “knowledge“, and “instrument“ component describe and characterizes knowledge aspects and elements which are shared or required in the organization, and methods and activities to realize the knowledge processes respectively. The main categories of instrument are human-oriented and technological instruments. Finally results in the GKMF describe the key outcomes of the knowledge processes using some form of assessment and metrics. Comparing to other frameworks, the GKMF is complex in its design with many components in it.

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 the organization to design a project knowledge management system 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 prototype with aligning the organization readiness and to formulate questionnaire.

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".

Dimension	Definition
Strategy	A well-curated plan that allows the organization to formulate a plan of action to achieve a sustainable competitive advantage, reinforced by the organization's mission and values.
Structure	Basis of specialization and co-ordination influenced primarily by strategy, size, and diversity of organization.
Systems	Formal and informal procedures that support the strategy and structure.
Style	Consisting of two components: Organizational culture: the dominant values, beliefs, and norms which develop over time and become relatively enduring features. Management style: more a matter of what managers do than what they say; how do the organization managers spend their time; what are they focusing on.
Staff	The human resource management- processes used to develop managers, socialization processes, and ways of introducing young recruits to the organization.
Skills	Skills form the capabilities and competencies of a company that enables its employees to achieve its objectives.
Shared Values	Guiding concepts, fundamental ideas around which the organization is built

Table 4: Definition of the elements of McKinsey 7S (Alshaher, A. A. F., 2013).

The researcher adopts a multidimensional Conceptual model to the design of a PKMS. The advantage of using multidimensional model is that the contribution of each dimension in a higher level construct can be assessed as compared to setting all items in a single composite score.

2.9 Related works

There are some research works in the area of knowledge management system framework design which are similar with this study. The researcher focused on the research works which are appropriate and having a direct link with this study. Hence, the most related works are reviewed here respectively.

2.9.1 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 focused on designing a knowledge sharing framework for Addis Ababa Land Holding Registration and Information Agency (AALHRIA). But this thesis focused on designing a project knowledge management system for project based organizations.

2.9.2 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 sect oral 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 sectorial 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. But this thesis focused on designing a project knowledge management system for project based organizations

2.9.3 Analysis and Design of Knowledge Management System for School of Information System at XYZ University

Yohannes Kurniawan and Siti Elda Hiererra (2014) studied about how to analyze and design knowledge management system for school of information systems at XYZ University. The research was qualitative and used literatures and direct observation as a data collection method. According to the findings of the study,

- All management institutes possess a state of the modern information infrastructure;
- Sharing knowledge among teaching staff, students, and administration staff in all management institutes;
- The academic environment in generally is considered trustful in the sense that no one is hesitating nor being afraid of publishing knowledge;
- Each institute wants its internal documentation management and the level of information and knowledge sharing to improve;

- There is an increased demand for few strategies that help management institutions meet external and internal demands.

The researchers concluded that by proposing a web based knowledge management system design. The researcher recommended that the system design model can be implemented by other universities which want to implement the knowledge management system. Yohannes Kurniawan and Siti Elda Hiererra (2014) designed a KMS system for school of information systems at XYZ University. But this thesis differs from Yohannes Kurniawan and Siti Elda Hiererra (2014) by designing a PKMS to facilitate project knowledge sharing and reusing for AASTA context.

2.9.4 Designing a knowledge reuse framework for project based organizations

Mekdes Asema (2020) explored the existing practice of knowledge reuse and to propose knowledge management framework to improve project knowledge reuse within the organization which is Information Network Security Agency. The general objective of the research was to propose knowledge management reuse framework to improve project knowledge reuse between and among projects within the organization, so that the organization be able to successfully retain knowledge management practice and decrease chances of project rework.

The study followed qualitative and the design science research methodology in addition with both questionnaires, in depth interview and focus group discussion method was used as the data collection method. The research identified organizational and individual factors that have direct influence on project knowledge reusing activities. The study proposed a knowledge management reuse framework that retain knowledge management practice and decrease chances of project rework in Information Network Security Agency. But this thesis focused on designing a project knowledge management system for project based organizations with respect to project knowledge areas.

2.10 Research Gap

From the related works the results of all projects that make up project based organization achieve its goal. According to Disterer (2002), most businesses were unable to review initiatives and learn from their prior mistakes. This is due to a lack of effective knowledge management. Expert knowledge should be used and stored as a repository throughout the project's life cycle. This means that it can be used later by a newcomer to the project or by the expert on another project within the same organization.

It is difficult to create PKM architecture without considering some technological support tools (Ali & Ahmad, 2006). Although there is a general proposal for KMS architecture (see Gupta et al., 2008; Sureephong et al., 2007; Karadsheh et al., 2009), it cannot be directly implemented to Design PKM Architecture in AASTA.KMS development requires design of an architecture that fits to existing KM practices (McDermott & O'Dell, 2001). In addition, the work by Mekdes Asema (2020) followed qualitative and the design science research methodology. Both questionnaires, in depth interview and focus group discussion method were used as the data collection methods. The research identified organizational and individual factors that have direct influence on project knowledge reusing activities. The study proposed a knowledge management reuse framework that retain knowledge management practice and decrease chances of project rework in Information Network Security Agency. But this thesis focused on designing a project knowledge management system for project based organizations with respect to project knowledge areas. The prototype tries to manage project knowledge up to task level and also tries to develop a different knowledge sharing mechanisms.

This research fills the gap of the shortage of the PKM system design studies in Ethiopia. According to the Literature review, there is absence of studies about PKM system design and its implementation especially in Addis Ababa governmental offices. Hence, this study has practical contribution in attempting to explore the existing PKM practices and develop a prototype that satisfies AASTA PKM demand.

CHAPTER THREE
RESEARCH DESIGN AND METHODOLOGY

This chapter deals with the research design, methodologies and tool adopted to conduct this research together with explanation and justification as to why such methods and techniques were used to produce the research findings that follow.

3.1. Research Design

Research design aims to give a clear picture of the structure of the research and the used methods such as data collection, research questions, and sources of data. Research design enables the researcher outline all needed method and tools for the research like selecting theory of project and research methodology (Mohamed & Volodymyr, 2016). Two ideal models characterize much of the research within the Information Systems discipline: behavioral science and design science. The behavioral science paradigm looks for to create and confirm theories that explain or predict human or organizational behavior. The design-science paradigm looks for to extend the boundaries of human and organizational capabilities by making modern and inventive artifacts. Both ideal models are foundational to the IS discipline, positioned as it is at the confluence of individuals, organizations, and technology.

Hevner et al. (2006) have presented a set of guidelines for design science research within the discipline of Information Systems. Design science research needs the creation of an innovative, purposeful artifact for a special problem domain. The artifact must be evaluated in order to ensure its utility for the specified problem. In order to form a novel research contribution, the artifact must either solve a problem that has not yet been solved, or provide a more effective solution. Both the construction and evaluation of the artifact must be done rigorously, and the results of the research presented effectively both to technology-oriented and management-oriented audiences.

Design Science Research (DSR) creates and evaluate IT artifact intended to solve the identified organizational problems (Gacenga et al., 2012). DSR has been seen to constitute the third form of science "Artificial" in addition to the natural sciences and the human sciences (Alturki et al., 2013). It is also seen as a research activity that build new or invents, innovate artifacts for problem solving or improvement attainment such new innovative artifact create a new reality, rather than the existing reality been explain or trying to make sense from it, it creates, and evaluates IT artifact which is intended to solve some identified

organizational problems (Alturki et al., 2013). DSR is seen as the other side of IS research cycle that creates, evaluates information Technology artifacts intended to solve problems identified in an organization (Hevner, Salvator, Park, & Ram, 2004).

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 questions raised, a design science process model suggested by Peffers et al., (2006) is followed, which encompasses six steps: problem formulation, define objective of the solution, design and development, demonstration, evaluation finally communication. The problem centered approach is the entry point of this research so that the researcher can identify the problem area in detail regarding the management of project knowledge so that it is a good source to define the research objectives.

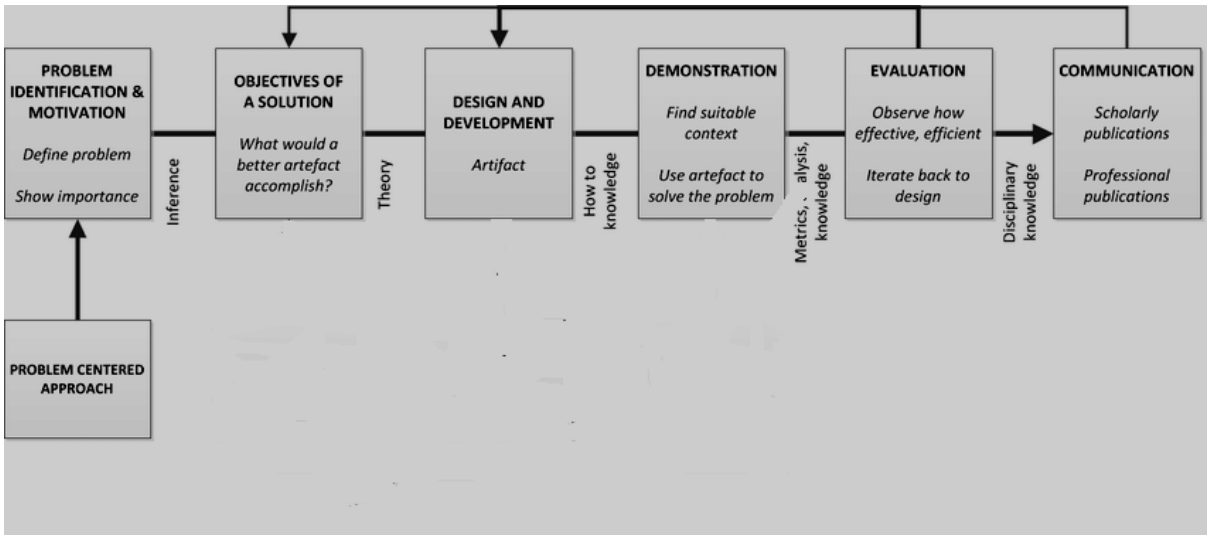


Figure 18: Design science research process (DSRP) model, (Peffers et al, 2006).

3.1.1 Problem Identification and motivation

Most organizations are not able to evaluate the performance of projects and learn from them. As emphasized by Karlsen and Gottschalk (2004), it becomes challenging to develop steady routines that exploit knowledge flow and capture learning, both in the project and from one project to the next. In project-based organizations, knowledge management is frequently a difficult endeavor, as project teams frequently consist of individuals with varying levels of experience working together for a limited time. Project team often contains members who

have never previously worked together and do not expect to work together again (Ajmal and Koskinen, 2008). Many projects lack knowledge capture, which can lead to upcoming projects failure due to the lack of supporting documents. Technology such as "knowledge bases" and "lessons learned" systems, according to Obaide (2008), are available to support knowledge storage and documents, but this documentation is rarely intended for future projects. Documentation needed for future projects represents procedures, proceedings, outlines of precise problems, explanation of successful and unsuccessful solutions and a directory of individuals who possess specific knowledge and skill (Obaide, 2008).

An example of a capture process is storing information on every project undertaken by an organization in a project repository. This allows members of the organization to search the database to find out if there is knowledge from previous projects which can be applied to new ones. This can be used in multiple ways. Sometimes you need to answer the question “have you ever done this before” when proposing a new project to a customer. Or you want to review lessons learned from prior work. Reusing documents such as proposals, statements of work, project plans, and designs is another benefit of KM.

At the junction of two management areas, which are PM and KM, arises the problem which was recognized by Thiry and Deguire (2007) who argued that project-based organizations have problems with the integration of knowledge. The problem which might be not so important for a singular project becomes a significant issue for organizations that use projects on a regular basis for delivering their strategic objectives. Under detailed consideration, the problem of knowledge integration can be seen as an analogy with an iceberg, have a giant invisible level. For example, Leseure and Brooks (2004) highlighted such issues as corporate memory loss during downsizing or other structural changes; low professional level of employees because of lack of time for training; repeating the same mistakes in different projects; low level of innovative solutions in an organization; and poor communication between upper and lower management.

Reich, (2007) uses the term Knowledge Trap to identify those times or events within an IT project in which there is a loss of project-specific knowledge (Schindler & Eppler, 2003), where the project lacks some relevant knowledge, or where knowledge is not created or applied optimally. The author, Reich illustrates the four parts of Knowledge Traps model.

1. Inputs: A project’s knowledge inputs
2. Process: A project’s governance

3. Process: A project's operational phases—plan, design, build/configuration, and implementation.
4. Outputs: A project's delivery and its closeout

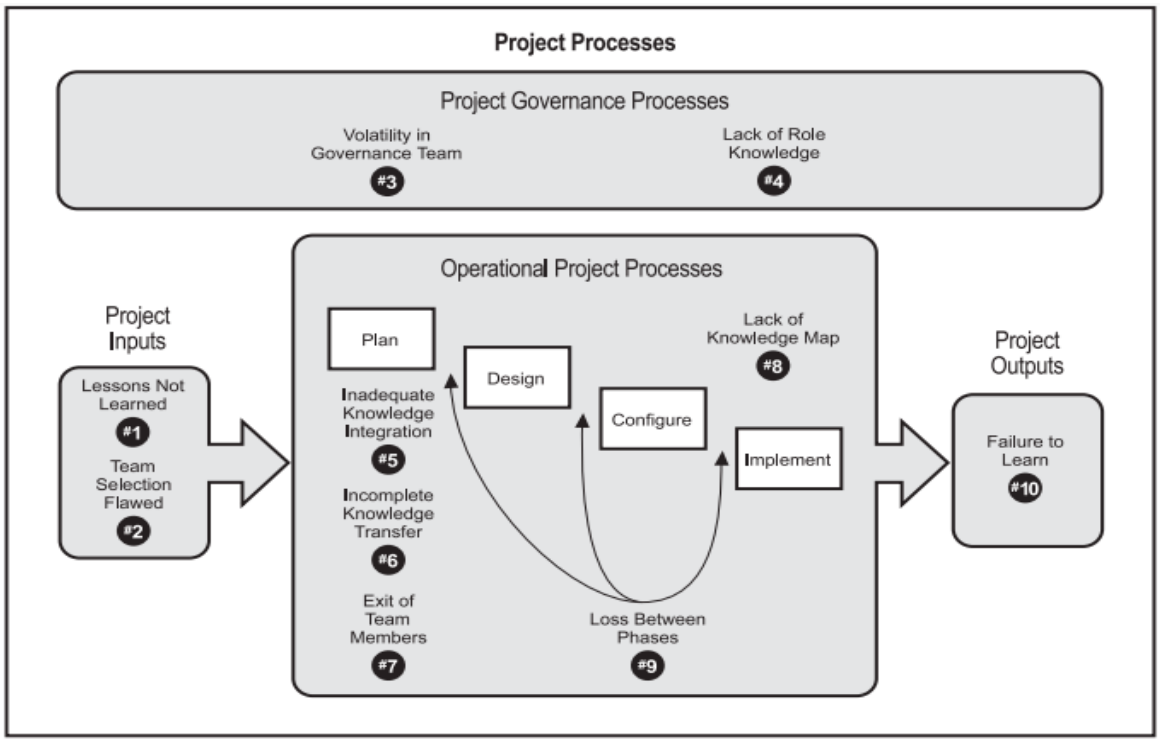


*Figure 19: Knowledge traps in IT projects (*Reich*, 2007)*

AASTA has been in ICT-Based Service for years with many kinds of information technology based projects implemented on different offices under the city administration of Addis Ababa. It has, thus, acquired a lot of experience, insights, skills, and expertise in the process. Both tacit and explicit knowledge have been generated from the projects implemented at AASTA. However, the accessibility of the Project knowledge resources does not match up with the rich experience of the AASTA, because the knowledge that is found in the minds of technical employees and specialists are of high quality and essential, but it cannot be easily accessed since it is not captured and codified to be shared within the Agency. The Project knowledge found in the documents, which are produced and distributed to different departments are not well organized in a manner to be easily accessed by those who seek it. In short, AASTA does not have any formal way of managing its Project knowledge, and thus it does not know adequately what it has under its disposal nor does it access efficiently what it knows to have in the various offices under its structure. Some of the negative consequences of this state of PKM at the agency are replication of works that have already been done in the various offices scattered in the city, failure to exploit lessons learned from projects executed in the agency, failure to complete projects based on the goal and time frame, failure to fulfill

their clients and stakeholders need, failure to access and utilize its own existing knowledge, and resources,.

Therefore, this research aims to design a PKM system architecture and test a prototype of the system for the AASTA. The proposed systems is expected to provide a comprehensive knowledge base of projects, lessons learned, expertise developed experiences and insights gained and so on related to ICT related projects executed at AASTA.

3.1.1.1 Study area

This study was taking place in the AASTA, one of the public organization which regulates and implements any kind of information technology solutions for any organization under the city administration.

This study is initiated for two main reasons. In the first place, modernizing public services under digital information technology solutions are now the burning issue for the government and the public. Addis Ababa city administration council has passed the decision to transform the manual services in to the modern technology based system and most of these systems are implemented on a Project Base. However, the knowledge created in each project is not well managed. Hence, managing Project knowledge through knowledge management system is very crucial for AASTA. Second, there is no doubt that PKM is highly important to efficient project planning and implementation. Today in complicated and complex projects there is a high probability of losing initiative directions by teams, which are not focused on the critical activities. This results in impaired performance and wasted efforts. Meanwhile, implementing a system for managing project knowledge transfer helps to avoid misleading and focus teams on the right initiatives.

3.1.1.2 Population Size and Sampling

Target Population

In research, two terms namely population and sample are involved to each other. Population refers to the total collection of elements and sample as a part of such population that is selected according to some rules and statistics (Kothari, 2004; Creswell, 2014).

For this research the total population was considered from employees of the AASTA who have a minimum work experience of 3 years and educational background of College Diploma and maximum of Master's Degree, since the researcher believed that they can understand the questions in the questionnaire. By this case the total population of the study was 78.

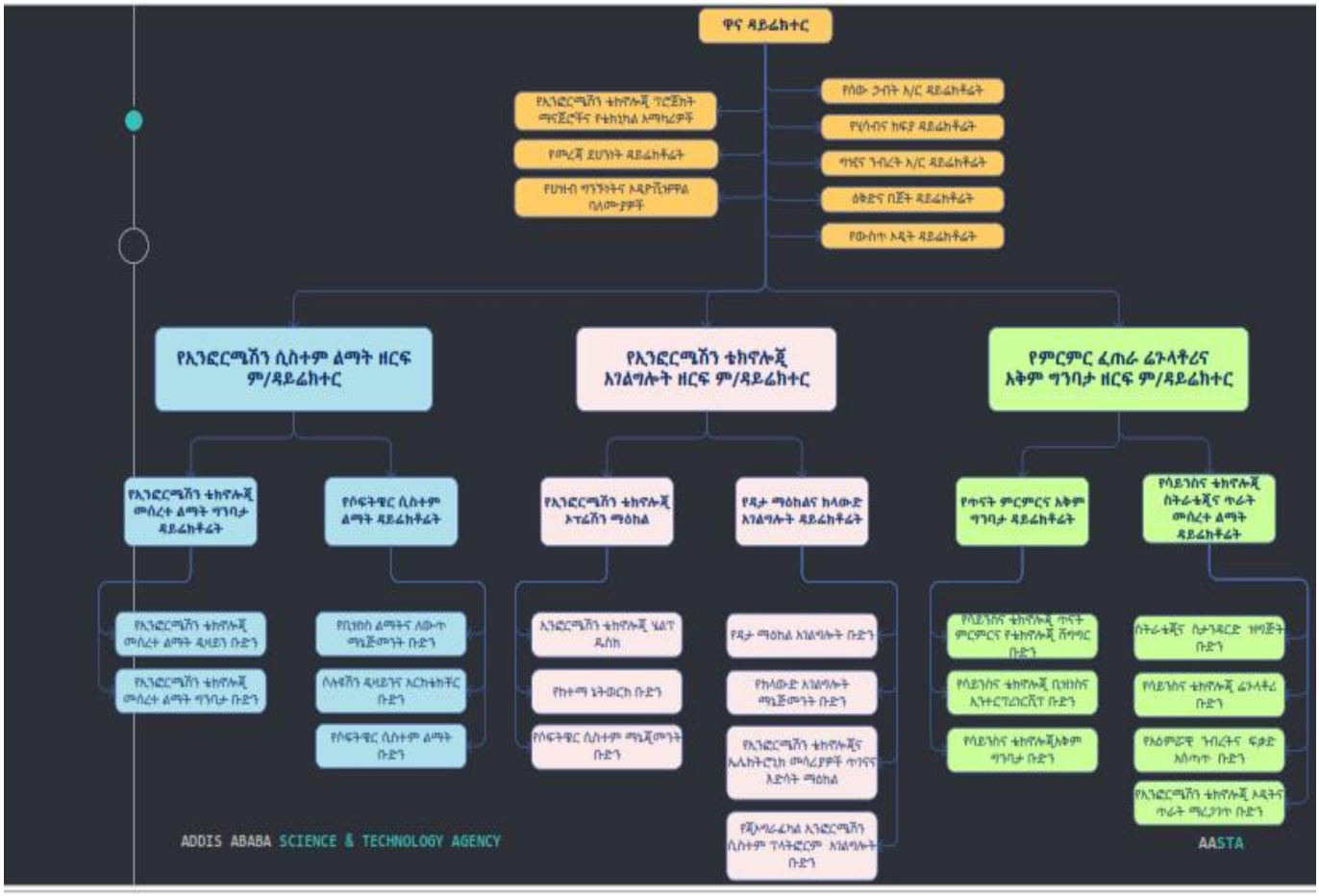


Figure 20: organizational structure of AASTA

The City Government of Addis Ababa has established long-term master plan in ICT (Information & Communication Technology) sector and has propelled it gradually. As it was stated in the plan, the establishment of well institutionalized and strong science and technology agency and institutes of technology serve as a cornerstone to build an economically developed and industrialized state of Addis Ababa. As a result, AASTA was founded in 2002 E.C.

As shown from the above organizational structure, currently, the agency has more than 150 employees with one main director and three deputy directors with infrastructure development, administration and research sector. Inside this there are six directorates and nineteen teams.

Sampling Technique

The total population was considered from employees of the AASTA who have a minimum work experience of 3 years and educational background of College Diploma and maximum of Master's Degree, since the researcher believed that they can understand the questions in the questionnaire, who are 78.

However, the study population is comprised of 78 employees of AASTA, due to financial and Time constraints the study is conducted mainly in the directors, team leader, and senior Experts selected using Purposive sampling. Purposive or judgmental sampling is an approach in which specific settings persons or events are selected purposely based on their special perspective, insight, experience, characteristic, or condition that we wish to understand and in order to provide significant information that cannot be gained from other choices (Maxwell, 1996). To compute the sample size, the researcher used the formula provided by Yamane (1967), which is computed as follows.

$$n = \frac{N}{1 + Ne^2}$$

Where: n = the sample size

N= the population of the study (78)

e= the level of significance (set at 0.05 for this study)

To get the sample size, the above formula was used by substituting with known size.

$$n = \frac{78}{1 + 78*(0.05)^2}$$

$$n = 65.271$$

As per the sample size determination, 65 samples out of the total population are considered in this study. Table 5 summarizes samples selected for this study based on the calculated sample size which includes Director, Team leader and senior expert.

No.	Target Groups	Position	Quantity
1	Infrastructure Design and Development Directorate	Director	1
		Team Leader	2
		Senior Expert	5
2	Software and web development directorate	Director	1
		Team Leader	3
		Senior Expert	7
3	Datacenter and cloud service	Director	1

	management directorate	Team Leader	3
		Senior Expert	5
4	Infrastructure Administration Directorate	Director	1
		Team Leader	3
		Senior Expert	5
5	Research and Capacity Building Directorate	Director	1
		Team Leader	3
		Senior Expert	7
6	Project Management Directorate	Director	1
		Senior Expert	2
7	Science and Technology Infrastructure Strategy and Quality Directorate	Director	1
		Team Leader	4
		Senior Expert	6
8	Procurement Directorate	Director	1
		Team Leader	1
		Senior Expert	1
Total			65

Table 5: Participants for survey

3.1.1.3 Method of Data Collection

Data collection is a term used to describe a process of preparing and collecting research data. It is important to choose the right data collection method as this allows data to be collected to meet the objectives of the research. Data collection can be derived from a number of methods, which include interviews, focus groups, surveys, phone interviews, field notes, taped social interaction, questionnaires, and from various publications.

Data collection consists of either primary or secondary data. Primary data is information that is collected afresh by the researcher to answer his current research questions. There are several methods of collecting primary data; it either can obtain through questionnaires, observation or through direct communication with respondents in one form or another or

through personal interviews (Alemayehu, 2014). Secondary data is that the use of data already collected by somebody else. Secondary data may be either published data or unpublished data. Usually, published data are available in various publications of the organizations, governments, researchers, individuals, and other sources of published information. The sources of unpublished data are many; they all be found in diaries, letters, unpublished biographies and autobiographies, and also could also be available with scholars and research workers, trade associations, and other public/private individuals and organizations. For this study five point Likert scale questionnaire was used as a primary data collection method. Secondary data source publications such as textbooks, magazine articles, book reviews are also another input of this research.

a) Questionnaire

A five point Likert scale questionnaire was the main instrument to collect data from the Head Office directors, Team leader, and Senior Experts purposefully. The logic behind choosing purposive sampling method for this study is: purposive sampling can be very useful to reach a targeted sample quickly and with a purposive sample, it is likely to get the opinions of the target population (Maxwell, 1996).

Rating scales are commonly used in the social sciences and with attitude scores. Such instruments often use a Likert-type scale. A Likert-type scale "requires an individual to respond to a series of statements by indicating whether he or she strongly agrees (SA), agrees (A), is undecided (U), disagrees (D), or strongly disagrees (SD). Each response is assigned a point value, and an individual's score is determined by adding the point values of all of the statements" (Gay, Mills, & Airasian, 2009, pp. 150- 151).

The study adapts and customize the five point Likert scale questionnaires in way to be suitable for my research from Mekdes Asema, (2020), a study with the aim to Design a knowledge reuse framework for project based organizations.

The Google Forms is a cloud-based data management tool used for designing and developing web-based questionnaires. This tool is provided by Google and freely available on the web to anyone to use and create web-based questionnaires. The anywhere-anytime-access and other advantages (unlimited surveys, 100% free) have made Google Forms a popular product in online survey research (Narayanaswamy, 2016, pp.6).

The primary data for this research was collected through a questionnaire which was prepared in the Google form online data collection tool and the questionnaire link was attached with

emails which were sent to respondents. This method has the advantage of obtaining data more efficiently in terms of finances, time, resource and availability of respondents. The questionnaire has two parts. Part I deal with background information like: gender, age, and experience in AASTA and educational qualification. Part II contains 35 questions which were divided into eight parts: - organizational strategy, organizational structure and system, organizational culture and staff, shared values, skills and benefits of PKM (See Appendix A). A total of 65 research questionnaire were distributed by email and 61 (93.8%) respondents returned.

b) Secondary Sources of Data

According to Hancock & Algozzine (2006) and Yin (2003), Documents are used as important data source for the research as they contain readily available data. In this connection, organizational documents, including the strategic plans, project technical documents, project progress reports, handover documents, Information Communication Technology development Policy and Strategy, annual plans and reports are reviewed.

To build conceptual and theoretical background of the research and support the discussion in the preceding parts of the research, books, journals-articles, and other internet resources related with Knowledge, KM, and PKM architecture are also reviewed.

c) Observation

In this study, observation was used as a data collection method because it is a method of data collection without interacting with the research participants (Hancock & Algozzine, 2006).The researcher used observation checklist to collect the data. The researcher had undertaken Most of the observation during his time of work. The researcher took notes of personal interaction among employees to solve work related problems, use of any tools like for PKM and general work environment condition such as office layout, computer and internet access and document organization. Moreover, the researcher jotted down events and situations that appeared important.

3.1.1.4 Data analysis and interpretation

For qualitative data, the researcher might examine as the research progresses, continually filtering and re-organizing in light of the emerging results (Dawson, 2009). According to Yin (2003), qualitative data analysis is usually a challenging task. Attride-Stirling (2001), explained that if qualitative research is to produce meaningful and valuable results, it is

imperative that the material under study is examined in a methodical manner, but unfortunately there is a regrettable lack of tools available to facilitate this task.

Quantitative data mostly collected through survey questionnaire is analyzed using descriptive statistics techniques. The analysis is done using Google form response summary Frequency, average and percentage values are used for discussion of the data collected from the survey. This data has been triangulated with the secondary data to maximize the reliability and validity of the findings.

3.1.2 Objective of the Solution

The overall objective of this study is to design and test PKMS for the AASTA to guarantee the correct use of its venture project information assets. In order to achieve this objective, requirement is gathered by conducting 5 point Likert scale questionnaires and on job observation; moreover to know more about project knowledge management system in organizations a literature review is carried out on related literature topics.

In implementing the PKMS, AASTA can manage its project knowledge properly, improve communication with different project teams and stakeholders, enhance employee skills and productivity, can develop learning/adaptation capability, increase collaboration within departments and organizations, improved product or service quality, can learn from previous mistake, and provide complete and accurate information when needed, at any given point in time, complete projects with the specific time limit with better decision making.

In addition the system:-

- Improve the quality of management decision-making by ensuring that reliable and secure project knowledge, information and data is available through the project service lifecycle.
- Enable the service provided in each sector office of Addis Ababa to be more efficient and improve quality of service, increase Satisfaction and reduce the cost of service by reducing the need to rediscover project knowledge.
- Ensure that project staffs have a clear and common understanding of the value that their services provide to customers and the ways in which benefits are realized from the use of those services
- maintain a service of PKMS that provides controlled access to knowledge, information and data that is appropriate for each audience

- Gather, analyze, store, share, use and maintain project knowledge, information and data throughout AASTA.

3.1.3 Design and Development

Knowledge Management Technologies are information technologies that can be used to facilitate knowledge management. Knowledge Management Technologies are intrinsically no different from information technologies, but they can focus on knowledge management rather than information processing.

Knowledge Management Technologies also support knowledge management systems and benefit from the knowledge management infrastructure, especially the information technology infrastructure. KM technologies constitute a key component of KM systems.

Technologies that support KM include artificial intelligence (AI) technologies including those used for knowledge acquisition and case-based reasoning systems, electronic discussion groups, computer-based simulations, databases, decision support systems, enterprise resource planning systems, expert systems, management information systems, expertise locator systems, videoconferencing, and information repositories including best practices databases and lessons learned systems. KM technologies also include Web 2.0 technologies, such as wikis and blog (Becerra-Fernandez and Sabherwal, 2010). Knowledge Management Mechanisms and Technologies work together and affect each other.

This study developed a web-based PKMS which is useful for IT companies, i.e. AASTA. The system is a platform that enables project knowledge storage, sharing and retrieval. It also serves as an aid for project management activities. It is a web-based knowledge management and communication system that is composed of both knowledge created at the project level and strategic knowledge at the corporate level. The system was developed based on the technology of databases within web-applications and it allows storing enormous volumes of project knowledge unlike the internet technologies that collect information and spread it out with the global world.

The proposed system is different from the other web-based databases with its unique approach brought to the knowledge sharing mechanism. It enables users to classify whole document information according to project types local, international, in-house, and outsourced. Additionally, the system allows the project knowledge to be managed within the AASTA by assigning a date, title, and revision to the documents and placing them to specific locations with respect to project types.

The proposed system is a web-based project knowledge monitoring and management system. Users affiliated projects are allowed to access to the system from anywhere around the world through their accounts. The system has various authorization levels for the users. The content of each section can be uploaded according to the fact of authorization leveling. Another authorized person that can access the page can view or download the uploaded documents. Based on the specified authorization level, a user can either upload or download the available documents. The system runs on a windows environment platform and is coded in PHP with MYSQL from the back side.

The researcher used the following system development life cycle (SDLC) by Jirava (2004) for developing PKMS for AASTA

Requirement identification: In this phase, a requirement analysis work is conducted with different target groups to determine the specific requirements for the new system. To do this, observation procedures are documented, key players are interviewed, necessary documentations are organized and data requirements are developed in order to get an overall picture of exactly what the PKMS is supposed to do.

System Design: Based on the input from requirement identification the researcher develops the specific technical details required for the system. Means the business requirements are translated into specific technical requirements. The design for the user interface, database, data inputs and outputs, and reporting are developed here.

Prototyping: In this phase, PKMS prototype is proposed. According to Peffers 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 system and whether the intended system 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.

Using the system-design document as a guide, a prototype is developed using the selected tools which is PHP and MySQL because With PHP MySQL web development, the open source code developed by the system analyst enables to achieve the project goals with little effort and time. The usage of these programming languages also ensures the future up gradation and storage of content in database for software application venture.

The result of this phase is an initial working system that meets the requirements laid out in the system-analysis phase and the design developed in the system-design phase for demonstration to users.

3.1.4 Demonstration

The demonstration step of design science proves 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 (Peffers et al, 2012).

Demonstrate the efficacy of the artifact is useful to check the performance of the system this could involve in experimentation, simulation, a case study, proof, or other appropriate activity. Resources required for the demonstration include effective knowledge of how to use the artifact to solve the problem. This involved demonstrating the resulting process model with case studies for web-based system. For the new PKMS the researcher tries to use different case studies from the different level of users sides based on the privilege they have.

3.1.5 Evaluation

A common definition of evaluation in the DSR literature reads, “The process of determining how well the artifact performs” (March and Smith, 1995, p. 254). An artifact can be a construct, a model, a method or an instantiation (e.g. Hevner et al., 2004; March and Smith, 1995). In this respect, even information system research is considered as an artifact. The main purpose of evaluation is to generate knowledge that can be used for improvement of the artifact. Another purpose of evaluation is to conclude that the new artifact should provide greater relative utility than existing artifacts that can be used to achieve the same purpose (Venable et al., 2016)

The main goal of the evaluation is to assess the quality and the usability, usefulness and completeness of the system, so different tests, not only to see if the system works as it is expected, but also to check whether it fulfills the requirements from the point of view of the users. Apart from the system tests, a check list with Likert scale questionnaires was given to different experts and representatives of the final users of the system (See Appendix B). From the results of this evaluation, it is possible to rearrange some of the features, and to make the application ready to be implemented in a real environment, that is in AASTA.

In addition in this phase, the PKMS developed in the previous phase is put through a series of structured tests. The first is a unit test, which tests individual parts of the code for errors or bugs. Next is a system test, where the different components of the system are tested to ensure that they work together properly. Finally, the user-acceptance test allows the system users or target groups to test the system based on evaluation checklist to ensure that it meets their requirements.

3.1.6 Communication

According to Peffers et al. (2006), Communicate the problem and its importance, the artifact, its utility and novelty, the rigor of its design, and its effectiveness to researchers and other relevant audiences, such as practicing professionals, when appropriate have a positive impact for the design of the new system.

For this study the research was presented as a thesis for defense at AAU and scented for publication in journals as article after that it has to be implemented in the AASTA.

3.1.7 Ethical consideration

The research has a potential benefit to the AASTA where this study is going to be conducted. The target populations requested to fill the questionnaire willingly and the purpose stated clearly and discussed with most of them also, before beginning of the questionnaire. Confidentiality of the respondents was ensured by asking them to fill the questionnaire anonymously.

3.2 Validity and reliability

Validity is defined as the extent to which a concept is accurately measured and reliability is the accuracy of an instrument. The extent to which a research instrument consistently has the same results depends on, its use in the same situation on repeated occasions (Heale &Twycross, 2015). The content validity also assured when the questionnaire was prepared based on extensive reading of literature review. So, the validity of each question to collect data that focused on the present research objective was discussed by selecting four persons with the Project management directorate and Infrastructure design and development directorate of the AASTA by selecting purposefully based on their respective insight and level of awareness in conducting the research. The feedback also led to minor modifications aimed at increasing the questionnaires validity and clarity.

CHAPTER FOUR
PROBLEM IDENTIFICATION

4.1Overview

This chapter focuses on the description and analysis of the data collected to assess the current project knowledge management (PKM) practices, resources, constraints and requirements of the AASTA. All of the related data were collected using questionnaires distributed to employees working in the AASTA. Employees working as Director, Team leader and senior expert are involved in responding to the questionnaires. The responses obtained through questionnaires are supplemented with on the job observation. The analysis is done using the Google form response summary and used for discussion of the data collected. These measures are used for describing the data collected to investigate the existing PKM practices in the organization. The data gathered using the questionnaire is compiled, presented and analyzed using the tabular format as follow.

4.2 Analysis of Project Knowledge Management Practices at AASTA

This section presents and analyzes the data collected using the questionnaire regarding project knowledge management practices in the AASTA. The questions were categorized into six different categories (Strategy, Structure, Systems, Style / Culture, Staff, Skills, and Shared Values) based on the McKinsey 7S conceptual framework which was discussed on the literature review chapter. The categories, the questions, and their corresponding responses are presented as follows.

Strategy

Assessing organizational strategy helps to gain top management commitment, project knowledge management practice (project knowledge acquiring, project knowledge sharing, project knowledge using and reusing), awareness and understanding of project knowledge in the organization. Table 6 presents summary of respondents' reply concerning strategy of project knowledge management.

Strategy	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Project knowledge management practice is aligned with the agencies vision and mission.	37.7%	36.1%	13.1%	8.2%	4.9%
The agency supports managing existing project knowledge and creating new ideas.	30%	51.7%	11.7%	5%	1.7%
Nowadays Project knowledge management contributes a great benefit to achieve the Agency goals	29.5%	47.5%	13.1%	8.20%	1.6%
Existence of documented Goals / objectives of Project Knowledge Management in the strategy.	36.1%	47.5%	8.2%	6.6%	1.6%

Table 6: AASTA strategy towards PKM

For questions categorized under strategy as shown by the above table most of the respondents disagreed on the alignment of project knowledge management practice with organizational vision and mission in which 78.8 % disagreed, 13.1 % neutral and 22.3% agreed. For the question whether the agency supports managing existing project knowledge and creating new ideas; most of the respondents which is 81.7% disagreed, 11.7% neutral and 6.7 % of respondents agreed . For the question Currently in AASTA Project knowledge management contributes a great benefit to achieve the Agency goals, 83.6% disagreed, 13.1% neutral and 9.8% agreed. . Lastly, 83.6% disagreed, 8.2% neutral and 8.2% agreed for the contribution of project knowledge reuse to achieve organizational goals. This indicates that the organization has not tried to establish alignment of project knowledge management with organizational strategy this indicates that there is more work is required in terms of engaging the employees to know and practice PKM activities.

Structure

Knowing the organization structure helps to identify whether managing project knowledge is initiated or directed by top managers and whether there is a project management directorate which assists to facilitate project knowledge storage, sharing, using and reusing. Summary of respondents on structure of organization for project knowledge management is presented in table 7 as follows.

Structure	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Projects are fully controlled by project managers.	26.7 %	43.3%	11.7%	15 %	3.3%
The existence of clear decisions from top management towards using project knowledge management tools.	32.8%	50.8%	9.8%	4.9%	1.6%
The organization practices tight control from top management/Project managers.	27.9%	49.2%	9.8%	11.5%	1.6%
The organizations have technical team members to support project knowledge storage.	28.3%	38.3%	10%	13.3%	10%
Necessary resources are available to facilitate project knowledge management system.	37.7%	50.8%	6.6%	3.3%	1.6
Currently Project management Directorate /Department is a strategic partner in the agency	39.3%	31.1%	8.2%	11.5%	9.8%

Table 7: Organizational structures towards PKM

As can be observed above from the analysis report for projects are fully controlled by project managers most of the question raised under this category 70% of the respondent answered Disagree,11.7 % neutral and 18.3% agreed.. For question whether the organization practices tight control from top management and project managers similarly 77.1% respondents disagreed. On the other hand whether the organizations have technical team members to support project knowledge storage only 23.3% of the respondents are agreed, 10% natural and 66.6% are disagreed. For the question, whether necessary resources are available to facilitate project knowledge management system 6.6% of respondents reply by neutral, 4.6% agreed and 94.4% respondents disagreed. Finally for the question in which project management Directorate /Department is a strategic partner in the agency the majority which is 70.4% of respondents disagreed, 8.2%nutural and 21.3% agreed. This indicates that even if AASTA have a huge organizational structure But there is a gap in managing projects, support from top management, availability of resources for project knowledge management and strategic partnership with other directorates.

System

This questionnaire category helps to assess whether the organization encounter problems related to projects when an employee leaves, whether the technological platform helps to manage previous project knowledge and to get whether previous documents are suitable for designing a project knowledge management system. Respondents reply concerning the organization current system for project knowledge management is presented in table 8.

System	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
AASTA does not encounter any problems when an individual is left/leave the team tasks.	39.3%	42.6%	9.8%	6.6%	1.6%
The system in the AASTA supports reusing previous best practice for another project.	39.3%	44.3%	8.2%	4.9%	3.3%
The content of the project document in AASTA contains all information clearly to be reusable by other projects.	41%	45.9%	8.2%	3.3%	1.6%
The documentation of the projects is done carefully by giving attention.	37.7%	42.6%	14.8%	3.3%	1.6%

Table 8: Organizational system towards PKM

For questions categorized under the organizational system, 81.9% of the respondents disagreed, 9.8% neutral and 8.2% agreed. For the question raised whether the organization does not encounter any problems when an individual is left/leave the team tasks. For The system in the organization supports reusing previous best practice for another project; the respondents reply with 83.6% disagreed, 8.2% neutral and 8.2% agreed. Where us for the question related with the content of the project document contains all information clearly to be reusable by other projects; 86.9% disagree, 8.2% neutral and 4.9% agreed. For the last question in this category which asked as whether the documentation of the projects is done carefully by giving attention 80.3% of them disagreed, 14.8% neutral and 4.9 % agreed. . This shows that the organization is not have any computerized IT tool to record each lessons throughout the implementation of a project so if someone leaves the office all the tacit and explicit knowledge related with him will be lost.

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 9 summarizes respondents' reply concerning organizations style/culture for PKM.

Style/Culture	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
AASTA regularly captures and uses tacit knowledge of experts in order to reuse for future projects.	39%	45.8%	8.5%	5.1%	1.7%
AASTA provides a technology tool to keep the project knowledge of employees so that it doesn't lose the knowledge due to staff turnover, retirements, etc.	45%	50%	3.3 %	-	1.7%
AASTA have a culture intended to promote project knowledge management.	36.1%	55.7%	4.9%	1.6%	1.6%
In AASTA, there is a motivational scheme to encourage staff to share and apply shared project knowledge for other similar projects.	37.7%	45.9%	11.5%	3.3%	1.6
I use IT tools for recording my day to day tasks.	36.1%	47.5	8.2%	4.9%	3.3%
IT in AASTA support in searching and accessing previous project knowledge	50.%	40%	6.7%	1.7 %	1.7%
i am aware of lesson learned concept in project management	28.3%	45%	6.7%	13.3%	6.7%

Table 9: Organizational style/culture towards PKM

As can be shown from the above table 84.8% of the respondents disagreed,8.5 neutral and 6.8% agreed 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 capturing of tacit knowledge from experts. For question raised whether The organization provides a technology tool to keep the project knowledge of employees so that it doesn't lose the knowledge due to staff turnover, retirements, etc., 95% of the respond-

ent disagreed,3.3% neutral and 1.7% of respondents agreed this shows there is no technology tool that support managing and reusing of project knowledge. For question the organization has a culture intended to promote knowledge sharing and reuse, 91.8% of the respondents disagreed, ,4.9% neutral and 3.2% of respondents agreed and this analysis indicates that there is no any culture to promote project knowledge management.

Question number four asks whether there is a motivational scheme to encourage staff to share and apply shared project knowledge for other similar projects. 83.6% of the respondent digreed11.5% neutral and 4.9% agreed this shows that organizational motivation scheme is poor. And for the question which asks whether the experts use IT tools for recording there day to day tasks related with project activities most of the respondent, 83.6% disagreed 8.2% neutral and 8.2% agreed this indicates they did not record their day to day task using IT tools means that there is no information technology system.

For question which rises whether IT in AASTA support in searching and accessing previous project knowledge, 90% disagreed, 6.7% neutral and 3.4% agreed; this indicates that there is no PKMS to find previous project knowledge. Lastly, 73.3% disagreed, 6.7% neutral and 20% of respondents agreed 45% disagreed and 13.3% answered agreed for aware of lesson learned concepts in project management; which indicates most of them are not aware of lesson learned concepts but still have small number of respondents that are familiar with the positives and negative issues found during a project implementation.

Staff

The staff category helps to analyze if there exist a capacity building programs regarding project management, project knowledge management mechanisms, project knowledge documentation and sharing, whether best practices used more than once and shared and used again by another employees.

Staff	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
AASTA arrange for capacity building programs related to project knowledge management mechanisms.	23%	44.3%	8.2%	16.4%	8.2%
AASTA encourages experienced workers to transfer or document their project related knowledge to new or less experienced workers.	32.8%	36.1%	11.5%	13.1%	6.6%
At the end of the completion of a project, I share my experience and best practices with other experts.	29.5%	44.3%	13.1%	9.8%	3.3 %
I have reused my project experience /lesson learned points for more than one project.	34.4%	36.1%	13.1%	13.1%	3.3%

Table 10: Project knowledge reuse of organizational staff

.

From the above table for question whether the AASTA arrange for capacity building programs related to project knowledge management mechanisms 67.3% disagreed ,8.2% neutral and 24.6% agreed which indicate that a capacity building programs with in the AASTA related with PKM is very low. 68.9 % disagreed, 11.5% neutral and19.7% agreed towards the question whether AASTA encourages experienced workers to transfer or document their project related knowledge to new or less experienced workers. In addition 73.8% disagreed,13.1% neutral and 13.1% agreed , for question which asks whether at the end of the completion of a project, AASTA experts share their experience and best practices so as to reuse it for the upcoming project; this indicates that most of the experts do not share their project knowledge after the completion of a project. For the question which asks whether they have reused their best practice or lesson learned points for more than one project; 70.5 % of respondent's disagreed, 16.4% agreed and 13.1% neutral this indicates that almost 70.5% of them did not reuse their best practices.

The analysis indicates that because there is no any mechanism for managing and sharing project knowledge the experts did not use pervious project knowledge for themselves and also not enabling others to reuse the project knowledge beyond themselves.

Skills

This questionnaire category helps to asses employees in the organization have technical and communication skills to use project knowledge management system. Table 11 presents summary of staff projects skill and knowledge.

Skill	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Project managers have technical skills towards managing project knowledge.	14.8%	29.5%	19.7%	19.7%	16.4%
Project managers have communication skills in guiding team members in managing project knowledge.	14.8%	42.6%	11.5%	19.7%	11.5%
I have technical and communication skill in sharing my project experience with other team members.	21.3%	37.7%	9.8%	21.3%	9.8%

Table 11: Staff projects knowledge and a skill reuse.

As table 11 shows for the question which asks if project managers have technical skills towards managing project knowledge 44.3% agreed, 19.7% neutral and 36.1% disagreed. In the same manner 57.4 % disagreed and 31.2% agreed and 11.5% neutral for the question that the project managers on the AASTA have communication skills in guiding project team members. Lastly 59% of respondents disagreed, 9.8% neutral and 31.1% agreed regarding weather the employees have technical and communication skill in sharing project experience with other team members. The above analysis indicate that in both project knowledge management and technical & communication skill even if there are some experiences still it needs lot of works to be done.

Shared values

This category helps to identify whether employees have common understanding towards the benefits of managing project knowledge. Summary of shared values of project knowledge management is presented in table 12 below.

Shared Values	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
AASTA Project managers have a strong belief in the benefits of managing project knowledge.	16.4%	9.8%	6.6%	47.5%	19.7%
I have a strong confidence in the benefits of managing/recording my project experience.	8.3%	10%	11.7%	40%	30%
AASTA Project Team members are aware of the benefits of project knowledge management in the organization.	10%	33.3%	15%	25%	16.7%
AASTA Project managers encourage documentation of previous best practice to achieve the project goal.	13.1%	36.1%	6.6%	24.6%	19.7%

Table 12: Shared values in project knowledge reuse.

As shown in table 12 for question, project managers have a strong belief in the benefits of managing project knowledge, 67.2% agreed,6.6 % neutral and 49.2% disagreed this analysis does make to conclude that project managers have a strong belief in the benefits of managing project knowledge. Most of the respondents' total of (70%) has a strong confidence in the benefits of managing /recording project experience. Question number three asks regarding of the awareness and benefits of PKM with in the project team members which results 43.3% of respondents disagreed ,15% neutral and and 41.7% of respondents agreed which indicates some employees in AASTA can make themselves familiar with PKM through reading or experience but as an office level the awareness creation work regarding PKM is in a very low stage. The last analysis in this section which describes the encouragement from the project managers to document their previous lesson learned points is also needs an improvement because 44.3% responds agreed but 49.2% responds disagreed with 6.6% of the respondents respond neutral .

Benefits of project knowledge management

The following table 13 presents respondents suggestions about the advantage of project knowledge reuse.

Project knowledge management	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I believe managing project knowledge make the project team to be efficient in their work.	1.6%	3.3%	3.3%	41%	50.8%
I believe managing project knowledge make AASTA to reduce its budget and optimize its resources.	1.6%	1.6%%	3.3%	42.6%	50.8%
I believe managing project knowledge will bring advancement and innovation.	1.6%	1.6%%	3.3%	41%	52.5%

Table 13: Summery of project knowledge reuse.

As the analysis shows most of the AASTA employees agreed towards the advantage of managing project knowledge which is 91% agreed, 3.3% neutral and 4.9% disagreed this indicates, the respondents believe that managing project knowledge make the project team to be efficient in their work. Most of the employees total of 93.4% think that managing project knowledge make the AASTA to reduce its budget and optimize its resources. And 93.5% agreed, 3.3% neutral and 3.2% disagreed for the question whether employees believe managing knowledge will bring advancement and innovation. In general, most of the employees understand and believe that managing project knowledge make them to be efficient and effective in their project implementation work.

4.3Gap Analysis

Based on the survey result presented above concerning factors that influences the management of project knowledge in the organization, the researcher tries identify the following gaps :-

- Most of the employs do not know whether their organization support a project knowledge management.
- Most of the respondent agrees that there is no IT tool to find documented resources or best practices regarding project implementation.
- According to the analysis the quality and mechanism of the Documented project knowledge/hard copy and soft copy/ is poor.
- There is no standard to prepare project documentation.

- Based on the questionnaire analysis the culture of the AASTA towards project knowledge management is poor.
- Most of the participants have positive attitude towards managing project knowledge.
- There is no mechanism of finding project knowledge by using IT tools.
- It can be said that the participants have not better awareness on the benefit of managing project knowledge
- The participants need to manage their project knowledge using a formal system or IT tool.

The gap analysis shows the need for a project knowledge management system. The system should facilitate proper documentation of project knowledge, enabling communication, searching, and fast access to knowledge.

4.4 Objective of the solution

The objective of the solution is to provide project based organizations with insight on project knowledge management by designing a project knowledge management framework and prototype. This is to foster project knowledge reuse within the organization, so that the organization can be able to successfully retain project knowledge for reuse purpose. This in return decreases the chance of losing project knowledge and project rework.

The general objective of the proposed framework is to enable project knowledge in the AASTA 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 has a tremendous effect on the AASTA to:-

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

CHAPTER FIVE
DESIGNING A PROJECT KNOWLEDGE MANAGEMENT SYSTEM

This research designed the project knowledge management system based on the current practice of project knowledge management implementation of AASTA. The research tried to address the basic design requirements that have been gathered from the questionnaires with in AASTA. This study mainly focused on the design and implementation of PKMS architecture for the AASTA to ensure the proper usage of its project knowledge resources and improve sharing of the tacit and explicit project knowledge among all staffs within the organization and increase the entire performance of the AASTA. The research designed the PKMS based on the requirements gathered from questionnaires and theories from literature.

5.1. Overview

According to Polyaninova (2011), knowledge becomes one of the main assets of organizations that seek competitive advantage in the dynamic market environment. Knowledge comes from many different sources in the organization. Such sources include internal processes, projects, clients and stakeholder details. As markets change, the way you do business changes. In today's market many companies use different projects to deal with the changing conditions. Projects collect a lot of intellectual knowledge that can be used by similar companies to add value, compete and improve future projects in each way. Companies utilize KM to create, identify, and communicate organizational knowledge and lessons learned. However, because projects have specific goals and deliverables that differ from one another, it can be challenging to capture project knowledge. The use of KM in project area is increasing as it aids in project success.

Project knowledge is often established by project participants, including project managers, project team, project stakeholders and sometimes even the client. Knowledge on projects comes from a variety of internal sources, such as risk logs, lessons learned and experience, as well as external resources, such as conferences, benchmarking and competitor analysis. As emphasized by Ajmal and Koskinen (2008), project managers must find ways to store and use knowledge within the practices used in day-to-day collaboration. In carrying out this task, project-based organizations need a clear understanding of the types of knowledge and knowledge bases to be incorporated into an effective KMS. Conroy and Soltan (1998) identified three knowledge bases on projects:

- **Organization knowledge base** - which comprises knowledge specific to organizations and environments in which projects are executed;
- **Project-management knowledge base -** which includes knowledge of the principle and application of PM;
- **Project-specific knowledge base -** which includes specific knowledge acquired within the execution of a particular project.

Conroy and Soltan (1998) also classified project-created knowledge into three categories:

- **Technical Knowledge** - relates to methods, techniques, procedures, costs and other factors involved in specific aspects of the project;
- **Project management Knowledge -** relates to the methods and procedures required for managing project implementation;
- **Project-related Knowledge** - refers to Knowledge about customers and other people or organizations that are critical to the company's future business.

5.2. PKMS prototype with 3-Tiers

At a high level, the architecture of an application defines how different parts of the system are organized and logically separated yet ensuring that they work together. The architecture used for this system is with three tiers (see figure 21) such as presentation, logic and data tiers, since 3-Tier Architecture is most commonly used to build web applications Schwabe & Rossi (2002). In this model, the browser acts like a client for presentation, middleware or an application server contains the business logic, and database servers handle data and its functions. The advantage of this approach is that it separates business logic from display and data.

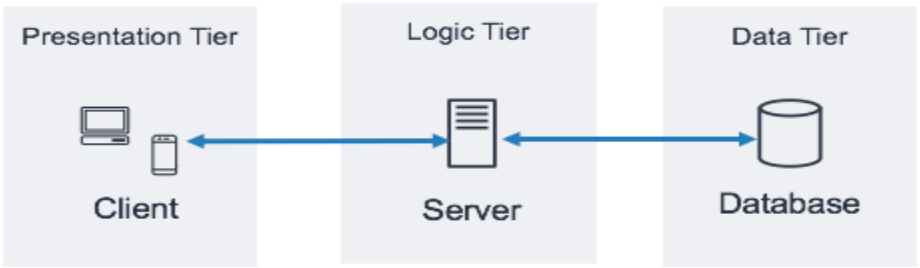


Figure 21: A 3-Tiers PKMS

5.3. Proposed Framework Design for PKMS

The suggested project knowledge management system architecture is based on literature reviews, McKinsey 7S Model for maturity evaluation and gap identification. The proposed framework connected success indicators for developing and using project knowledge system using tools. The suggested project knowledge management system framework for the AASTA Information is shown in Figure 22 below.

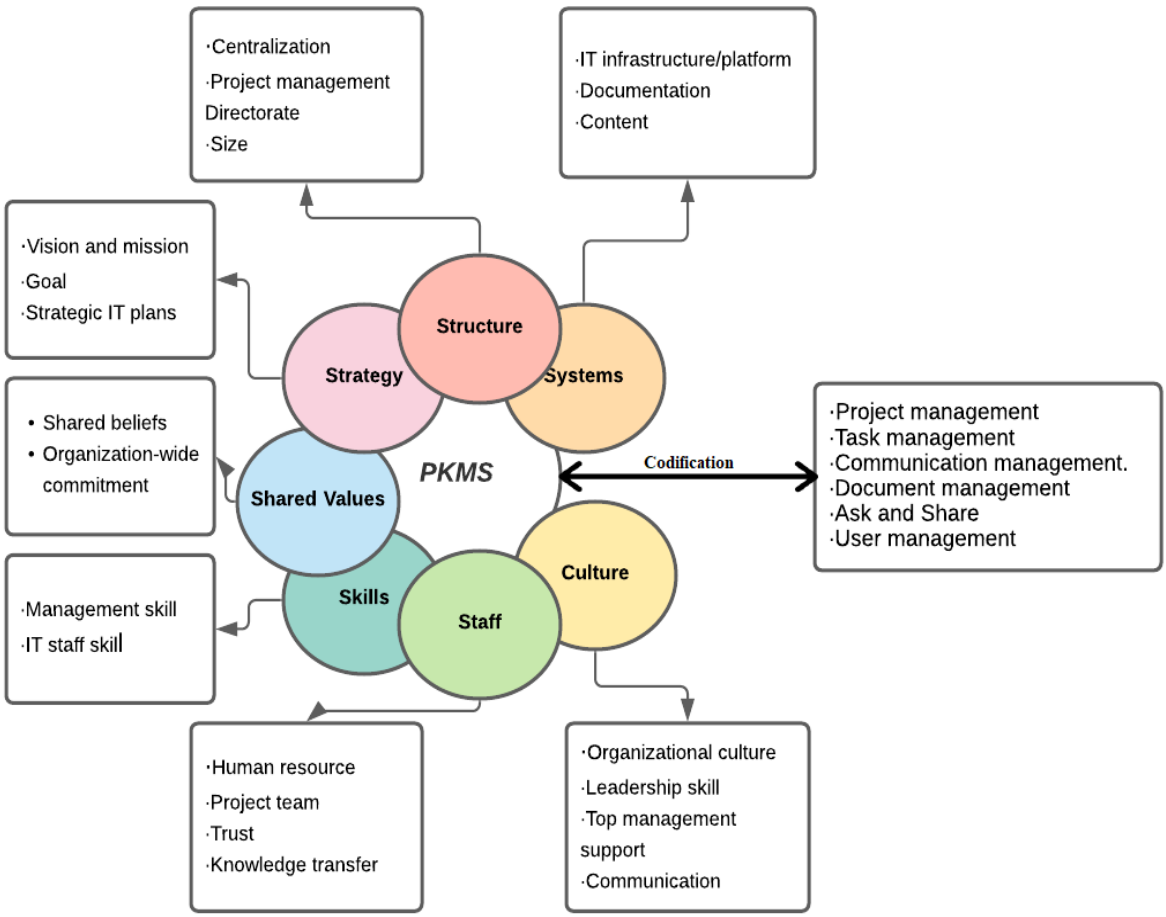


Figure 22: Proposed Framework design of PKMS

The study proposes a new framework for managing project knowledge on the basis of McKinsey 7S model using fuzzy logic analysis. The study considers 7 dimensions as approach to assessing the current situation of the organization prior to project management implementation to identify weakness areas which may encounter the project with failure.

The proposed framework integrates project knowledge management success factors with the proposed PKMS. the features of the PKMS such as project management, task management ,communication management, document management, ask and share and user management helps to maintain the success factors; in return it enables for documenting, updating, edit, modify, share

project related ideas and files which enhances project knowledge management practice in AAS-TA. The foundations of the proposed framework are the following:

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, Goal, and Strategic plans.

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), Alshaher 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.
- *Project management directorate*: According to Alshaher (2013) the role of the project management directorate has grown in importance and the role has evolved into the one responsible for providing IT infrastructure and capabilities to ensure effective business operations. It helps planning and implementing IT strategies in organizations and 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. Alshaher pointed out also that, 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.

- *IT infrastructure/Platform*: 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 including many lessons learned from in the project, can help the work process to continue not form the scratch, but from where it's been left and to continue without being seriously disabled by any knowledge gap.
- *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 management. In addition Chung & Galletta, (2012) and Wu & Wang, (2006) noted 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 to apply it in the new context.

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.

- *Leadership Skill*: are decision making and problem solving skills. As stated by Argyris, (1991) and Yeung & Holden, (2007) project team members are influenced positively on their decision to engage in knowledge management 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:

- *Human resource*: 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 management practice.

- *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 management, increases people's intention to engage in knowledge reuse practice.

Skills

Alshaher (2013) mentioned that, 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.

Codification

Codification strategy is a "people-to-documents" approach that involves securing explicit and implicit knowledge in the form of databases for others to access and re use (Boh, 2007). Codification is a useful tool for storing vast amounts of organizational memory (Boh, 2007).This approach enables all authorized employees to retrieve the codified knowledge and share their expertise via electronic devices. Through this means, the codified knowledge is acquired, re-uses, saved, refined and improved which ultimately forms to be an organizational innovation.

5.4. Design Goal

Design goals refer to what is expected when the system under consideration become fully functional. When the PKMS is designed it is destined to have a set of desirable characteristics. Among list of goals it should achieve, the following were considered.

- **User Interface:** The system should possess a very simple user interface that let users feel easy when using it. Since it is web based the interface elements involved are thought to be very familiar to anyone having prior experience. The interfaces comprise of buttons and links which are very simple to use and make users feel comfortable in using the system.
- **Security:** Security is of paramount importance in any web application, both from the point of view of the owner and the users of the application. Therefore, the PKMS should only be accessible to authorized users and furthermore all data stored in the database must be secure.
- **Utility:** The system must address the possible functional requirement of the system users. Consequently, all the functional requirements identified in the preceding chapter have been implemented in the system.
- **Availability:** The system should be available for any legitimate users as long as the service provider is available or it is not shut down by any technical problem.
- **Efficiency:** Users are becoming increasingly unwilling to wait for pages to load; therefore the speed at which the system operates is vital for its success. In order to minimize the time it takes to generate (i.e. download time) and dispatch a new page for the PKMS, interface design not include in any large graphic files.
- **Robustness:** A web application should be rigorous enough to handle errors or exceptions. Even though sometimes errors in such applications are inevitable because of the factors that are out of the developer's hand, they should be dealt correctly, either by trying to solve the problem or displaying a helpful error message.
- **Maintainability:** Any system should consider what to do during a need for maintenance. It may be required to add services, serve more users, etc. Hence, the PKMS should allow continuous expansion and possess easy scalability capability.

◊ **Authentication:** Database security include authentication, the process of verifying if a user's credentials match those stored in PKMS database.

CHAPTER SIX

DEMONSTRATION AND EVALUATION

6.1 Overview

This chapter presents the demonstration of the proposed project knowledge management system. Demonstration is the process of using the artifact to solve one or more instances of the problem (Peffers, 2007). This chapter then presents the evaluation result for the project knowledge reuse framework.

The prototype is developed based on the requirements gathered from the questioners and the contents which should be incorporated in to a PKMS system as suggested by employees with the integration of the proposed framework. The researcher used PHP and MySQL database to develop a web-based project knowledge management system prototype. The reason to select PHP software tool is that it can fit the purpose of the study. It is a server-side scripting language that is used to create dynamic web pages that can interact with databases. It is a widely-used open source language that is specifically used for web application development and can be embedded within HTML.in addition some designing tool like CSS, Bootstrap and Ajax also used to make the system user-friendly.

The goal of designing this PKMS is to facilitate the project knowledge management activities of the employees and increase the efficiency and effectiveness of the AASTA in project implementation. The designed prototypes contained Feature, Home page, Dashboard, Project page, Task page, Personal Note page, Chat page, Ask and Share page. Each page and its descriptions are discussed here forth:-

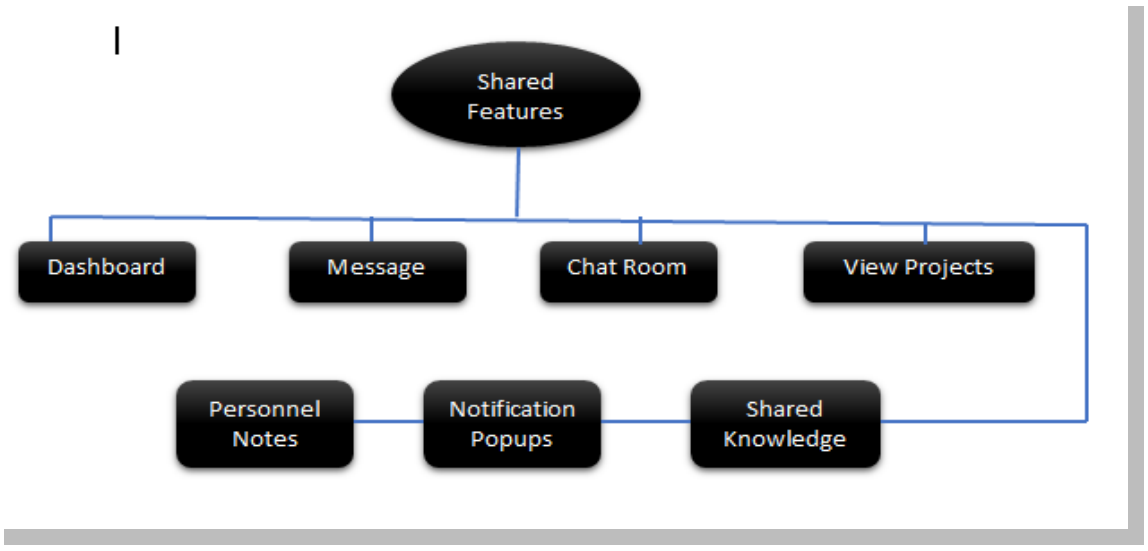


Figure 23: Features of the proposed PKMS for knowledge sharing

- **Login Page**

The login page (see figure 24 below) authenticates the authorized employee who has an account for the project knowledge management system of AASTA.

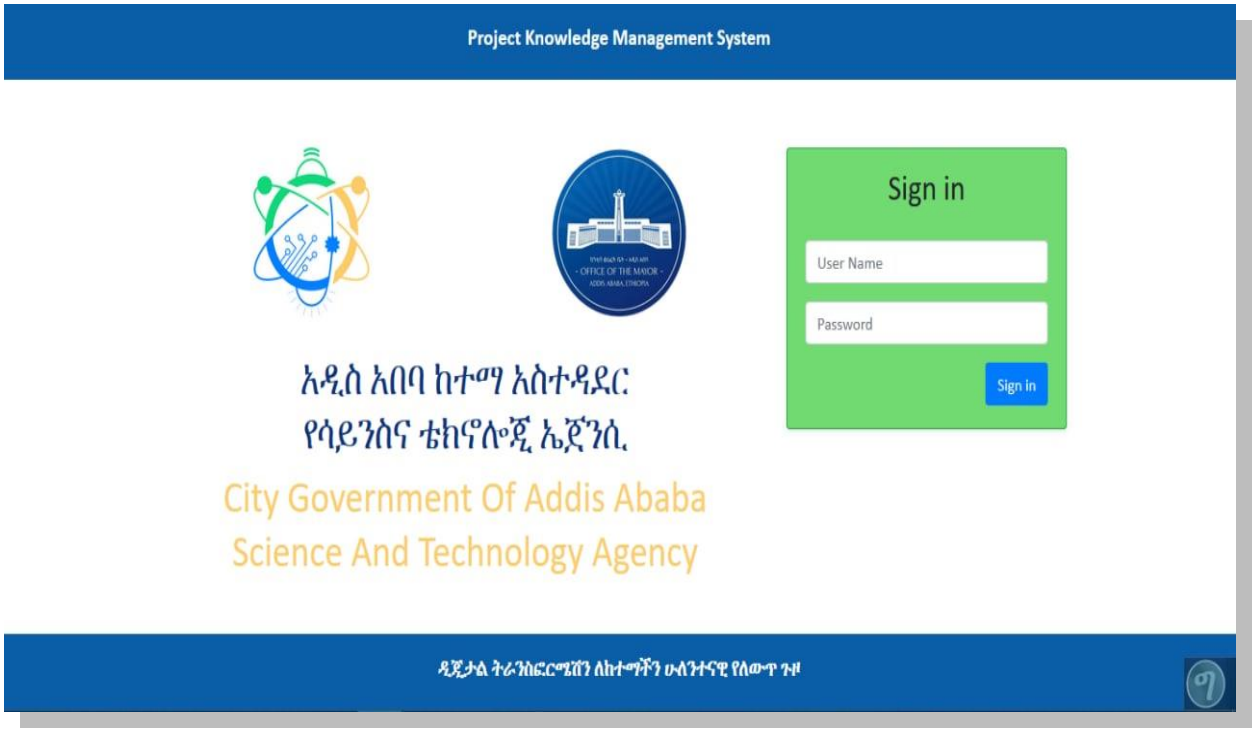


Figure 24: User interface to login page of PKMS

- **Dashboard Page**

As depicted in figure 25 below, this page tries to display different kind of information like total projects, tasks, evens and shared ideas based on the user privilege.

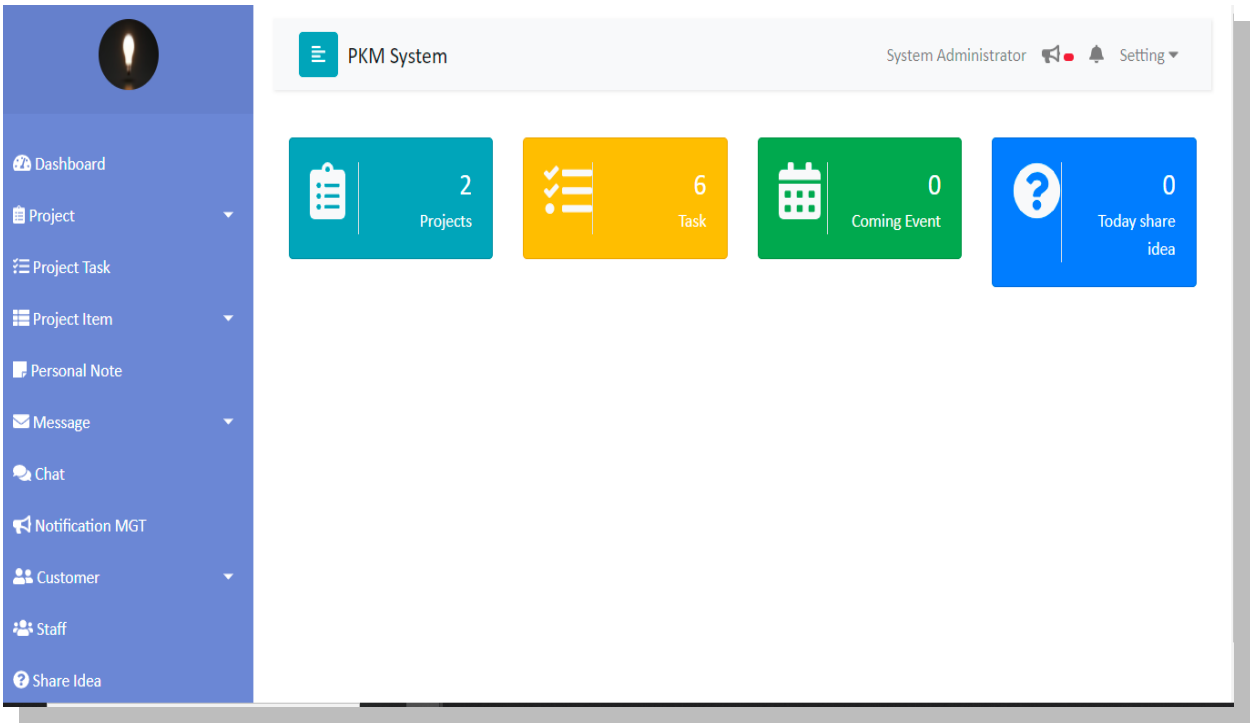


Figure 25: Dashboard page

- **Add New Project**

As shown in figure 26, this page enables to add new projects which include project name, project budget, start and end date, manager, client, project owner and document related to the project.

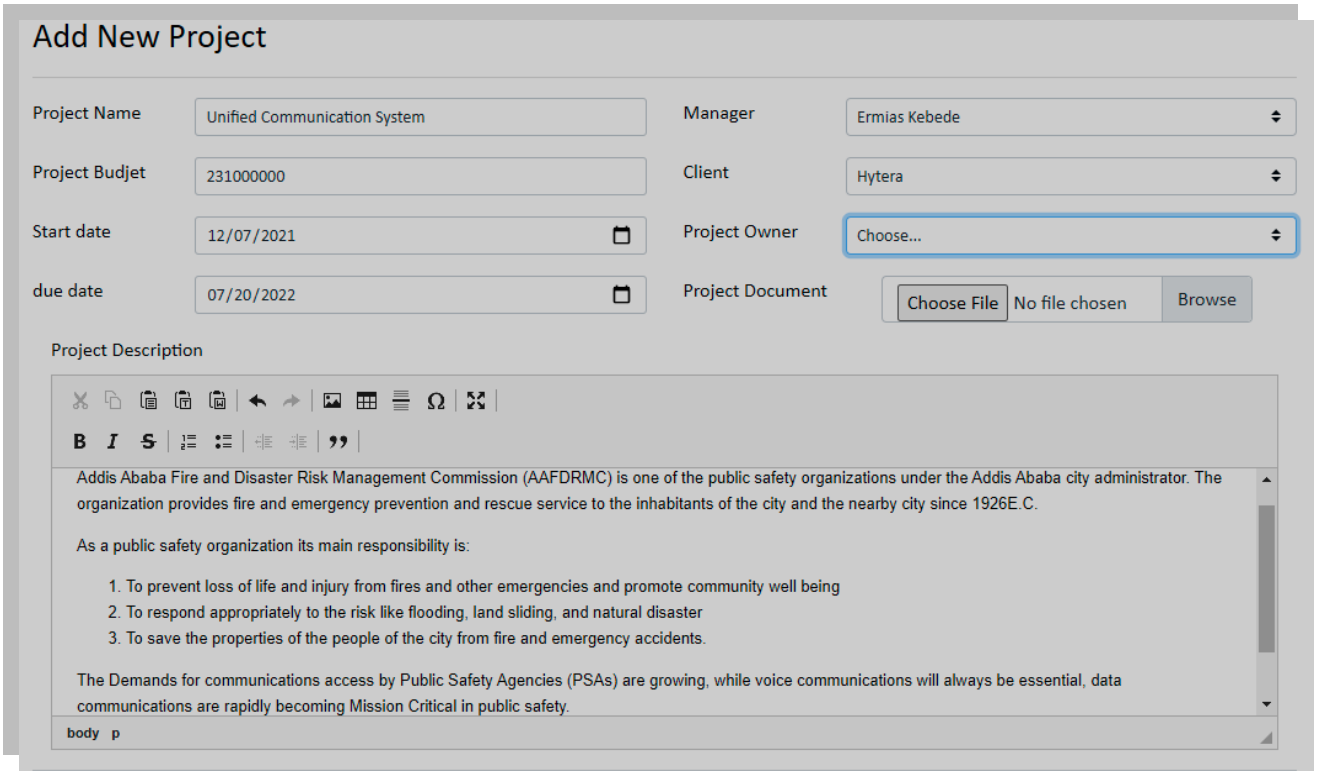


Figure 26: Interface for adding new project

- **Project Task Assignment page**

This is also an interface for assigning a task to project members specific to a project from a project manager, as presented in figure 27 below.

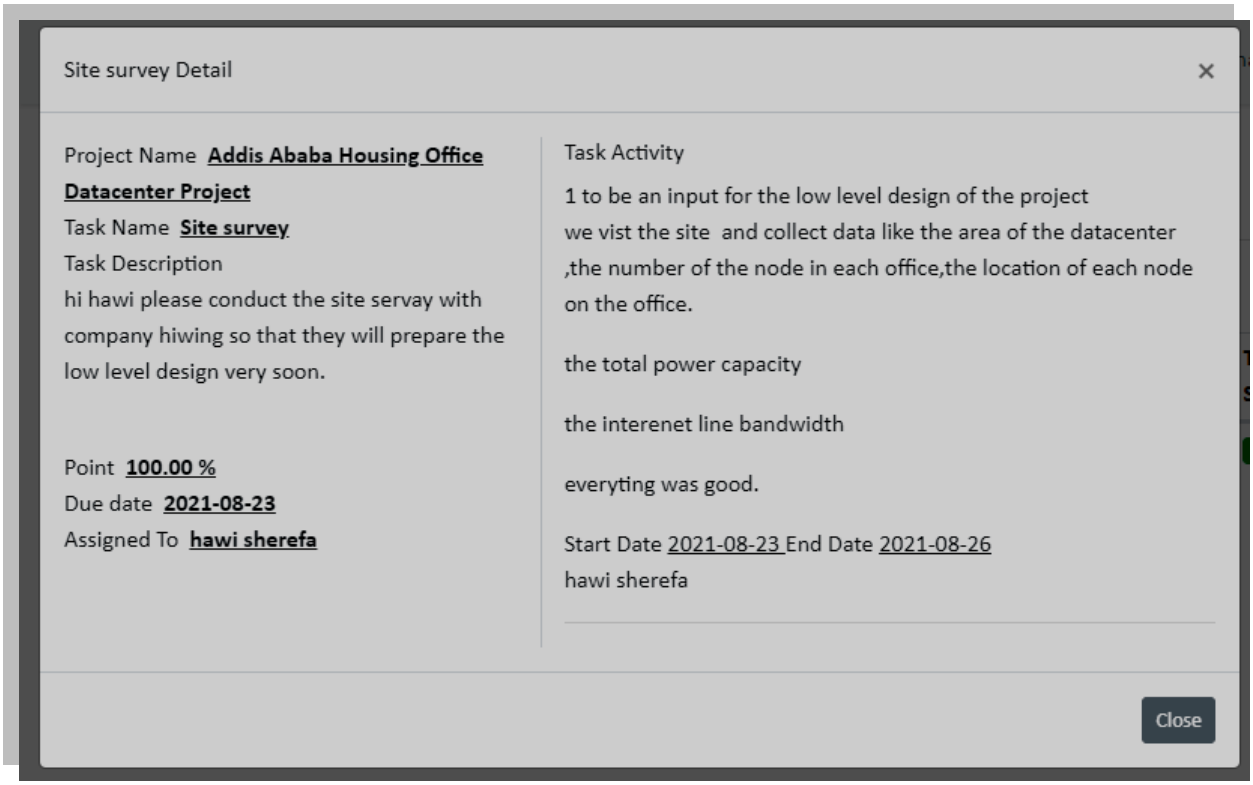


Figure 27: Interface for Project Task Assignment

- **Personal Note Page**

This page allows the system user to add a personal note regarding to his/her task or any other issues, using the form shown in figure 28 below.

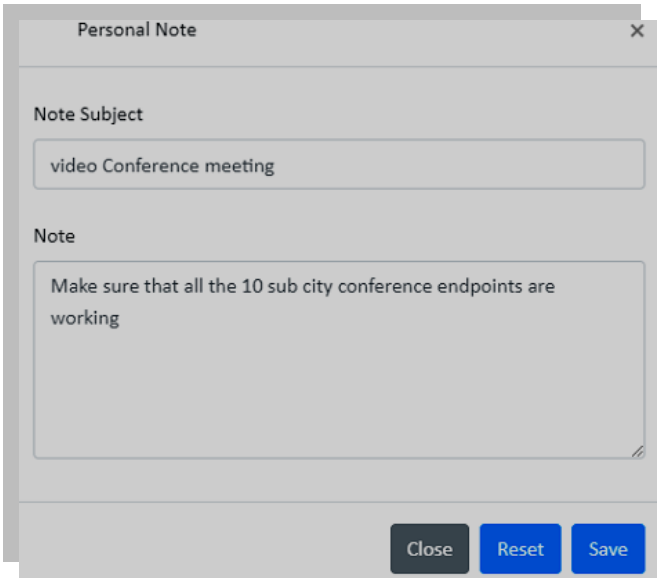


Figure 28: Interface for recording personal note

- **Message page**

Good communication keeps conflict and confusion from bogging the project down by ensuring key players are aligned on project goals and know exactly what's expected of them. It also helps build team-wide trust so everyone works better together from project start to finish. Figure 25 below presents the interface to message page.

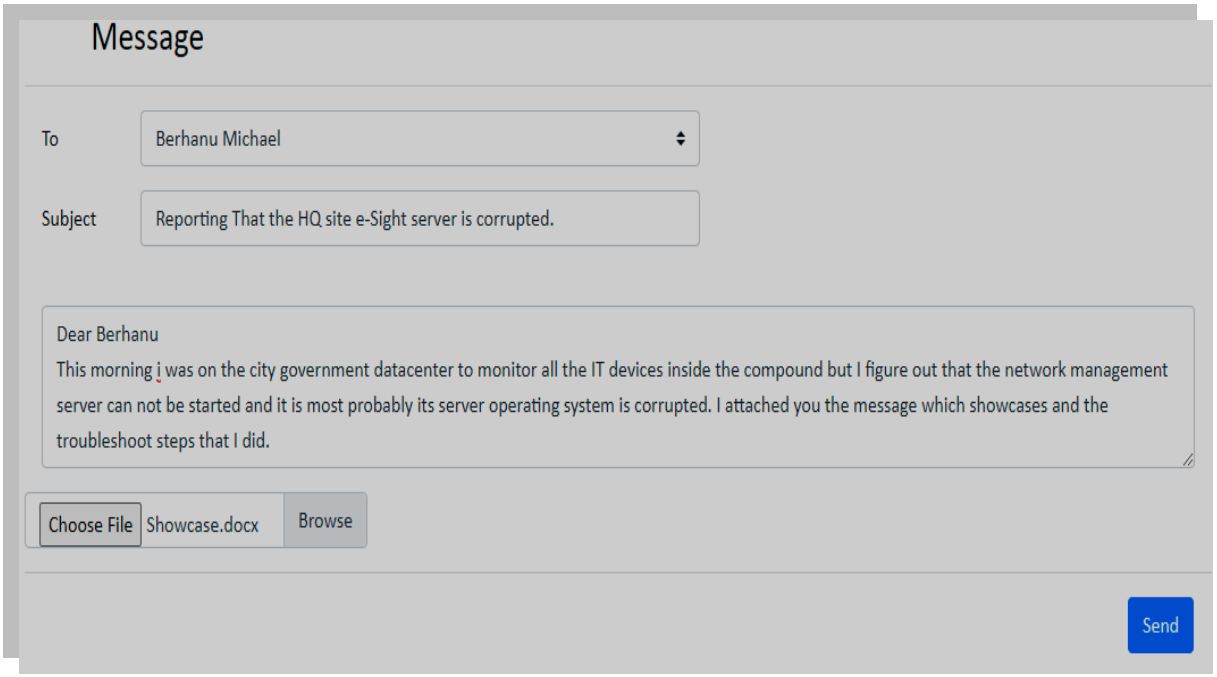


Figure 29: Interface for message page

- **Chat**

The chat page enables the system user to keep active, open communication with all those involved in the project as it is easy to use, comfortable and accessible to all.

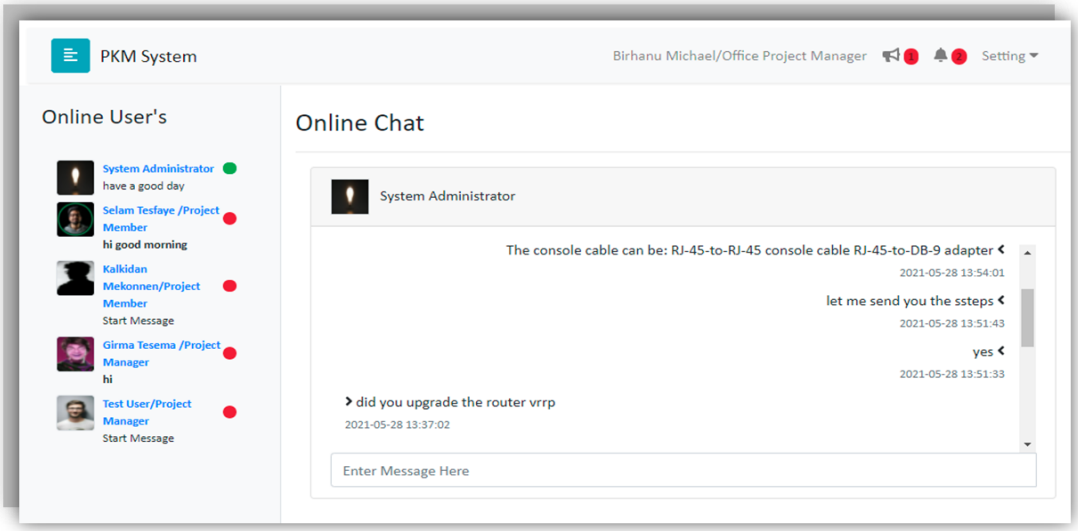


Figure 30: Interface for chat page

- **Ask and Share idea Page**

This page enables the system users to ask, answer, discuss, share, and make use of the shared knowledge based on the main project management knowledge areas. Sample shared idea is presented below in Figure 31.

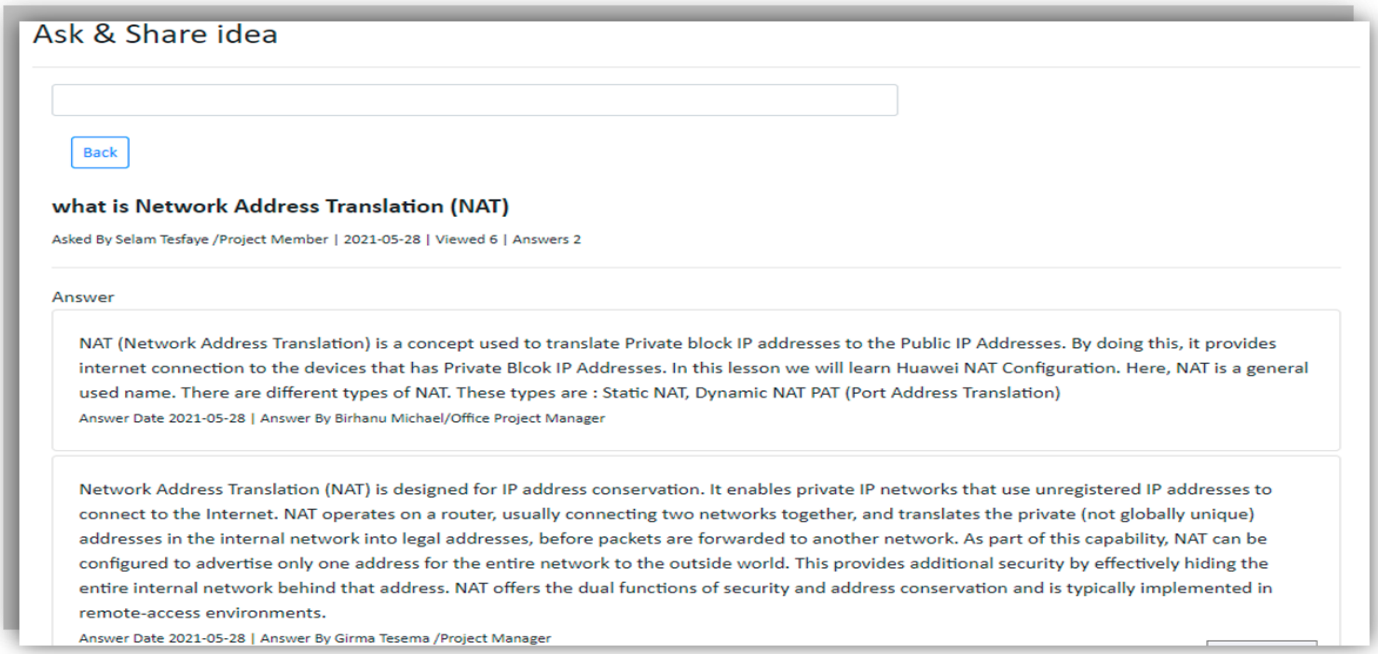


Figure 31: Interface for ask and share page

6.2 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.

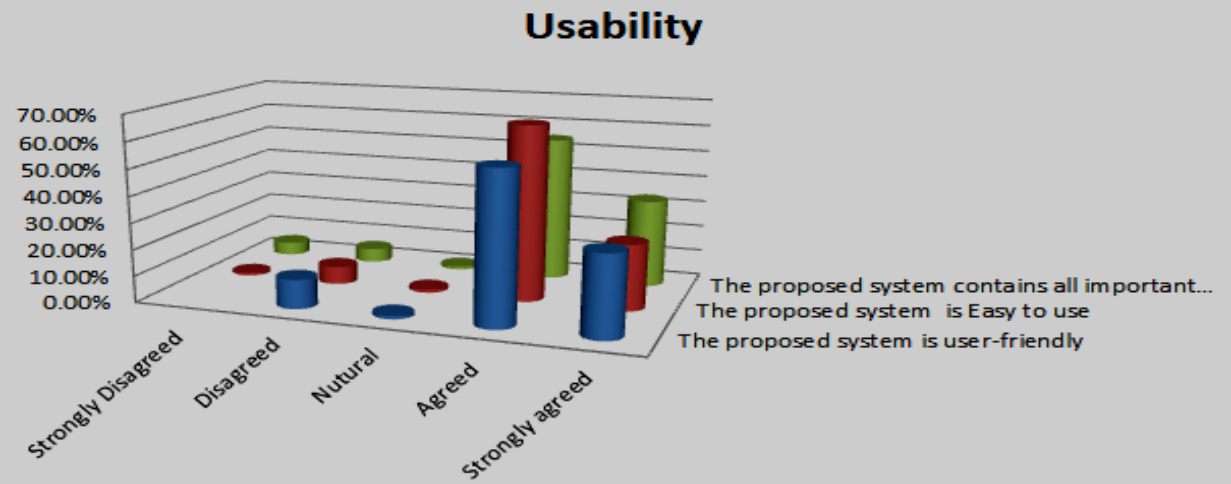
The researcher selected illustrative scenario evaluation methods because, according to Peffers et al, (2012) illustrative scenarios are used for framework type artifacts and applies for the artifact in a real world situation to validate its usefulness, and other relevant quality attributes.

The evaluation criterion was focused on the issue of four elements; utility, consistency with organization, the content of framework and, the usefulness of the framework. The researcher used human expert to evaluate the efficiency of the project knowledge management platform.

The evaluation data was collected using evaluation checklists with selected target group of twenty one representatives. The evaluation result of the questionnaire is presented as follow.

6.2.1 Usability of the proposed system

According to Peffers et al, (2012), when we consider utility of the artifact we are referring to its usefulness, content, and ease of use.



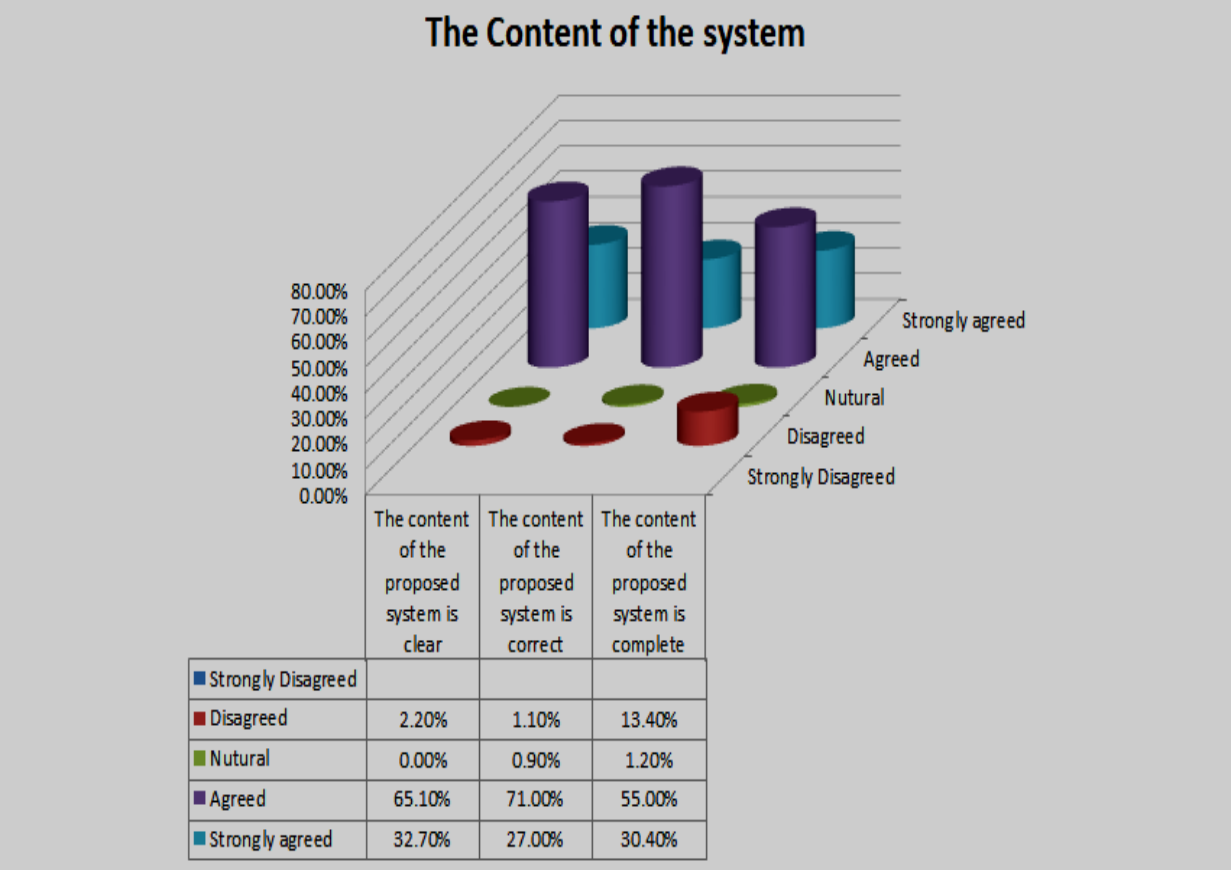
	Strongly Disagreed	Disagreed	Nutural	Agreed	Strongly agreed
The proposed system is user-friendly		11.10%	1.20%	57.00%	30.70%
The proposed system is Easy to use	1.00%	6.80%	1.20%	66.00%	25.00%
The proposed system contains all important aspect	5.00%	5.40%	1.20%	55.00%	33.40%

Figure 32: Evaluation result for Usability of the proposed system.

As shown in figure 32, most of the respondents which is 87.7 % agreed, 1.2% natural and 11.1% disagreed to the criteria in which the proposed system is user friendly. On the other for the question that the system is easy to use the respondents replay with 91% respondents agreed, 1.2% neutral and 7.8% disagreed. Lastly 88.4% of respondents said that the proposed system contains all important aspects with small number of respondents which is 10.4% disagreed with that. This helps to conclude that the majority of respondents agreed on the usability of the proposed system.

6.2.2 Content of the system

The content of the system is described in terms of the artifacts of clearness, correctness and completeness. Summary of the evaluation result of content of the system is presented in figure 33 below.



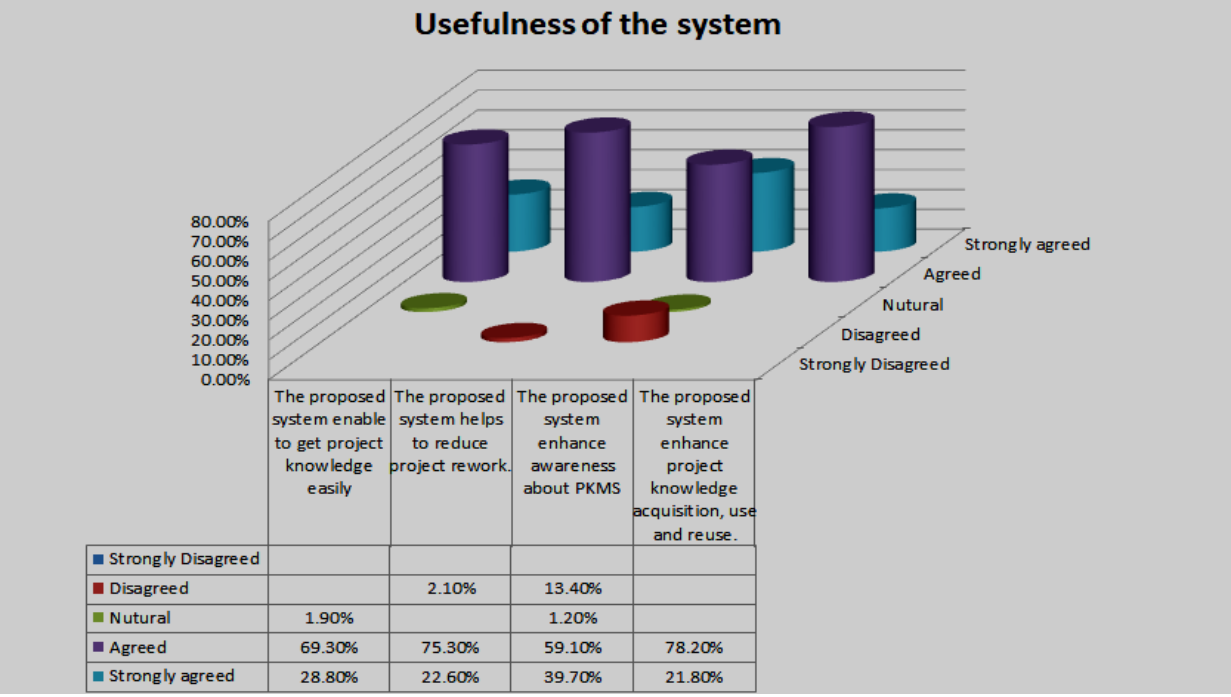
	The content of the proposed system is clear	The content of the proposed system is correct	The content of the proposed system is complete
Strongly Disagreed			
Disagreed	2.20%	1.10%	13.40%
Nutural	0.00%	0.90%	1.20%
Agreed	65.10%	71.00%	55.00%
Strongly agreed	32.70%	27.00%	30.40%

Figure 33: Evaluation result for content of the system

As shown in figure 33, most of the respondents which is 85.0 % agreed, 1.2% natural and 13.4% disagreed to the criteria in which the content of the proposed system is complete. On the other for the question that the content of the system correct the respondents replay with 98% respondents agreed, 0.9% neutral and 1.1% disagreed. Lastly 97.8% of respondents said that the content of the proposed system is clear with small number of respondents which is 2.2% disagreed with that. This helps to conclude that the majority of respondents agreed with the proposed PKMS prototype.

6.2.3 Usefulness of the system

The usefulness of the artifact is conducted by end users with its content and aim. The evaluation result is presented in figure 34 below.



	The proposed system enable to get project knowledge easily	The proposed system helps to reduce project rework.	The proposed system enhance awareness about PKMS	The proposed system enhance project knowledge acquisition, use and reuse.
Strongly Disagreed				
Disagreed		2.10%	13.40%	
Nutural	1.90%		1.20%	
Agreed	69.30%	75.30%	59.10%	78.20%
Strongly agreed	28.80%	22.60%	39.70%	21.80%

Figure 34: Evaluation result for framework usefulness

As shown in figure 34, most of the respondents which is 100 % agreed to the criteria in which the proposed systems enhance project knowledge acquisition, use and reuse. On the other for the question that the system enhance awareness about PKMS the respondents replay with 98.8% respondents agreed, 1.2% neutral. To check if the proposed system helps to reduce project rework 97.9% respondents agreed with only 2.1% disagreed. Lastly 98.1% of respondents said that the proposed system enables them to get project knowledge easily. This helps to conclude that the majority of respondents approved the usefulness of the system.

6.3 Discussion of results

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 to prevent sensitive knowledge such as configuration codes, passwords and system security problems and its solutions.

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

6.4 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 PKM 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 management and proposed a project knowledge management framework that mitigates project rework in the AASTA.

There have been valuable researches regarding knowledge management activities for different government sectors including banking, agriculture sectors, Higher education and others but there is no research conducted on the application of knowledge management for project related organization up to task level management and knowledge sharing; so this research paper helps for future researchers as a reference. This research tried to go through the management of project knowledge up to the sub-task level and have different knowledge sharing mechanism during a project implementation it can be through chat, message, notification even personal message so it update the work of Mekdes Asema (2020) which was limited on managing project knowledge just on higher level.

CHAPTER SEVEN
Conclusion and Recommendation

Knowledge is a broad and abstract notion that has defined epistemological debate in western philosophy since the classical Greek era. Consistent with the interest in organizational knowledge and knowledge management (KM), IS researchers have been promoting a class of information systems, referred to as knowledge management systems (KMS). The purpose of KMS is to support the creation, transfer, and use of knowledge in organizations. 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 PKMS is to manage project knowledge, ask and share lessons and ideas, communicate with teams, make ease of project knowledge accessibility and application of knowledge in organization.

7.1. Conclusion

Knowledge management can be more or less successful, and the success of knowledge management depends on many factors within each organization. It primarily depends on the desire of the organization to establish such a process, the willingness and ability of its employees to maintain the process of knowledge management, trust in the organization, the culture that exists or should exist within the organization, the technology which the organization possesses, all those persons who should formally be holders of knowledge management, and other factors. The research investigated the practice of project knowledge management among employees of the AASTA. Project knowledge management required for improved processes, Because of the temporary nature of projects, it is necessary to employ useful KM strategies to address issues such as knowledge leakage and project rework.

This study followed design science research methodology (DSRM). Accordingly, based on problem identification, a prototype is designed for project knowledge management at AASTA. The prototype 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., (2006) and consists of six main steps.

Since knowledge is a key resource in any organization, this study tries to show the importance of managing project knowledge and how it should be supported for improved performance and quality of work by associating important KM enablers, frameworks, practices and project success dimensions. Top managements, Knowledge manager, project manager, project members and other stakeholder's leaders inside or outside of the organization can benefit from this study in different ways. They can assess knowledge gap in project execution from start to end in order to optimize the knowledge creation and utilization between individuals and teams. In light of this study, organizations can plan and implement knowledge retention mechanism or strengthen what they already have. By doing this, they may save important resources that might be spent for or wasted due to lack of knowledge. They can also discover failures and successes, minimize project completion time and cost with better quality requirements and also increase project team motivation.

The study was conducted in a single project based organization this might raise issues of generalizability to take the result for other similar organizations. However, effort has been made to get the right data from the right people who are currently involved in different project tasks; instruments are developed from related papers and easy to respond; the data also passed through appropriate reliability and validity test. This study does not attempt to control cofounding or moderating variable that might affect the relationship between KM practice and project performance. To minimize complexity, the research model proposed does not consider this in the study. To address such issues, further research and verification are necessary to further develop and reinforce the findings.

The study tries to visit a vast amount of literature works and related studies and from that develop the system which can answer the problem of the agency regarding the management of the project knowledge but due to the pandemic issue of vocid-19 at the time of the study the data collection process was not conducted as planned and the way of data collection also changed from face to face interview to liker scale questionnaire that limits the amount of data which is collected from experienced target groups. The study limited only on the small sections of the project execution teams it is better if further investigation is done on other departments and different stakeholders who are working corporately with the Agency regarding on the implementation of projects.

Overall this study has contribution to those who engaged in project work to have efficient management of project knowledge for increased project success rate or minimize failure.

The more they can perform on projects mean their competitiveness and trust with in the city government offices increase to win or run more projects.

7.2 Recommendation

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

- ◊ Each employees working in the AASTA should:
  - Engage in project knowledge management through the use of PKMS.
  - Change their attitude of project knowledge management in to positive.
  - Develop a culture of recording or sharing their day to day activities through the PKMS.
- ◊ As an immediate governing body of the AASTA, the top management is advised to engage in actions like:
  - Complete implementation and usage of proposed PKMS for project knowledge activities.
  - Equipping the agency with up-to-date ICT infrastructures suitable for PKMS.
  - Creating awareness on project knowledge management attitude and usage of the PKMS for all staff.
  - Developing and applying rule and regulation on PKMS usage.
  - Setting up a reward system in order to motivate employees who are using the system effectively and share a lesson learned knowledge regularly.

7.3 Challenges of the Study

Much qualitative research typically relies on face-to-face interaction for data collection through interviews, focus groups and field work. Since there is a global pandemic issue, which is Covid-19 the researcher change the first data collection method which is face to face interview and use 5 point Likert scale questionnaires.

Since the study is conducted in one organization, participants may exaggerate or undermine certain organizational events due to their personal bias they have on the agency. The researcher tried to minimize such kind of biases by asking multiple respondents when he

recognized some exaggeration in the response. Therefore, it cannot be absolutely said that this study is free from respondents' bias.

7.4 Future Research

This research tries to explore the existing practice of AASTA regarding project knowledge management. It is also used the design science research methodology to design an artifact or prototype that can solve the project knowledge management gap in AASTA. Indeed, this study attempts to answer the research problems mentioned in Chapter One. However, there are other issues that need to be studied further by other researchers.

In order to address issues that are not covered by this research and build a more detailed understanding relevant to the topic, additional research should be made. This research has covered major KM practices and enablers identified from the literature in a project environment but there are some not explained in this study. Moreover, this study tries to investigate empirical finding of the general PKM practice influence on few project success dimension and tries to develop a prototype system. It might be important to find out the significance or contribution of each individual PKM practices for the good management of project knowledge. By identifying this and giving priorities to essential PKM practices, it helps AASTA to focus on those practices for their specific problems. It is also important to add value on this research by controlling variables that may impact the relationship between KM practice and project success such as geographical location, project size and project type.

In addition The designed system cannot be generalize to solve the gap that is found in the finance, plan & budget and procurement directorates of AASTA so it require further development , implementation and integration of this system with other directorates of AASTA because project implementation work is the total effort of more than one department. Lastly it is good if other researcher try to conduct such kind of project knowledge related system design or framework on different offices under the city government of Addis Ababa.

Reference

Abdullah, R., Selamat, M. H., Sahibudin, S., & Alias, R. A. (2005). *A framework for knowledge management system implementation in collaborative environment for higher learning institution.* Journal of knowledge management Practice, 6(1), 1-8.

Alavi, M., & Leidner, D. E. (2001). *Knowledge management and knowledge management systems: Conceptual foundations and research issues*. MIS quarterly, volume -25(1), 107-136.

Alshaher, A. A. F. (2013). *The McKinsey 7S model framework for e-learning system readiness assessment*. International Journal of Advances in Engineering & Technology, 6(5), 1948.

Ajmal, M. M. (2009). *Managing knowledge in project-based organizations: A cultural perspective.* PhD dissertation, University of Vaasa, Finland.

Antonova, A., Gourova, E., & Nikolov, R. (2009, September). *Extended architecture of knowledge management system with Web 2.0 technologies*. 10th European Conference on Knowledge Management ECKM09.

Argote, L., McEvily, B., & Reagans, R. (2003). *Managing knowledge in organizations: An integrative framework and review of emerging themes.* Management science, 49(4), 571-582.

Arnetz, M. (2013). *Use of Knowledge Management in Project Environments: A Cross-Case Analysis of Five Organizations.*

Bolisani, E., & Handzic, M. (Eds.). (2014). *Advances in knowledge management:* celebrating twenty years of research and practice (Vol. 1). Springer.

Cunningham, M. P., & Ferrell, O. C. (2015). *Marketing is Greatest Challenge: The Social Impact of the Globalization of Markets.* In Proceedings of the 1989 Academy of Marketing Science (AMS) Annual Conference (pp. 231-234). Springer, Cham.

Connelly, C. E., Ford, D. P., Turel, O., Gallupe, B., & Zweig, D. (2014). *'I'm busy (and competitive)!'Antecedents of knowledge sharing under pressure.* Knowledge Management Research & Practice, 12(1), 74-85.

Dalkir, K., & Wiseman, E. (2004*). Organizational storytelling and knowledge management: a survey*. Storytelling, self, society, 1(1), 57-73.

Dwivedi, A. N., Bali, R. K., & Naguib, R. N. G. (2003, September). *Organization current knowledge design (OCKD): A knowledge management framework for healthcare*

institutions. In Proceedings of the 25th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (IEEE Cat. No. 03CH37439) (Vol. 2, pp. 1236-1239). IEEE.

Gasik S, (2001*), a Model of Project Knowledge Management:* Project Management Journal. 42(3), 23-44.

Gacenga, F., Cater-Steel, A., Toleman, M., & Tan, W. G. (2012). *A proposal and evaluation of a design method in design science research.* Electronic Journal of Business Research Methods, 10(2), 89-100.

Grillitsch W, Müller-Stingl A, Neumann R, (2007). *Successful Sharing of Project Knowledge: Initiation, Implementation and Institutionalization*. The Electronic Journal of Knowledge Management. 5(1),19 – 28.

Guptara, P. (1999). *Why knowledge management fails*. Knowledge Management Review, 26-29.

Ferrada, X., Núñez, D., Neyem, A., Serpell, A., & Sepúlveda, M. (2016). *A lessons-learned system for construction project management: a preliminary application. Procedia-Social and Behavioral Sciences*, 226, 302-309.

Fugate, B. S., Stank, T. P., & Mentzer, J. T. (2009). *Linking improved knowledge management to operational and organizational performance*. Journal of Operations Management, 27(3), 247-264.

Hevner, A. R. (2007). *A three-cycle view of design science research. Scandinavian journal of information systems*, 19(2), 4.

Hung, D. F. (2015). *Sustained competitive advantage and organizational inertia: the cost perspective of knowledge management.* Journal of the Knowledge economy, 6(4), 769-789.

Hevner, A., March, S. T., Park, J., & Ram, S. (2004). *Design science research in information systems*. MIS quarterly, 28(1), 75-105.

Hevner, A., & Chatterjee, S. (2010). *Design science research in information systems.* In Design research in information systems (pp. 9-22). Springer, Boston, MA.

Jamshed, S., & Majeed, N. (2019). *Relationship between team culture and team performance through lens of knowledge sharing and team emotional intelligence.* Journal of knowledge management.

Jirava, P. (2004). *System development life cycle. Scientific papers of the University of Pardubice.* Series D Faculty of Economics and Administration. 9 (2004).

Jacyntho, M. D., Schwabe, D., & Rossi, G. (2002). *A software architecture for structuring complex web applications.* J. Web Eng., 1(1), 37-60.

Kartam, N. A. (1996). *Making effective use of construction lessons learned in project life cycle. Journal of Construction Engineering and Management*, 122(1), 14-21.

Peffers, K., Tuunanen, T., Rothenberger, M. A., & Chatterjee, S. (2007). *A design science research methodology for information systems research. Journal of management information systems*, 24(3), 45-77.

Newman, B. D., & Conrad, K. W. (2000, October). *A Framework for Characterizing Knowledge Management Methods, Practices, and Technologies PAKM 2000*, Third International Conference on Practical Aspects of Knowledge Management, Proceedings of the Third International Conference, Basel, Switzerland, October 30-31, 2000. CEUR Workshop Proceedings 34, CEUR-WS.org 2000

Kerzner, H. (2018). *Project management best practices: Achieving global excellence*. John Wiley & Sons.

Loufrani-Fedida, S., & Missonier, S. (2015). *The project manager cannot be a hero anymore! Understanding critical competencies in project-based organizations from a multilevel approach.* International Journal of Project Management, 33(6), 1220-1235.

Nonaka, I., & Takeuchi, H. (2007). *The knowledge-creating company*. Harvard business review, 85(7/8), 162.

Karlsen, J. T., & Gottschalk, P. (2004). *Factors affecting knowledge transfer in IT projects.* Engineering management journal, 16(1), 3-11.

Kasvi, J. J., Vartiainen, M., & Hailikari, M. (2003). *Managing knowledge and knowledge competences in projects and project organisations*. International journal of project management, 21(8), 571-582.

Kerth NL (2001). *Project retrospectives: a handbook for team reviews*. Dorset House Publishing, New York.

Lewis JP (2000), *The Project Manager's Desk Reference*: 2nd ed. New York: McGraw-Hill.

Liebowitz, J. (2008). *Knowledge retention: strategies and solutions*. CRC Press.

Mumford, A. (1995). *Putting learning styles to work: an integrated approach.* Industrial and Commercial Training, 27(8), 28-35.

P. J., Arisha, A. and Ragab, M, (2015): *A Review of Knowledge Management in the Public Sector: A Taxonomy*. International Forum on Knowledge Asset Dynamics. Bari, Italy.

Pemsel, S., & Wiewiora, A. (2013). *Project management office a knowledge broker in project-based organisations.* International journal of project management, 31(1), 31-42.

Polyaninova, T.: *Knowledge Management in a Project Environment: Organisational CT and Project Influences.* Vine, vol:41, iss:3, 2011. doi:10.21427/D7NK7M

Powell, W. W. & Snellman, K., (2004). *The Knowledge Economy*. Annual Review of Sociology, 30(1), pp. 199-220.

Project Management Institute. (2011). A guide to the Project Management Body of Knowledge (PMBOK guide) (6th ed.), p17 Project Management Institute.

Project Management Institute. (2013). *A guide to the Project Management Body of Knowledge (PMBOK guide) (6th ed.)*. Project Management Institute.

Reich, B. H. (2007). *Managing knowledge and learning in IT projects: A conceptual framework and guidelines for practice.* Project Management Journal, 38(2), 5-17.

Abdullah, R., Selamat, M. H., Sahibudin, S., & Alias, R. A. (2005). *A framework for knowledge management system implementation in collaborative environment for higher learning institution.* Journal of knowledge management Practice, 6(1), 1-8.

Schneckenberg, D., Truong, Y., & Mazloomi, H. (2015). *Microfoundations of innovative capabilities: The advantage of collaborative technologies on organizational learning and knowledge management in a multinational corporation. Technological Forecasting and Social Change*, 100, 356-368.

Tangaraja, G., Rasdi, R. M., Samah, B. A., & Ismail, M. (2016). *Knowledge sharing is knowledge transfer: a misconception in the literature.*

Terzieva, M., & Morabito, V. (2016). *Learning from experience: the project team is the key*. Business Systems Research Journal, 7(1), 1-15.

Walsh, J. P., & Ungson, G. R. (1991). *Organizational memory. Academy of management review*, 16(1), 57-91.

Appendix A: Questionnaire

I am conducting a research which aims to develop a Project Knowledge Management (PKM) System for the Addis Ababa Science and Technology Agency (AASTA), as part of the partial fulfillment of the Master's Degree in Information System, at Addis Ababa University.

Knowledge can be defined as the fact or condition of knowing something with a considerable degree of familiarity through experience, association or contact. It can be shared between individuals, codified from individuals to explicit form, and new knowledge is internalized from codified knowledge back to individuals. PKM is a set of actions for organizing and disseminating knowledge, establishing and training teams, and using technology solutions to ensure that relevant and filtered project knowledge is used appropriately and accurately by employees.

This questionnaires are prepared to collect the necessary data on the practices of PKM and factors that may influence the effectiveness of managing project knowledge in the AASTA, so that an appropriate organization specific PKM System can be designed .

This survey is completely confidential and anonymous. No personally identifiable information will be collected and all information will be analyzed and reported in aggregate. None of the information requested will identify you or your unit. Your data will be treated with strictest confidentiality and will only be used for the purpose of this study. I kindly request you to carefully and attentively read all the questions and give your genuine answers to the best of your knowledge by selecting the response that best represents your view.

Please put a tick mark (√) or an (×) sign for your selection in the corresponding box. If you have any questions about this research in general and the questions in particular, you may contact me using the following address.

Yirga Mekonnen Tel: 0912773936 e-mail: yirgat10@gmail.com

I. Background survey

1. Name of organization:_____
2. Gender: ☐ Male ☐ Female
3. Level of Education: ☐ 10+3 ☐ Diploma ☐ BA/BED/BSc

☐ MA/M.Sc. ☐ PHD Other:_____

4. Field of Study:_____
5. Position Currently you hold: _____

_____

6. Experience since you joined this organization

☐ 3 to 6 years ☐ 7 to 10 years ☐ more than 10 years

II. Please put a mark depending on the degree to which you agree with the statements.

1. Strongly disagree 2. Disagree 3.Neutral 4. Agree. 5. Strongly agree

Strategy	*1*	*2*	*3*	*4*	*5*
Project knowledge management practice is aligned with the agencies vision and mission.					
The agency supports managing existing project knowledge and creating new ideas.					
Project knowledge management contributes a great benefit to achieve the Agency goals.					
Existence of documented Goals / objectives of Project Knowledge Management in the strategy.					
Structure	*1*	*2*	*3*	*4*	*5*
Projects are fully controlled by project managers.					
The existence of clear decisions from top management towards using project knowledge management tools.					
The organization practices tight control from top management/Project managers.					
The organizations have technical team members to support project knowledge storage.					
Necessary resources are available to facilitate project knowledge management system.					
Project management Directorate /Department is a strategic partner in the agency					
System	*1*	*2*	*3*	*4*	*5*
The organization does not encounter any problems					

when an individual is left/leave the team tasks.					
The system in the organization supports reusing previous best practice for another project.					
The content of the project document contains all information clearly to be reusable by other projects.					
The documentation of the projects is done carefully by giving attention.					
Style/Culture	*1*	*2*	*3*	*4*	*5*
The organization regularly captures and uses tacit knowledge of experts in order to reuse for future projects.					
The organization provides a technology tool to keep the project knowledge of employees so that it doesn't lose the knowledge due to staff turnover, retirements, etc.					
The organization has a culture intended to promote project knowledge management.					
In the organization, there is a motivational scheme to encourage staff to share and apply shared project knowledge for other similar projects.					
I use IT tools for recording my day to day tasks.					
IT in AASTA support in searching and accessing previous project knowledge					
i am aware of lesson learned concept in project management					
Staff	*1*	*2*	*3*	*4*	*5*
AASTA arrange for capacity building programs related to project knowledge management mechanisms.					
AASTA encourages experienced workers to transfer or document their project related knowledge to new or less experienced workers.					
At the end of the completion of a project, I share my experience and best practices with other experts.					
I have reused my project experience /lesson learned points for more than one project.					
Skill	*1*	*2*	*3*	*4*	*5*
Project managers have technical skills towards man-					

aging project knowledge.					
Project managers have communication skills in guiding team members in managing project knowledge.					
I have technical and communication skill in sharing my project experience with other team members.					
Shared Values	*1*	*2*	*3*	*4*	*5*
AASTA Project managers have a strong belief in the benefits of managing project knowledge.					
I have a strong confidence in the benefits of managing /recording my project experience.					
Project Team members are aware of the benefits of project knowledge management in the organization.					
Project managers encourage documentation of previous best practice to achieve the project goal.					
Project knowledge Management	*1*	*2*	*3*	*4*	*5*
I believe managing project knowledge make the project team to be efficient in their work.					
I believe managing project knowledge make AASTA to reduce its budget and optimize its resources.					
I believe managing project knowledge will bring advancement and innovation.					

Table 14: Questionnaires

Appendix B: PKMS 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
Usability					
The proposed system is user-friendly					
The proposed system is Easy to use					
The proposed system contains all important aspect					
Content of the proposed framework					
The content of the proposed system is clear					
The content of the proposed system is correct					
The content of the proposed system 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 enhances project knowledge acquisition, use and reuse.					

Table 15: Evaluation check point