Cape Peninsula University of Technology

THE USE OF WEB 2.0 TO ENHANCE KNOWLEDGE MANAGEMENT IN PROJECT-BASED ENVIRONMENTS

by

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DECLARATION

I, **Bongani Chehore,** declare that the contents of this dissertation/thesis represents my own unaided work, and that the dissertation/thesis has not previously been submitted for academic examination towards any qualification. Furthermore, it represents my own opinions and not necessarily those of the Cape Peninsula University of Technology.

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ABSTRACT

The Project Based Environment (PBE) use projects as a primary means of production. Projects gather resources for a limited time with a specific goal in mind. In this time existing knowledge is sourced, new knowledge is created, consumed, and remixed. Managing knowledge effectively to support knowledge management (KM) activities can help improve productivity. The study of the relationship between KM and productivity has been ongoing, and it has shown a positive relation between the two. Despite this positive relationship managing knowledge is still a challenge. Projects continue to fail at a high rate despite the advent Web 2.0 based social media. The technology has shown capacity to create communities and foster information exchanges online. Projects are short lived communities that gather for a specific goal and as part of their process exchange a lot of information. Therefore, it is plausible that social media can enhance the management of knowledge in projects.

To explore the idea of using social media to manage knowledge in PBEs, literature was used to understand how knowledge is managed, the project environment and to clearly understand characteristics of social media and its capabilities. Furthermore, an online survey was randomly distributed to staff who work within a PBE at the City of Cape Town. The survey collected data on their experiences in the project environment regarding knowledge manage activities and social media.

The results show that social media can enhance the effective management of knowledge in the project environment. However, there is limited use of social media for the purpose of knowledge creation, dissemination and retention. A portion of that use is unsanctioned and therefore occurs outside of the KM strategy. On that basis it was concluded that social media can facilitate the management of knowledge in a project environment but only if careful consideration is taken to select the correct social media.

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DEDICATION

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GLOSSARY

PBO	Project based organization
PBE	Project based environment
KM	Knowledge Management
SAP ESC	SAP ERP Support Centre
SECI model	Socialization, Externalization, Combination and Internalization
SME	Subject matter experts
IT	Information technology
PMO	Project management office
URL	Uniform resource locator
UI	User Interface
SCN	SAP Community Network

CHAPTER ONE: INTRODUCTION

1.1 Introduction

1.2 Background to the Study

Project-based organizations (PBO) are widespread and are a large and vital part of modern societies and gain more considerable and effective share in the market (Almedia & Soares, 2014; Hartono et al., 2019). Gemünden et al., (2017:) states that, “In Germany's manufacturing industries, 46% of sales in 2013 were generated by commissioned external projects”. Projects within the PBO bring together individuals from different backgrounds for a limited amount of time to achieve a common goal. In such an environment, an enormous amount of knowledge is created, shared and consumed by the temporary integration internal and external experts (Hanisch et al. 2009:150). The combined effect of the uniqueness and a limited time due to the temporary nature of project makes knowledge management (KM) in a project a challenge (Hanisch et al. 2009; Hartono et al., 2019). The advent of Web 2.0 has brought about social media that has proven to be an effective in real time searching, organizing, and sharing memories and experiences through blogs (e.g., Blogger and Twitter), online social networks (e.g., Facebook, and Trip Advisor), media sharing websites (e.g., Flickr and YouTube) and social bookmarking websites (e.g., Delicious) (Nezakati et al., 2015:124;Nath, 2021:1). Social media enables personalized content exchanges that are more effective in meeting individual needs which in turn could lead to idea capture, management, and innovation (Archer-Brown & Kietzmann, 2018:1288-1289). The ability to create, manage, and leverage knowledge assets systematically can increase work efficiency and reducing risk, and moreover contribute to the organizations long term goals. As such, the research will look at how to apply social media and its capabilities in project-based environments for successful KM.

1.3 Problem Statement

The goal of KM is to effectively enable the sharing, creation, collection, and dissemination of knowledge which in turn positively impacts productivity in organization (Kianto et al., 2019). Projects are temporary organizations setup with to be operational for a finite amount of time resulting in challenges managing knowledge within and across projects. KM in projects is often downplayed in favour of scope, time and budget this is despite the positive impact KM has on productivity which can be seen in improved team performance, increased financial savings, revenue generation and solution adoption (Chua & Lam, 2005; Nath, 2021). Web 2.0 based social media enables the information sharing and collection in real time by turbocharging the network effect and enabling interaction, combination, upload and the customization on the web (Shuen, 2018:2). The advent of Web 2.0 based social media has

the potential enhancing KM in a setting specific to a project-based environment.

1.3.1 -problem (Managing Knowledge)

Ling (2011) defines KM as “The management of creating, storing, sharing and utilising organisation’s knowledge that gives understanding, experience, and expertise efficiently and effectively in a specific context for achieving specific organisational goals”. Ling (2011) goes on to say that KM activities: creating, storing, sharing and utilising are required to effectively implement KM. Projects can involve many people from different countries who speak different languages and have different cultures but for a finite amount of time leading to a huge that needs to be managed adds to the complexity (Foote & Halawi, 2016). The formulation of strategies to incorporate KM into organization is diverse, problematic with an array of views. (Kruger & Johnson, 2010)

1.3.2 Sub-problem (Role of social media)

Looking at the capabilities of social media to enable collaboration value through rich peer to peer and participative computing (Nath, 2021) alongside the activities managing knowledge, KM can potentially be shifted into a more efficient interactive conversational approach. In other words, by applying social media to facilitate knowledge creation, dissemination, utilization, and storage. If social media is to play a role in managing knowledge, then it should be applicable to structured approach of KM in a project setting. Even through there are internet based currently in use, Web 2.0 based are a newer generation of applications that harness network effects by facilitating collaborative and participative computing (Nath, 2021).

1.3.3 Sub-problem (Project structure)

The PBO is defined as “The project-oriented organization is conceptualized as an entrepreneurial, future- and stakeholder-oriented innovating organization, which uses projects as temporary, task-focused organizations, to define, develop, and implement its strategies, to transform its structure, culture and behaviour, and to define and develop new products, services, and business models” (Gemünden et al., 2018:1). By nature, projects are temporary. Projects unique, discrete a discontinuous where resources are put together and disbanded once the goal is accomplished therefore it becomes this creates a question of the continuity of meaningful knowledge from previous or related projects being retained for future use (Bartsch et al., 2013).

1.4 Aim, Objectives and Research Questions

1.4.1 The aim

The aim of the research is to investigate how Web 2.0. in the form of social media, can be used enhance the capturing, dissemination and retention of knowledge in a project-based environment. The research looks at the dynamics of KM in project-based environments and sought to find opportunities where the features of Web 2.0 can be made use of. Drawing from Burrell and Morgan (1979) in the context of empirical enquiry, the purpose of this research was to use a selected organization as a case study to describe the use of Web 2.0 in project-based environments.

1.4.2 The Objectives

The main objective was, therefore, to determine the influence of Web 2.0 in managing knowledge in a project-based environment. In order to address the aim and the main objective, the sub-objectives were therefore:

a) to explore the definitive characteristics of PBE;
b) to probe the types of knowledge to be managed within the PBE;
c) to investigate the functionality of Web 2.0 for facilitation of KM in PBE; and
d) to propose a set of guidelines for managing knowledge in PBE using Web 2.0.

1.4.3 The Research Questions

Given the above aim and objectives, the research questions were:

a) What are the characteristics of a PBE?
b) What type of knowledge is needed to manage in the PBE?
c) Which features of Web 2.0 will facilitate the management of knowledge in PBE?
d) What set of guidelines will enhance the management of knowledge in PBE using Web 2.0?

1.5 Overview of Research Design and Methodology

Given the ontological and epistemological position adopted for the empirical enquiry, the phenomenon that is considered as a social construct with embedded social-technical processes, the positivist paradigm was adopted as opposed to the interpretive due to the objectiveness of the real worldview of the phenomenon being studied. The research was conducted in a project-based environment as a single-case study, the analysis made use of statistics rather than individual experiences. The research therefore made use of quantitative research methodology with a web-based questionnaire as the survey instrument.

The research assessed the existing KM systems in the environment. The dissertation looked

at IT enabled business projects because they are seen as knowledge-intensive projects. The linkage between KM and project success is particularly relevant to IT projects because among other industries such as engineering, construction, and defence IT has been using projects to bring about strategic change. (Foote & Halawi, 2016).

Whereas other projects like construction projects also involve large quantities of physical materials, IT projects work with knowledge as their core input material (Reich et al., 2012) (Hartono et al., 2019). The research looked at a project-based environment within a metropolitan municipality. Project work in such institutions brings together individuals, from different disciplines and backgrounds from all over the world. A single case study was used in the research. The number of case studies to be included in the research were determined by factors that include the availability of time and ease of access. After assessment and analysis of the research findings will be made and recommendations will be made based on the findings.

1.6 Demarcation of the Research

The research was limited to a single site: the SAP ERP Support Centre (SAP ESC) at the City of Cape Town. The SAP ESC is focused on maintaining and developing the SAP ERP system on behalf of the City of Cape Town. The maintenance and development operations are executed by means of projects thus making it a project-based environment. At any given time, the floor consists of between 160 to 200 consultants at any given time with system development experience from all over the world. The respondents who took part in the survey held at least one of the following roles in their IT consultant experience: project manager, team leader, steering committee member, business analyst, developer/programmer and a functional consultant.

1.7 Significance of the Research

KM is considered as a vital factor to the success of projects despite a gap in how KM is implemented in PBEs (Sokhanvar et al., 2014). Almeida and Soares (2014) confirm that effective knowledge sharing within project and across projects in the temporary systems in the PBO remains a challenge. Researching the process of managing knowledge within the PBE will shed light on how it can be enhanced. This is taking into account the advent of Web 2.0 based Social Media applications and their potential capacity to enhance KM in a PBE.

1.8 Limitations of the Study

Limited research was conducted on how KM can be enhanced by using the Web 2.0. based social media. The study was done in a global context. The literature and data were gathered

from respondents with experience gained from all over the world. There are many forms of PBOs; construction companies, research and developments units in construction, defence, pharmaceutical companies, information technology (IT) systems solution development organizations, among others. The study was limited to a single IT development PBO.

The respondents who participated in the survey were working at the City of Cape Town SAP ESC, an information systems development business unit within the municipality. At the time of the research, the respondents were working at the SAP ESC, but the questions contained in the survey sought responses based on their entire project experience.

At the time when the study was conducted there existed limited research of the use of social media in relation to the management of knowledge in a project-based environment (PBE). Because of the infancy of research of social media usage for managing knowledge not all the existing platform types were presented but rather the definitive capabilities were highlighted.

1.9 Outline of the Study

The research is distributed over six chapters to address how social media and its capabilities can facilitate the management of knowledge in projects-based environment. The first chapter introduced the research. The background of the study will highlight the previous and current research concerning the use of social media and KM in the PBEs. Also included in the first chapter as part of the introduction to the research is the problem statement which points out the issue to be addressed, the study objectives which is how the research was conducted in the research design.

The second chapter is focused on the literature review. The literature to be reviewed will cover topics that include the capabilities of social media as a technology based on Web 2.0., management of knowledge and the related activities, types of knowledge, and the nature and knowledge dynamics within a PBO.

The third chapter focused on the research design and methodology that was applied in the investigation of the research problem. This chapter further explains the instruments used and the motivation in the collection of primary and secondary data.

The fourth chapter presented the data that was collected and analysed with reference to the research problem and the literature explored in the literature review. In the fifth chapter the findings are based on the data that was collected, discussed as well as the recommendations of how to address the research objectives are given. Suggestions are made as to which areas of the research topic can be taken further. The sixth chapter concludes the

research.

1.10 Summary

This chapter provided the background and the rationale for the research by introducing the research problem, and the objectives of the research, which were subsequently linked to the research questions and their sub problems.

The next chapter assessed the current literature on the management of knowledge, the project-based environment and the key characteristics of the types of Web 2.0 based social media. This introductory chapter highlights the research, and the background, as a prelude to the exploratory study into what constitutes the management of knowledge, the related activities, the types of knowledge and strategies and the role of potential Web 2.0 technology. This then is assessed against the collected data leading to a conclusion related to the hypothesis.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

Organizations are increasingly implementing their operation through the project to the point that projects became the most important delivery vehicle for products (Todorović et al., 2015; Almeida & Soares, 2014; Allameh, 2018). Projects continue to fail after many years of focusing on performance defined by scope, time, and budget (Reich et al., 2014). According to (Mieritz, 2012) seventy to seventy-five percent of all IT projects still fail. The Chaos report (2015:4) by Standish states that only thirty percent are considered successful. Disterer (2002) attributes this to the fact that traditional project management is overly concerned with efficiency and effectiveness. As a result, KM in the project environment has often been overlooked. Brown (2008) states that: "the fact that there is very little knowledge transfer and sharing between project teams this has to play a key role in allowing these failures to occur." If KM is made a key criterion for successful project completion it would increase the growth of the learning curve of the organization. KM in the project settings can also leverage technology like social media to stimulate personal ideation or support collaborative knowledge development (Maravilhas & Martins, 2019).

Empirical studies into the relationship between KM and productivity shows a strong correlation between KM practices and project managements success (Reich et al., 2012). Todorović et al. (2015) and Park and Lee (2014) concur and go on to highlight literature in studies by Faraj and Sproull (2000), and Quigley et al. (2007) from as far back as three decades that also confirms a positive relation between KM and performance in projects. Wiig's (1993) study states that: "knowledge management is the management of corporate knowledge that can improve a range of organizational performance characteristics by enabling an enterprise to be more intelligent acting."

Even with the confirmed positive contribution of KM to productivity there are still challenges in the implementation. Todorović et al. (2015) attributes these challenges to the lack of routines and other appropriate learning mechanisms, as well as the unavailability of the previously learned lessons and reports from the previous projects. Poor documentation of organizational processes, fail to fully reflect the course of procedures and activities (Todorović et al., 2015). The right tools and structures are needed to facilitate the activities in the management of knowledge in all its forms. Maravilhas and Martins (2018) suggest that tools and machines can be stimulate creativity and enable personal ideation while also supporting knowledge created collaboratively when inserted in a network of participants.

One such tool to enable learning and knowledge transfer can be found in Web 2.0 which forms the bedrock of social media which in turn comprises a set of platforms that enable "people to connect, communicate, and collaborate" (Hemsley & Mason, 2012: 3928). The different types of social media platforms have shown an ability to enable conversational interaction and social feedback that facilitates building trust and signalling reputation within a community (Hemsley & Mason, 2012). The capabilities of social media has had an impact on how the dissemination, creation, consumption and retention of knowledge in an informal setting is evidenced by platforms such as Stack Overflow, Wikipedia, Reddit and Twitter or the use of social media for disaster recovery management in the wake 2010 earthquake in Haiti (Pew Research Center, 2010). The same capabilities have the potential to facilitate the management of knowledge in a formal setting within an organization such as a project environment (Nath, 2021).

The next step is to establish a clear understanding of what constitutes knowledge and how to manage it.

2.2 Concept of Managing Knowledge

Understanding knowledge is the first step to managing it effectively (Verna, 1997). Knowledge is a: "mix of framed experiences, values, contextual information, and expert insight that provides a framework for evaluating and incorporating new experiences and information" (Davenport & Prusak, 2000). The above definition of knowledge by Davenport and Prusak (2000) is based on two underlying concepts: data and information. Bellinger, Castro and Mills (2004) also referenced Ackoff's (1989) who is of the same opinion that data is raw and has no significance beyond itself.

Davenport and Prusak (2000) expand on their definition of knowledge, they define data as a set of discrete objective facts about events. Data becomes information once meaning has been added to it the form of a relational connection(Bellinger et al., 2004). Information is data that is processed to be useful by providing answers to "who," "what," "where," and "when" questions but not "how" when data organized into meaningful unions (Paunović, 2008). It is in the application of data and information, providing answers to "how" questions, only then does it become knowledge (Chen et al., 2009).

Bellinger, Castro and Mills 2004) go on to make a distinction between data, information and knowledge by way of examples. "Data: It's raining. Information: The temperature dropped by fifteen degrees and then it started to rain. Knowledge: If the humidity is very high and the temperature drops substantially the atmosphere is often unlikely to be able to hold the

moisture and so it rains." The examples above show that data is statement of raw fact, which transitions to information when there is an understanding of a relationship of some sort, possibly the cause and the effect that leads to that fact. Bellinger et al., (2004) stated that information is converted to knowledge when it presents a pattern that connects and generally provides a high level of predictability as to what is described or what will happen next. However, Meter (2020) argues that the information is valuable if the underlying data is correctly interrogated and is accurate. Mazorodze (2020) add to this definition by saying that, "knowledge consists of a mixture of information, values, rules and experiences from different sources". Ultimately, knowledge has the capacity for action (Nickols, 2012).

From the above definition one can see that data, information and knowledge are related concepts. One stems from the evolution or devolution of the other. Once the basic elements of knowledge have been defined and understood then knowledge can be broken down according to where it is sourced. This is achieved by looking at the different forms in which knowledge can exist. Davenport and Prusak (2000) as part of their definition suggest that knowledge can be sourced in the minds of "knowers" and that in organizations it is often embedded not only in documents or repositories but also in organizational routines, processes, practices, and norms. If sources of knowledge are used to define knowledge, then value of knowledge is embedded in two basic kinds of knowledge, namely, tacit and explicit knowledge (Davenport & Prusak, 2000; Archer-Brown, 2018). Tacit knowledge resides with the individuals mind (Mazorodze & Buckley). Nickols (2012) describes tacit knowledge as being the kind of knowledge that is reflected in a person's internal state as well as in their capacity for action. Explicit knowledge is then described as the kind that has been articulated and frequently recorded. Explicit is also referred to as the "know-what" knowledge and tacit knowledge as the "know-how" knowledge (Li et al., 2018:). Tacit and explicit knowledge will be discussed in more detail in the next section.

2.2.1 Tacit and explicit knowledge

Explicit knowledge is commonly characterized by being visible, identifiable in written form and thus can be easily disseminated to others through communicable through formal and systematic language (Maravilhas & Martins, 2018). Explicit knowledge is public and most widely known. Explicit knowledge is the conventional form of knowledge that is found in books, journals, and mass media such as newspapers (Seidler-de Alwis and Hartmann, 2008). Nonaka (1997) added that it can be expressed in words, not necessarily written and needs not have a context.

An example of explicit knowledge is the requirements documentation in an information technology (IT) project. On the other hand, tacit knowledge is gained through an interactive process or an experience thus rooted in a person's ideals, values and emotions (Mazorodze & Buckley, 2020). It is not documented or easily articulated but still useful. It is stored in the individual's mind. "Tacit knowledge is a mix of experiences and is built on information as it contains this mix of experiences and skills" (Polanyi, 1967). Tacit knowledge embodies an individual's education, natural talent, experiences, and judgment (Kikoski & Kikoski, 2004: 67).

Drew (2023) who also references Polanyi's definition of tacit knowledge furthermore by providing an example of tacit knowledge: As a child grows, they acquire their native tongue language through before formally studying the rules of grammar and syntax. Tacit and explicit knowledge are not a mutually exclusive, meaning that knowledge types can co-exist in the same space (Nonaka, 1994). In fact, they are both essential for knowledge creation. The two types of knowledge have no single agreed upon definition but characteristics such as visibility, tangibility and sources can be used to highlight the differences. Table 1.1 below compares the properties of tacit versus explicit knowledge.

Table 1.1: Comparison of properties of tacit versus explicit knowledge (Nonaka, 1994)

Properties of tacit knowledge	Properties of explicit knowledge
Ability to adapt, to deal with new and exceptional situations	Ability to disseminate, to reproduce, to access and re-apply throughout the organization
Expertise, know-how, know-why, and care-why	Ability to teach to train
Ability to collaborate, to share a vision, to transmit culture	Ability to organize, to systemize, to translate a vision inro a mission statement, into operational guidelines
Coaching and mentoring to transfer experiential knowledge on a one-to-one, face-to-face basis	Transfer knowledge via products, services, and documented processes

Nonaka (1997) proposed that knowledge creation occurs through continuous interaction between tacit and explicit knowledge. Explicit knowledge without tacit insight quickly loses its meaning (Seidler-de Alwis & Hartmann, 2008:134) as tacit knowledge is created from application explicit knowledge. Tacit and explicit knowledge are complementary as are essential to knowledge creation (Li et al., 2018:887). Tacit knowledge includes insights gained from team social relations, experience and application, and without the intuition learnt over time the knowledge becomes outdated through the loss of some of these facets (Maravilhas & Martins, 2018; Almeida & Soares, 2014).

In Davenport and Prusak's (2000) definition of tacit knowledge they stated that tacit knowledge is created from experiences and values, which are often lost when tacit knowledge is codified. The transition from one form to another is blatant when new knowledge is being documented. In other words, the transition of tacit knowledge to explicit knowledge is the most conspicuous change of state between the two knowledge types. The explicit knowledge can then be turned back to tacit knowledge through application of the explicit knowledge. This further detailed in the knowledge creation process.

2.2.2 Creation of knowledge

With the co-existence and significance of the two types of knowledge in the management of knowledge being acknowledged one can now look at how knowledge is created because of the interaction between the two. According to the SECI Spiral Model also known as the SECI model of knowledge creation, a model proposed by Nonaka (1994) on synthesis of knowledge which was further refined in a joint study by Takeuchi (Nonaka & Takeuchi, 1995), knowledge is a result of the interaction between tacit and implicit knowledge. The SECI Spiral Model proposes that continuous knowledge creation is enabled by the knowledge conversion between tacit and explicit knowledge (Li et al., 2018:). The two forms of knowledge even though seemingly opposite when contrasted they coexist in a continuum in the knowledge creation process (Nonaka et al., 2014). The SECI Spiral Model has four processes on the continuum namely: socialization, externalization, combination and internalization (Kianto et al., 2018).

The first of the four processes to be described is called socialization. Socialization is the exchanging of tacit knowledge with other forms of tacit knowledge through shared experiences (Creswell & Poth, 2018: Spencer 1997) in his summary of Nonaka's (1994) presentation defined socialization as: "the process that transfers tacit knowledge in one person to tacit knowledge in another person". Chatti et al. (2007) gave a more comprehensive definition of socialization as: "the process of sharing tacit knowledge, that is the rich and untapped knowledge that resides in individuals such as know-how, expertise, understandings, experiences and skills resulting from previous activities, not through language but through observation, imitation, practice, and participation in different formal and informal communities". The first definition highlights that socialisation has the need for person-to-person contact, and the second definition details how the process occurs but both definitions still speak about human interactions as a means by which socialization occurs. The core aspect of socialization is knowledge sharing through interaction (Natek & Zwilling, 2016; Li et al., 2018)

The next process in the SECI Spiral Model is externalisation, this is the conversion of tacit knowledge to explicit knowledge for example, when common office practices become written rules within the organisation and are added to the requirements of writing guidelines. The externalisation process can be seen as the formalizing of knowledge. Key to the externalization process is that one's ideas. The tacit knowledge, be expressed either as words, concepts, figurative language such as metaphors, analogies or narratives or visuals in an understandable format for collective consumption (Nonaka et al., 1998). Li et al., (2018) argue that internalization and externalization are the base of individual knowledge. Maravilhas and Martins (2019) concur and further that the externalization process result in the creation of conceptual knowledge. Archer-Brown & Kietzmann (2018) say that tacit knowledge needs to be socialized to become explicit knowledge that is to be useful. Maravilhas & Martins (2019) go on to say that the critical step in the conversion of tacit to explicit knowledge is codification. In essence the conversion of tacit knowledge to explicit requires socialization as a prerequisite.

The second last process to be explained, combination; involves merging this explicit knowledge with other explicit knowledge. Combination results in the emergence of new knowledge (Li et al., 2018). An example would be adding a template of the document to the written documentation rules. It is in this step that technology is most useful (Spencer, 1997). This is because it creates from one explicit knowledge a more complex set of explicit knowledge. Technology can facilitate the capturing, integration, editing and dissemination of the explicit data. This when individual knowledge is transformed into organizational explicit knowledge to reconstruct existing explicit knowledge and generate new explicit knowledge by organizing, classifying and connecting knowledge (Li et al., 2018).

Lastly, internalization is the conversion of the explicit knowledge back to tacit knowledge. This can be seen as the converse of externalization. The conversion of tacit knowledge happens through the practical application of doing what was specified in the explicit form. It is through this application that new insights and know-how is gained. Li et al., (2018:7) also argue that internalization can occur by reflection resulting the know-why knowledge. Using the above hypothesis based on the SECI Spiral model, knowledge is created and updated through interactions between tacit and explicit knowledge, also known as knowledge conversion, and not from either tacit or explicit knowledge alone (Nonaka et al., 2000:6; Kianto et al., 2019).

It is worth noting that while technology support all knowledge conversion, but it is weaker when supporting externalization and socialization because these forms of knowledge

transfer are grossly based on shared experience (Gyamfi, 2018).

2.2.3 The facilitation of knowledge creation

Davenport and Marchand (2000) suggested that KM creation extends beyond the management of existing knowledge. Davenport and Marchand (2000) stated that: “whilst KM does involve information management, beyond that it has two distinctive tasks: to facilitate the creation of new knowledge and to manage the way people share and apply it’’. Kianto et al., (2019) add to the previous statement by saying KM should organizational mechanism that allow individual to develop knowledge collectively within the organization. the four processes described by Nonaka (1997) detailed how knowledge was created and provided insight into how knowledge could be shared and consumed in any environment. The processes proposed by (Nonaka et al., 2000:8) are necessary in capturing knowledge, enhancing the knowledge, sharing the knowledge and the application of the knowledge. It can therefore be concluded that the four processes mentioned above occur during the creation, dissemination and application of knowledge and are an integral part of the management of knowledge.

2.3 Managing Knowledge

Duhon’s (1998) definition of KM: “Knowledge management is a discipline that promotes an integrated approach to identifying, capturing, evaluating, retrieving, and sharing all of an enterprise’s information assets. These assets may include databases, documents, policies, procedures, and previously un-captured expertise and experience in individual workers”. Reich et al., (2012) focused on projects for their definition of management of knowledge in the IT project environment, and their definition within that context management of knowledge in a project is the management activities required to source the knowledge stock, create the enabling environment, and manage the knowledge practices to result in an aligned set of project-based knowledge. Reich et al., (2012) go on to explain the concepts of knowledge stock, enabling environment and managing knowledge practices. An explanation is given below to provide a full understanding of the definition as it provides insight into the concepts involved in managing knowledge. An enabling environment is a combination of the technological and social aspects of a project that facilitates knowledge practices. Knowledge stock is the relevant domain knowledge of the IT team, the business team and the governance team. Knowledge practices is the actions taken to map and share knowledge within and between the IT, business and governance teams in an IT-enabled business

project. Summing it all up to effectively manage knowledge in IT projects requires one to create an environment, through its process and practices, which facilitates the accessing of knowledge repositories. Looking at the two definitions from Reich et al., (2008) and Duhon (1998), they both highlight the activities, resources and infrastructure employed in the management of knowledge. The definitions combined showed the interplay between the composite elements of KM. As broad as the concept of managing knowledge is shown to be by the above definitions, in practice, most attention is paid to codifying tacit knowledge. This speaks to the externalization process in the SECI Spiral Model. Fong et al., (2005) concurs with this point and goes on to add that knowledge can also be retained by ensuring the diffusion of knowledge among other members of the same community. The additional statement points at the undocumented tacit knowledge which is the socialization part in the SECI Spiral Model. By steering knowledge managers away from only looking at codifying tacit knowledge aspects of managing knowledge, it opens room to the other knowledge aspects mentioned above such as policies, procedure, and technologies.

A holistic perspective allows for the formulation of an effective strategy, this is encouraged since the point of managing project knowledge is to integrate the KM as a practice and its activities into all the processes and information systems of a project to ensure that knowledge is properly captured and shared (Headquarters Department of the Army, 2012). An integrated approach creates a synergy from the different KM activities in the project environment and formulates a strategy on how to approach the whole process. Knowledge transferring activities should be linked to the organisational strategy. A strategy which based on the best design for creating and maintaining, transferring, and applying organizational knowledge (Mazorodze & Buckley, 2020). Researchers and practitioners have formulated a multitude of approaches to managing knowledge. De Souza and Evaristo (2003) are of the standpoint that most of these strategies can be broadly categorized into codification and personalization approaches.

2.3.1 Personalization

Personalization is a KM strategy that focuses on transferring experience through direct contact (Bornemann et al*.,* 2003). The basis of personalization is that knowledge is thought to be the property of an individual and is generated when individuals work together in what is termed as “communities of practice” (Brown & Duguid, 1998). The definition suggests that personalization is similar to socialization which combines tacit knowledge together through personal interactions and human networks. Knowledge sharing can be achieved by personal interaction between individuals because the knowledge is tied to persons who developed it

(Fong et al., 2005). To this end knowledge seekers and providers must be granted access to suitable communication methods such as meetings, workshops, and coaching sessions where they can share the soft items (Bornemann et al., 2003 and Fong et al., 2005). Such methods of communication and creation of human networks can be effective especially because of the speed of knowledge and richness of the content. There is a direct transfer during meetings as the context of the knowledge exchanged is set by the agenda. However, these methods have some drawbacks namely interpersonal knowledge sharing activities are time consuming (Bornemann et al., 2003).

The greatest disadvantage is that the knowledge is not captured or codified by the organization (Polyaninova, 2011) thus knowledge cannot be accessed if the individual holding it is not accessible. The Bornemann et al*.,* (2003) is of the opinion that the nature of human networks makes them suitable for transferring knowledge on complex issues as it includes learned nuances, subtleties, and workarounds (Headquarters Department of the Army, 2012), while simpler issues can be shared through information communication tools which include among others social media, databases and organization documentation. The communication tools are central in the codification of data as they can play a complimentary role to the transfer and the creation of knowledge.

2.3.2 Codification

A codification strategy attempts to create documents of the knowledge that can be made explicit in database records in the form of documents, standard operating procedures, project definition, activities, history, and results (Bornemann et al., 2003 and Fong et al., 2005). The strength of this form of sharing is that the knowledge can be shared without having to encounter another individual. This lack of personal interaction and commitment of knowledge is the reason why this process is seen as the addition of knowledge to the organizations' memory. The fact that knowledge can be transferred without having to contact the person who originally developed it affords the organization the capacity of achieving the scale in knowledge reuse within large projects (Hansen, Nohria & Tierney, 1999). It also enables knowledge transfer across projects. A perfect example of codification is the documentation of lessons learnt in a project (Polyaninova, 2011). Bornemann et al. (2003) saw codification as having the advantage of having the knowledge contained in the document being available. Bornemann et al., (2003) also mentioned that the other advantages of codification are that the knowledge can be easily distributed and that it is suitable for situations where there is knowledge reuse.

The advantage of scalability, measurability and transferability can be reasonably seen in the justification for emphasis on codification practice. However, there are also disadvantages to this approach namely that the documents can become obsolete as time goes on and the context cannot be fully provided for. Knowledge is only actionable if it is in the appropriate context for use (De Souza & Evaristo, 2003). The documents are vulnerable to becoming out-of-date particularly if the documents are not easily updatable. Consequently, in time the knowledge contained therein cannot be applied. Codification is particularly suited for environments where knowledge processes or products are clearly defined and standardized. When comparing the different strategies strengths and weakness it is important to realize that they are complimentary to one another (Fong et al., 2005). For the purposes of selecting which strategy to apply as a main strategy the criteria should be based on the characteristics of its product portfolio, project deliverables and the nature of the employees' problem-solving activities (Ajith Kumar & Ganash, 2011). The success of codification rests on how knowledge can easily be captured and accessed. Accessibility depends on how well the data is organized in data repositories. Technology primarily plays a major role in the storage and retrieval of this information. A well-organized repository like a wiki or blog makes it possible for knowledge users to find the knowledge and apply it. In contrast personalization IT is used primarily as a means to locate knowledgeable people and enable direct communication (Kumar & Ganesh, 2011)

The crux of managing knowledge is seen as getting the right knowledge to the right person at the right time. The above strategies show that effective management of knowledge can be achieved making knowledge accessible by either locating the knowledge itself from electronic repositories or the individuals who hold it. This becomes especially important where knowledge is created, shared, and consumed by intense interactions in a limited space of time. Social media technologies like social networks have the capacity of making knowledgeable people accessible through the technologies' ability to create large user communities and knowledge repositories such as blogs and Wikis. De Souza and Evaristo (2003) suggest that personalization is best suited for global projects due to the difficulty in explaining tacit knowledge without interaction among peers. However, it is noted that the codification has the ability of sharing knowledge across projects, which is a challenge in the project environment. The most suitable strategy is selected based on understanding the unique characteristics of a project environment and its deliverables while taking into account tacit knowledge, explicit knowledge and their interaction as specified in the SECI model.

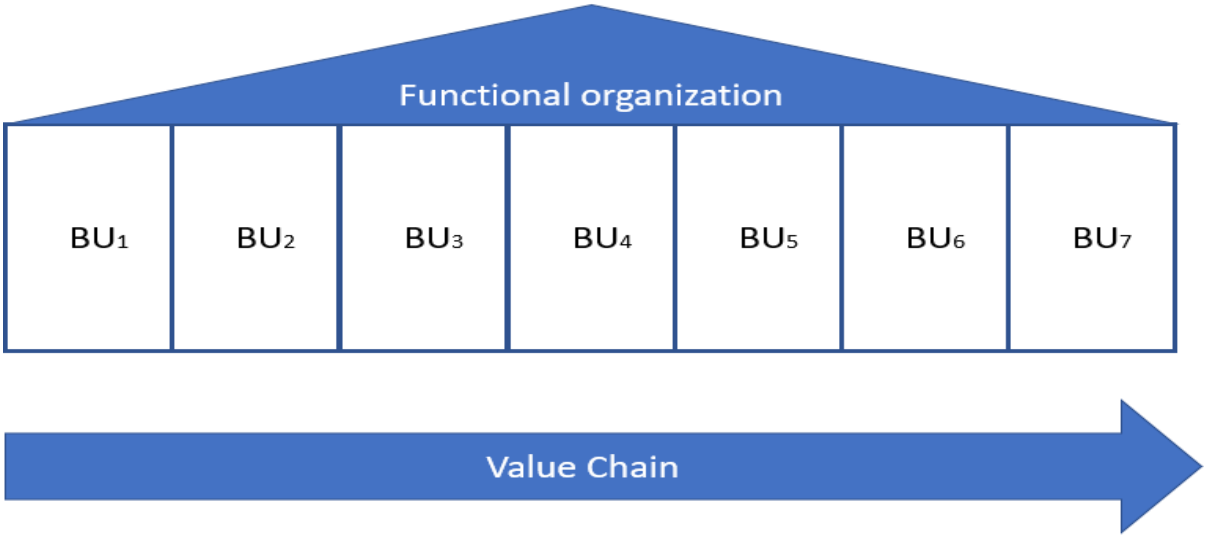
2.4 Project Environment

The project environment is a markedly unique environment with several distinct characteristics. Some of these characteristics have a significant impact on how knowledge is managed. One of the key characteristics of projects is that a project is a one-time activity with a determinate life (Egbu, 2010). A project is transient, that is, it has a start date and an end date within which all the activities of a project are supposed to occur (Turner, 1999: p.4) During this time, complex processes occur involving new product development and innovation. Project participants create and consume large amounts of information. Wiewiora et al., (2009) suggest that because of a combination of factors that include the finite structure of projects, the time distance between them, the lack of or the weakness of formal links across projects faces knowledge transfer challenges. As a result of the aforementioned characteristics of projects and capacity for innovation there is a need for the knowledge to be identified, captured, stored and processed (Bresnen et al., 2003). However, if you combine the limited time, the discontinuities in the flow of personnel, materials and information that are created by the complex processes of new product development and innovation; it becomes increasingly difficult to develop steady state routines that maximise the flow of knowledge and the capture of learning from one project to the next (Krause, 2018). This difficulty has a bearing on productivity as KM plays a part in the productivity of a system or organization and is direct and positive (Torabi and El-Den, 2017). The complexities resulting from the nature of a project and the probability of improved productivity can be resolved by understanding the dynamics of the project environment. This is particularly relevant in organizations or business units that use projects as a significant mode of production. An understanding as to how it differs from other production environments within an organization can bring to light the source of the knowledge challenges and possibly sheds a light on possible solutions.

2.4.1 Concepts of a project based environment

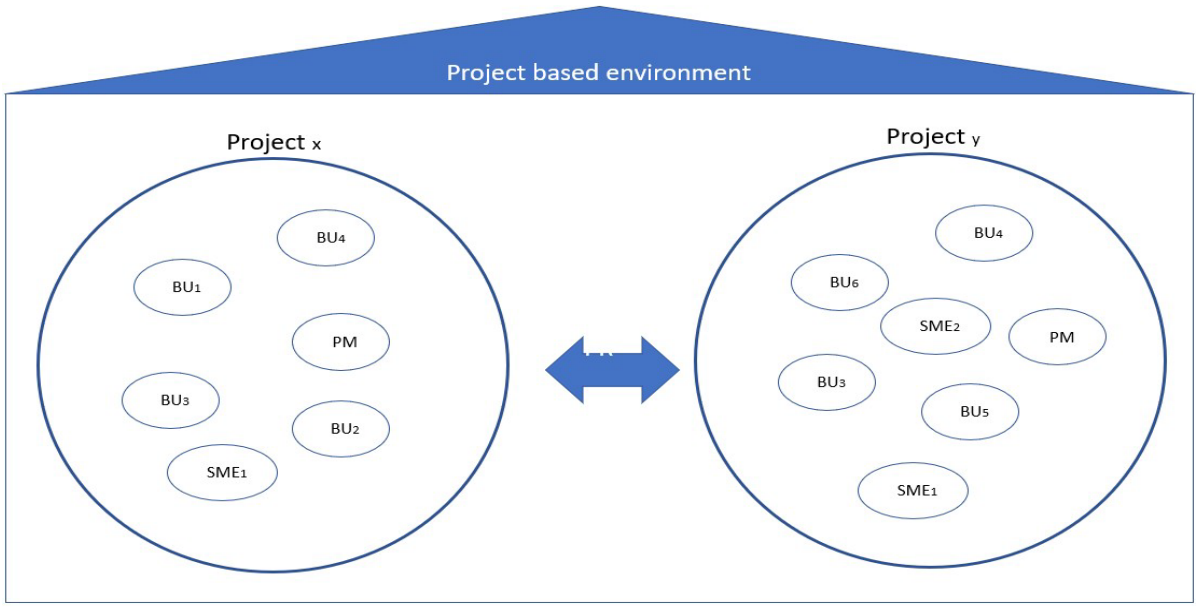
Pemsel and Wiewiora (2013) define a PBO as organizations in which the majority of products or services are produced through projects for either internal or external customers. An example of this is a construction company where new structures are rolled out by means of a project. A further distinction can be in that PBO are permanent structures consisting of g of multiple projects, whereas project-based enterprises are temporal entities created around a project (Miterev et al., 2016).

Figure 2.1: Functional business organization



BU – Business unit

For contrast and clarity on how a PBO organizational structure differs from the other type of production environments it can be compared to the functional business organizational structure. The business dictionary defines functional business organizational structure as an organizational structure in which the business is broken down into a logical segment of a company such as accounting, production, and marketing that performs a specific business function. Each component plays a defined role in the production through a continuous process.



BU – Business unit
SME – Subject matter expert
PM – Project manager

Figure 2.2: Project based organization

Pemsel and Wiewiora (2013) in their description clearly distinguish between the two environments at high level. In another article Wiewiora et al*.,* (2009) went on to show how the environments were distinguished at a lower level using four characteristics, namely, organizational structure, viewpoint on time, processes and people. In the next section, the PBO is viewed from these four perspectives. Since the aim is to understand the peculiarities of the project environment, the focus will be on PBOs with reference to other organizational environments for contrast.

2.4.2.1 Organizational structure

From an organizational structure perspective an extreme form of a PBO is organized solely around projects (Hobday, 2000). Each project is a standalone unit in itself and as such, there is no functional division of labour or task coordination across project lines. Unlike in functional organizations these are based on hierarchy and tasks are divided based on functional units. The functional units then co- ordinate to achieve the organizational strategy. An example would be the different departments such as human resources, logistics, finance and so forth in an organization that play a role in fulfilling the organizational strategy. Morley (2018) elaborates on the same point on the flat structure of PBOs when she states that: "there are many teams that are operating simultaneously yet independently, but they have no need to interact with each other as each team is focused on completing its project".

2.4.2.2 Time

From a time standpoint, projects are in operation for a limited amount of time. The time limit is one of the defining characteristics of a project. In the project environment, the handling of time is more complicated due to the fact that time is literally running out against a finite resource from the start, and this is known from the beginning (Wiewiora et al*.,* 2009). The time aspect where end date of the project is known from the onset creates a perception of discrete events from one project to another. As a result of this the perception management of knowledge is often ignored or undermined. The need to beat the set deadline further undermines KM resulting in project managers and the participants focusing on immediate wins.

2.4.2.3 Processes and resources

The processes and resources are focused on performing routine tasks, achieving economies of scale, and facilitating companywide technical development (Wiewiora et al., 2009). Whereas the PBO's focus in on innovation therefore are more focused on flexibility to quickly

adapt to situations (Wiewiora et al., 2009). The processes within a project operate within phases where once completed they are terminated. In the case of the functional organization these are continuous until such time there is compelling reason to change them.

2.4.2.4 People

Prior to the start of the project resources are planned for and allocated. The resources take the form of money, time, and human resources among other forms. The primary focus in this context is the human resources, their interaction and impact on the management of knowledge. Resources in a project are sourced from different business units or even externally.

The teams exist as a unit for a very short time or only for the duration of the project then they are disbanded. As a result, the disbanded team often has little time or motivation to reflect on their experiences and to document any knowledge for the future (Brady & Davies, 2004). Resources know that they are only in this environment for a limited amount of time and so they form weak ties. Bresnen et al., (2003) reemphasized the desolate nature of projects, they say that projects differ substantially from one another creating significant discontinuities in the flow of personnel, materials, and information. It can be argued that the finite resource allocation is similar to budgeting for a functional unit for a financial year. However, the business unit is not disbanded at the end of the financial year or upon fulfilment of a goal.

2.4.2 Managing knowledge in PBOs

Pemsel and Wiewiora (2013) describe a hybrid scenario where it is possible to have a PBO within a functional business structure. The Project Management Office (PMO) is a unit within organizations to facilitate and oversee organizational projects that serve as an interface between top management in the parent organization and project management within a PBO. They go on to state that in this case: “from a knowledge perspective, PMO can be regarded as an organizational unit facilitating coordination of knowledge and other resources between the PBO and its projects and can therefore act as a bridge over organizational and knowledge boundaries”.

Fong et al. (2005) in his presentation on management of knowledge in PBOs adds to the knowledge perspective by noting three types of KM in a PBO which usually fall under the ambit of the PMO these are Project-to-Project (P2P), Project-to-Business (P2B) Business (P2B) and Business-to-Project (B2P). The types of KM that occur between the PMO and the rest of the functional business units are explained in Table 2.1 below:

Table 2.1: Knowledge management types that occur in the PMO

KM Types	Description
Project (P2P)	The passing of experience and ideas from one project to another.
Project (P2B)	The movement of experience from project teams to the central business functions.
Project (B2P)	The dissemination and development of new skills and competencies in central departments to project teams.

Wiewiora et al., (2009) in their definition of knowledge state that: "it is a fluid mix of framed experience, values, contextual information, and expert insight that provides a framework for evaluating and incorporating new experiences and information". They go on to say that knowledge is sourced from the minds of knowledge holders and is codified as documents, organizational routines, processes, practices, and norms. The definition maps to the different processes in the SECI model look at the different types of knowledge and interaction between to create new knowledge. The projects resources, processes and knowledge as independent business units is co-ordinated by the PMO (Wiewiora et al., 2009). The PBO has a relatively flat structure that draws on resources, or alternatively has stakeholders from various business units to achieve a common goal in a limited amount of time that is known from the onset. After which the project resources are disbanded. This creates challenges for managing knowledge in such a space. For example, the high resource turnover creates the need for knowledge to be codified and to make it available for use within or across projects when the project personnel that hold the knowledge can no longer be accessed. It is also as simple as pointing to a codification strategy due to the ability to scale, focus and retain knowledge due to the fact that projects often address complex scenarios.

2.4.3 Challenges of managing knowledge in the project-based environment

The key characteristics of a project are the finite time, the clearly defined deliverables, the temporary gathering of resources and complex processes. These present a challenge on how knowledge is managed in such an environment. The simple fact that KM is not a metric of successful project completion creates a challenge for managing knowledge in the project. Reich et al., (2012) define the management of knowledge in the context of a project as the application of principles and processes are designed to make relevant knowledge available to the project resources.

The project environment presents a unique set of challenges different from the routine business operations. Within the project environment, the workforce is very mobile meaning that they move from one project too quickly as soon as it is done. Some of these challenges show themselves when collecting, filtering, storing, and disseminating knowledge. Knowledge transfer can become irregular and unstructured because of the high turnover.

Reich et al., (2008) added to the challenges of managing knowledge by looking at knowledge-based risks in IT projects. They say that from a KM perspective there are two main knowledge risks at the beginning of a project namely the failure to learn from past projects and the failure to meet the project's knowledge needs during team selection. As a result, when each new project starts, there is a tendency to reinvent the process, rather than learn from the experiences of previous projects (Prusak, 1997). It is important that the output of projects include technical knowledge of the service or product being delivered and procedural knowledge on how to use the service or the product. This points back to the types of KM that need to be catered for the PMO and the rest of the business Fong et al. (2005).

Lessons learnt in a project provide domain and institutional knowledge which are important to the project as they could affect the developing process knowledge and shape how the project manager plans and monitors the project (Thomas & Tjader, 2000). To minimize risk, the project manager will need to look at comparable projects make an assessment then pave the way for the project (Reich et al., 2008). The institutional and domain knowledge will curb project oversight in the planning phase. If the risk is not handled at this point it will affect the project throughout its lifespan.

The knowledge risk at the end of the project is that lessons learned are rarely satisfactorily captured (Middleton, 1967; Williams, 2006). Summarized debriefing during and at the end of a project leaves team members and other stakeholders with only a hint of what was learned and why things went wrong or right. Since this is usually left to the last minute because it disturbs the core effort if it only contains sketchy detail. Lessons learnt, provide a form of team-level learning and it is also an opportunity to improve organizational competency in managing and completing projects (Reich et al., 2012).

Grant (1996 cited in Huang and Li, 2012) stated that: "New product development often comes from bringing together knowledge embedded in individual minds. However, knowledge is not easily transferable between individuals because of stickiness and tacitness". A way needs to be found to facilitate the transfer of such knowledge as external resources only appear for specialized activities and with that, they bring unique knowledge

which will need to be retained for use in current and future projects.

The resources involved in a project tend to have a strong reliance on informal networks and collaboration. Inside the informal networks experience rich knowledge is disseminated, much like closed groups on social media. The unstructured nature makes it difficult to identify, filter and collect such knowledge. It can be argued that the personalization knowledge strategy is suitable to resolve the difficulties in such scenarios through direct interactions. However, the challenge is having the ‘know who’ in order to locate the repository of knowledge.

In addition to that this is also a lost opportunity to add to the knowledge repository which is forfeited if there is no effort to codify such exchanges, albeit without being intrusive. The need to not be intrusive is due to the fact that the knowledge transfers are based on trust so knowledge capturing should be non-intrusive; this is where socialization comes into play. The interaction between peers creates a sense of trust and a motivation to share knowledge with others. The inclusivity of social media can be employed to curb this exclusion and help forge bonds that will open up knowledge sharing channels.

Knowledge managent is often not a priority therefore there is rarely an incentive to share, capture and transfer knowledge during the project life span. Knowledge sharing is influenced by factors both at individual and organizational level (Jensen & Szulanski, 2004; Bratianu & Orzea, 2010). Project resources will wait to the end to focus on KM activities, this is only because it is required in the form of functional specifications and lessons learnt document. People do not realize the importance of knowledge, their own consumption and creation and consequently they tend to be indifferent to the consequences of not managing knowledge. The focus is on other deliverables that do not include KM activities as one of the project success factors. One of the key factors that determine the sharing of knowledge at individual level is trust. People will only share information with people they trust. In a project, this is more challenging because often people are coming together for the first time. There is a limited amount of time to establish and build these relationships. Individuals come in at different phases of the programme and it is at this point where it is most crucial to capture knowledge because huge volumes of knowledge are transferred between individuals. To minimize the loss of valuable knowledge there should be methods to promote trust between members in a short time. Goh (2002) suggests visible rewards as an incentive or using technology to flatten the organizational hierarchy. Common or shared project artefacts can help build this trust. Social media allows for rapport, collaboration and crowd sourcing. Open platforms like Wikis make it possible to participate and access knowledge limiting the exclusive nature cliques.

2.4.4 Conclusion

The different characteristics: organizational structure, resources and finite time, of the project environment presents unique opportunities and challenges to capture and transfer knowledge. The above characteristics need to be noted so appropriate KM strategies and where related activities are applied. An efficient knowledge transfer is not only dependent on the climate, but also on the systems and procedures in place (Bresnen et al., 2003). Social media has become popular for their capability to store, capture and transfer knowledge through a collective effort while knowing that this capability makes one of the systems that can facilitate the transfer of knowledge.

2.5 Social Media

2.5.1 Background

Social media is a buzzword that has taken the World Wide Web by storm. It has found notoriety through the popularity of social networking websites such as Facebook, Twitter and Wikis like Wikipedia. As a result of this hype the most common misconception is that social media is only social networking. To fully understand what social media, one has to take a step back and look at the World Wide World Web and in particular the platform known as Web 2.0.

The term Web 2.0 is commonly used to encompass various novel phenomena on the World Wide Web that gained notoriety after a Web 2.0 Conference which was held in late 2004 by O'Reilly Media although it was first used in 1999 (Cormode & Krishnamurthy, 2008). As a result, Tim O'Reilly receives much credit for the term Web 2.0. The idea behind coming up with Web 2.0 was to distinguish it from an earlier version of the internet namely Web 1.0. This earlier version of the web was described as being "static" because of the fact that changes to content could only be done by Web administrators, who had the sole responsibility of creating and updating content web pages.

Cormode and Krishnamurthy (2008) add to this point by stating that: "content creators were few in Web 1.0 with the vast majority of users simply acting as consumers of content." Web 2.0 is the "read and write web" where there is shareable content and linked communities, that allows participation and user generated content in an open and collaborative fashion. O'Reily (2005) an authority in Web 2.0 circles stated that: "Although Web 2.0 suggests a new version of the World Wide Web, it does not refer to an update to any technical specification, but rather to cumulative changes in the ways software developers and end-users use the Web". The core concept of Web 2.0 is that users can create, consume, and update web

content collectively. Now understanding this fact brings to light that social media is a grouping of one of the technologies and services that have shot to prominence while using Web 2.0 as a platform. It can be hard to distinguish between Web 2.0 and social media. To this point Bernal (2010: 14) stated that Web 2.0 technologies assist in the delivery of Social Networking capability. In short social media sits atop Web 2.0.

The accounts of where the roots of social media lie vary; some take it as far back as telecommunication manipulation colloquially known as "*phreaking*" in the 1950s (Taprial & Kanwar 2017: p.9) or bulletin board in the 1970s. Despite this nowadays there are generally accepted capabilities used to define social media. The most important of its capabilities is the ability to allow users to dynamically create and consume web content collectively. Kaplan and Haenlein (2009) define social media as: "internet-based applications that build on the ideological and technological foundations of Web 2.0., and that allow the creation and exchange of User Generated Content".

Social media includes blogs, discussion boards, chat rooms, business networks, collaborative projects, enterprise social networks, consumer-to-consumer email, consumer product or service ratings websites, forums, Internet discussion boards, photo sharing, product/service reviews, social bookmarking, social gaming, and video sharing. At the time of the social networking sites were the most popular type included examples such as Facebook and LinkedIn, which offer a combination of all the aforementioned activities but with an emphasis on the relationships among the users of the community (Agichtein, Gabrilovich & Zha, 2009). Taprial and Kanwar (2017) rather than use capability to define social media took a broader look by breaking down the two terms contained in the name: "social" meaning the interaction with other people to share and receive information, and "media' referring to a means of mass communication, web-based platforms in this case. Carr and Hayes (2015 cited in Alhabash and Ma, 2017) defined social media as: "Internet-based, disentrained, and persistent channels of mass personal communication facilitating perceptions of interactions among users, deriving value primarily from user-generated content". This definition is similar to the other as it highlights the continuous flow of information, mass communication and that their primary source of value is from the user-generated content.

Using the aforementioned definitions and themes social media can include collaborative projects, social networking sites, blogs, content communities and virtual worlds (Kaplan & Haenlein, 2009). The popular examples in each category in no order are Wikipedia, Facebook, YouTube, Twitter, WhatsApp, Instagram, Dropbox, and Reddit. There is no one that agreed, some categorization defined websites like Dropbox and WeTransfer as file

sharing, and video sharing sites like YouTube and Vimeo as separate categories yet they store files, and some have media players. Not all social media is relevant for official business let alone for the management of knowledge. Based on an analysis of literature by Al-ghamdia and Al-ghamdia (2015) that the characteristics can be outlined in terms of the following:

1) the active role of the user in building content,
2) facilitating the posting of multiple types of knowledge,
3) building on the collective intelligence theory,
4) the ease of use,
5) providing opportunities for personal dissemination and participatory authoring,
6) continuous updating of knowledge,
7) the ability to nominate information, and
8) Cooperative classification of information.

The listed characteristics are consistent with earlier definitions.

Social media has its foundation in Web 2.0 which has a large capacity for information capturing, dissemination and creates organic communities as evidenced by the popular online platforms. Therefore, if applied properly, it has the potential to facilitate the capture, sharing, storage and creation of knowledge. There are challenges and opportunities that lie in the application of social media as a KM tool. Understanding each type of social media will help in making a choice as to which one will best suite a particular scenario.

2.5.2 Social Media types and capabilities

Web 2.0 and social media technologies such as social networking applications, web-based forums, wikis, and folksonomies, are transforming the way people share knowledge and ideas with each other, as they have shown how useful they can be in sharing tacit knowledge (Dave & Koskela, 2009; von Krogh et al., 2011). Their popularity is as a result of their ease of use and the informal characteristics of these technologies (Dave & Koskela, 2009).

The informal nature makes social media a possible tool for managing knowledge since the value of knowledge is mostly realized if it is accessible when needed, making it necessary for managers to develop structures, systems, and procedures of transfer (Năftănăil, 2010). A popular reason to use social media is that it is not only capable of finding objects but also highlights trends and overviews of contributions made by users (Darwish & Lakhtaria, 2011). Different types of social media have different strengths even though some capabilities are shared. Lytras et al., (2009: 6) looked at the different types of social media and their

strongest feature. By first understanding the features of the different types of social media, only then did it become possible to decide how to best apply them effectively in the management of knowledge in projects.

Aichner and Jacob (2015) explained that even though, “social networks, video-sharing platforms and business networks are of high interest, other types of social media, such as photo sharing, social bookmarking or social gaming, might be less important in absolute terms and of less interest to companies because the scope of application is limited”. Aichner and Jacobs’ (2015) statement informs that the application of social media capabilities for KM activities in an organizational setting should be carefully vetted and monitored. With the thought that not all social media might be relevant in managing knowledge combined with the fact that there is no single agreed upon categorization of social media a select social media will be analysed to show that it can be packaged to form different social media types.

2.5.2.1 Social networks

Social networking sites have revolutionized online communication. The impact of social networking can be seen in Facebook, as the largest social networking website. They reported in their May 2013 financial report that they had 665 million daily active users (Facebook, 2013), compared to 1.47 billion in 2018 (Facebook, 2018). The global impact is undeniable such that organizations have created their own social networks for internal communication and knowledge sharing. IBM’s SocialBlue and BlueTube (Bernal, 2010) is one such example of an organizational social network. Another is Microsoft owned LinkedIn that is widely used for recruitment by companies all over the globe. Panian (2011), in his description of social media highlighted the online and offline impact of social networks. Social networking is described as a set of Internet tools that enable a community to share experiences, both online and in person. According to Panian (2011): “A community, in this context, is a group of people with common interests who connect with one another to learn, share knowledge, work, organize and socialize”. By that definition, a project can also be considered to be a community. However, the combination of finite time and staff turnover results in weak ties between members.

Using the definition by Panian (2011) and the fact that co-operative and collaborative culture is a prerequisite for knowledge transfer (Goh, 2002) social networks can potentially assist with remedying the turnover and weak ties problem through their features. Social networking websites features allow users to create personal profiles, express opinions through comments and features such as the ‘like button’ and status updates, list friends or

connections and make or receive recommendations (Treem & Leonardi, 2012). Social networks have evolved over time, initially the defining features of a social network site appeared to be the profile, the connections list, and the functional ability to traverse these connections but now media streams take centre stage and the incorporation of the "social graph" as a way of organizing content (Ellison & Boyd, 2013: 153). Traversing has become less central and "updating" has become more important. Ellison and Boyd (2013:157) go on to characterize social networks as: "a networked communication platform in which participants firstly, have uniquely identifiable profiles that consist of user-supplied content provided by other users, and/or system-provided data. Secondly, they can publicly articulate connections that can be viewed and traversed by others and finally, can consume, produce, and/or interact with streams of user-generated content provided by their connections on the site".

The above social networking sites features purport a high level of connectivity among individuals. There is also the accessibility of posts after the initial update which means that users can view them whenever they choose to which gives such social networks a higher degree of visibility compared to other social media like video conferencing where they need to be present during the initial transmission (Treem & Leonardi, 2012). The post-update availability also brings an aspect of persistence. Treem and Leonardi (2012) states that, "persistence opens the door to a variety of new uses and practices. Persistent conversations may be searched, browsed, replayed, annotated, visualized, restructured, and recontextualized, with what is likely to be profound impacts on personal, social, and institutional practices". An example of a situation of the possible institutional effect of persistence from knowledge seekers perspectives is that even when a knowledge holder is unavailable for whatever reason both the task information and the knowledge holder's information is still accessible so that if further consultation is required they can be contacted thus enabling resource reassignment across multiple projects and continuity.

The open access and persistence make it possible for knowledge to be restructured and recontextualised by making sure that the knowledge is available for adaption within the current project environment and any other subsequent projects. Social networking websites allow the creation of groups in addition to personal profiles. The groups are created around a specific subject matter. The groups consolidate users with common interests and expertise by further enhancing the collaborative creation capacity of specialized subject matter knowledge, this is especially suitable for use in project environments.

The Web 2.0 based features of social networking make it suitable for collaborative KM in a project environment. Kumar (2009) argues that one of the primary applications of social

networks in a business environment is the location of expertise. This capability makes social media especially useful in an environment where there is a high turnover like a project environment working on complex deliverables. A subject matter expert is located and consulted thus transferring knowledge on a one-to-one basis. In essence, social network facilitates human interaction and therefore socialization. The networking capacity of social networks stems from the explicit integration of a human profile to which Kumar (2009) explained the gross effect of this feature by stating that: “providing access to extended profiles that include competencies, project experience, past positions, and even the ability to share bookmarks or tags can make it easier to harness an enterprise’s internal knowledge base, not to mention the potential of additional valuable network effects.” The above statement highlights some of the features such as tagging social networks in several social media. There are shared and varied features which if combined will result in a different capacity that is useful for managing knowledge in project environments.

2.5.2.2 Forums and bulletin boards

Bernal (2010: 113) and Brown, M.K. et al., (2007: 265) defines Forums and Bulletin boards as asynchronous discussions that allow community members to discuss specific topics. It creates a repository where conversations are kept in context. The word forum is derived to the Roman era forum, which is an outdoor space that was reserved for varying gatherings that include a marketplace, meetings, discussions, and debates and such is Web 2.0 social media. The team leader or project manager can use the forums to guide certain conversations or alternatively they can be used to ask certain questions and the other project team members can answer those questions. The questions can be tied to the responses using a mechanism that is visible to all members called “threading”. The question and responses are commonly referred to as threads, and the thread will remain visible after (Brown, M.K. et al., 2007: 265). There are several mechanisms that allow people to sift through the threads. Threads with the latest responses can be “bumped” up. Conversely those that are seldom updated but are of importance are “pinned” or colloquially “*sticky*ed” up.

Bower (2015) suggests that Forums and Bulletin boards “can be useful for more reflective text conversations where real-time interaction is not required”. The responses are often more than one line therefore this can be used to discuss relatively complex issues and therefore extract tacit knowledge. The persistence allows the expertise to be found when the expert isn’t accessible. However, for this to be possible it means the users cannot be anonymous, which is possible. They will need to login to post but common users don’t need to do so to

read the threads depending on security needs. Even with user login in place a moderator is required to monitor all threads for spam. Spam would be anything that is not relevant to the topic. A moderator in tandem with the administrator, demote users who spam by changing their access accordingly.

2.5.2.3 Blogs

Weblogs, commonly known as blogs, are websites where people can post their thoughts, ideas, suggestions, and comments (Murugesan, 2007). Essentially the weblog is a web-based log of user generated content entered in unique entries called posts as a result you get web-logs. Blogs are by their format made up of posts stored in reverse chronological order (Murugesan, 2007; Schiano et al., 2004). Content in a blog consists of text, links, and images.

The following elements are what typically makes up a post: a title, body, a permanent link also known as a permalink, postdate, comments, category or tag, trackback, or pingback (Murugesan, 2007). Title, category or tag, and timestamp serve as a means to uniquely identify a blog entry, collectively they identify types of content in each entry and when it was posted. A blog can be a one-way mechanism to distribute information to an audience, but communication can be enhanced through bi-directional interaction via comments on each entry (Bernal, 2010; 17). The ability to post comments further make blogs a collaborative and social-interactive tool (Darwish & Lakhtaria, 2011). Comments, trackback and pingback serve as bi-directional feedback mechanisms. Comments allow the blog followers to give their input on the content of a particular blog. Trackback and pingback are notification tools. Trackback notifies other blogs when there is a new entry or comment posted on the blog, while pingback notifies the blogger when someone links to their posts (Murugesan, 2007). Several of the blogs features and functionality mentioned above that facilitate collaboration and universal access can be selectively exploited to make blogs useful for managing knowledge in a dynamic environment such as a project.

One of the challenges of managing knowledge in a project environment is that there is a time limit meaning that individuals want to use as little time as possible when accessing knowledge repositories during storage or retrieval. Blogs can save time because they are easy and come with a standard template that can be effective with little or no customizing. A key characteristic of blogs is that they are easy to setup. No programming skills are required, someone with no programming skills can set up a freely hosted web-interface blog using templates provided by blogging websites like blogger.com thus creating a password-

protected document repository accessible to anyone with internet access (Grudin, 2006). After the creation of a blog other project members are able to subscribe to it, voluntarily provide their input and receive notifications while they focus on the project activities. Grudin (2006) suggests that a project blog can link a document repository which can save time because members save time by sending an email when creating or revising documents. Furthermore, project members simply add an entry to the blog and the notifications make it easier to use than email since one does not have to enter an email address or use a distribution list (Grudin, 2006).

The open communication where commentary is publicly available fosters trust which can be difficult in projects as team members tend to only be available for a short time. Everyone is notified of an update at the same time. Knowledge is shared and accessed uniformly curbing the creation of cliques. Grudin (2006) suggests that since blog notifications and updates are done in real time and retained in chronological order it is easier to retain the knowledge context within the knowledge creation process. He goes on to say that the ability for posts to be shared by blogs allows the contextualized information to be shared by related project blogs that can be exploited by sharing knowledge across projects. Blogs have shown to be useful tools in sharing context rich knowledge online.

Lytras et al., (2009: 3) are of the standpoint that the biggest strength is the permanence of the content which has a unique uniform resource locator (URL). The permanence combined with the real time input capture makes them accessible when required thus providing up-to-date knowledge on demand. Blogging websites are also easy to navigate because of their hierarchy and the structure is flat (Murugesan, 2007). In addition to all the above feature blogs have collaborative capabilities that are better enabled by other Web 2.0 technology such as wikis.

2.5.2.4 Wiki

A wiki is a Web-based collaborative-authoring system for creating and editing content (Murugesan, 2007). Wikis and blogs both use collaborative effort for content, but the main difference between the two Web 2.0 technologies is that wikis allow users to add and remove content on a single document whereas a blogs additional input can only be made in the form of comments (Lytras et al., 2009: 4).

A wiki is a website that makes use of multiple contributors for the collaborative creation of content. A key feature of wiki pages is that they can be edited by anyone at any time. The collaborative capability allows for the easy creation of information from diverse sources.

However, uncontrolled access can lead to chaos, so to ensure quality in the content the wiki uses standardized procedures for users to edit content (Shang et al., 2011). As a measure of accountability and quality control the wiki has some features that manage the format, the link to other pages and keeps track of all changes by keeping records in the article histories and change logs (Shang et al., 2011; Murugesan, 2007). Formatting of text is done by Wiki text and a template, also known as, wiki mark-up provides formatting for the whole wiki thus creating a uniform look. Most wikis have the following features: registration, IP locking, history, search, recent changes and locking page (Brown, M.K. et al., 2007: 279). All these features ensure that the integrity of the information that is available on the wiki, includes those who logged in, who made what changes and so forth.

Authoring a wiki can easily be accomplished without supervision through a combination of technologies within the wiki (Murugesan, 2007). Changes are made through a simple workflow and if there are any problems, they can be rolled back to bring content. If a user repeatedly makes unwelcome changes, then access can be restricted limiting the proliferation of spam. One of the key strengths of a wiki is its revision history (Brown, M.K. et al., 2007: 277). Every minute change is noted, and that version is saved. The aim of this is to prevent unwanted changes and spamming and easy restoration of most acceptable version.

Another quality worth noting is that unlike blogs, wikis do not have a flat structure that allows linear access of related pages. It is a web of interlinked wiki pages making them suitable for fulfilling KM requirements in complex environments by providing a means traverse related or relevant topics. The linking of wiki pages is made easy and efficient as the wiki software creates links based on the page's title, so the author need not use, remember, or type long URLs to link one page to another within a wiki. Once the pages are created information can be sought by using specific information or topic within a wiki using associated keywords.

Collectively, the above features of a wiki makes it a potential technology for managing knowledge in projects. The project environment has limited time thus people need to focus on their core tasks by making wikis a viable KM tool since they can be created with very little supervision. The system self regulates the formatting of the wiki and goes on to link pages together using a feature called Simple templating (Murugesan, 2007). Wikis are dynamic allowing content to evolve during the project's lifetime meaning the knowledge retains context. The dynamism also encourages continuous improvement to the knowledge repository. Wikis, even though they are dynamic like blogs they are different in that they only avail only the final product making it easier to retrieve knowledge without having to sift through spam. Wikis are suited for managers, who deal with structured information such as

documents, slides, and spreadsheets (Grudin, 2006). Despite all this Wikis still have some shortcomings, these include content accuracy, balance, comprehensiveness, consistency, and reliability; issues of legal liability, privacy, reputation, security and accountability and controllability (Murugesan, 2007).

2.5.2.5 File sharing

File sharing, also known as file galleries, are software that allows team members to upload any kind of file for use or for review by other team members, including graphics, documents, spreadsheets, and more (Brown et al., 2007: 263; Bower, 2015). Bower (2015) goes on to say that file sharing generally only provides a directory or 'folder' system where permissions are managed to determine who can access the files while other types of tools enable users to view and often manipulate these files.

An example of this is Google docs, which integrates office tools to allow viewing and editing tools in the browser. With this argument sites such as YouTube, and Flickr can be added to the file sharing category. Even though some might argue that they deserve their own category. Other popular examples of file sharing sites include Dropbox, SharePoint, WeTransfer, MediaFire and many more, with the first two being popular for enterprise use. Even though the permission controls manage who accesses the files and what they can do on the files contained in the virtual drive, it does not solve the version control issue.

Multiple users might want to edit at the same time. This convergence of intent can create issues as to which version to save and not lose the other user changes. Brown, M.K. et al., (2007: 263) suggested resolving this via "version control" systems that "lock" the files being edited until the current user checks out. Once the files are available the system sends out a notification. It can take a step further where a user can reserve a file so that they can use it next. Access and visibility can be improved by the addition is the metadata to the content. Such metadata facilitates the categorization of files using formal or informal specific keywords defined by end users (Brown, M.K. et al., 2007: 263). File sharing sites create repositories where information is accessible centrally and updated via synchronization. It resolves the issues of localization of information in projects. The frequency with which the files are updated, and the quality requires human intervention by setting update schedules and peer reviews. On the other hand, access level is manageable by means of permissions, and concurrency can be managed by locking and checking out of files. Access can be improved with tools by using metadata using tools like tagging and sending out push notifications.

2.5.2.6 Really Simple Syndication (RSS)

RSS is an XML based content-syndication protocol that allows various social media to interact with each other as well as aggregate information based upon the user's needs (Cold, 2006; Darwish & Lakhtaria, 2011). In the simplest form, RSS shares the metadata about the content without actually delivering the entire information source. For example, RSS means a Twitter user can update their Twitter feed and have that content also appear on Facebook (Darwish & Lakhtaria, 2011). RSS allows the platforms of social media to "speak" to another.

The RSS web feed syndicates content from blog and web pages (Murugesan, 2007). An author might publish the title, description; publishing date, and copyrights to anyone who subscribes to the feed. RSS in essence is a notification tool that notifies users when there are updates to a website that they are interested in. For the end user to view the actual content of a different website and blog the end user is required to have an application called an aggregator. The aggregator, also known as newsreaders, automatically recognize whether a particular website or a grouped set of web pages has been updated or otherwise changed in some way and then sends it to the end user or the subscriber. By having the RSS aggregator application, end users need not visit each site in order to obtain information. From an end user perspective, the RSS technology changes the communication method from a search-and-discover to a notification model. Not only is content sought and retrieved, but it is also filtered by the subscriber.

RSS feeds unlike the other aforementioned Web 2.0 technologies do not offer a means of creating knowledge but a means of organizing and accessing knowledge. Murphy (2010) looks at RSS as an enhancement to other Web 2.0 technology and states that: "RSS enables blogs and podcasting, enhances social wikis and social networking applications and provides a channel for subscribing to content sharing common social tags". Their filtering capabilities protect consumers from information overload that can be experienced from services like emails (Dunay, 2006; Gruman, 2018). The subscription approach increases access to knowledge by delivering it to those who need knowledge by creating a communications channel that recipients consider useful (Gruman, 2018). The subscription service creates an environment where subscribers "pull" knowledge as compared to a "push" service like email, this timely knowledge delivery mechanism speaks to a key principle of managing knowledge: "getting the right information to the right person at the right time". Real-time updates are particularly useful when project personnel are spread out in different geographical locations, which projects can sometimes be, knowledge is made available to everyone at the same time meaning decisions and actions can be made from the knowledge

base. Dunay (2006) is of the opinion that RSS technology is well suited for group use as participants subscribe to the RSS group, allowing them to read and comment on the same core information. The capability makes sure that knowledge is uniformly, widely, and quickly available therefore addressing the challenge of project knowledge being shared exclusively amongst member of a certain clique.

According to Murphy (2010) RSS technology enables users to manage their content into an easily usable format and functions similar to a “bookmark” or “favourites” folder on an internet browser. The main application of RSS feeds in addition to the above is that it makes knowledge more visible so that only a subscribers’ relevant knowledge is retrieved from the repositories (Murphy, 2010). Murphy (2010) goes on further to say that this effectively decreases information-gathering time. As stated, there are similar technologies that are built with the same idea of sorting knowledge. Tags, folksonomy, and tag clouds are specifically designed for this purpose.

2.5.2.7 Tags, folksonomy, and tag clouds

Tags, folksonomy, and tag clouds have one thing in common besides all being Web 2.0 technology, they are designed to categorize content. They help users identify and sift through information easier. Tags, also referred to as labels, are keywords added to articles in blogs or Web pages via social page tag tools such as del.icio.us which serves as metadata that helps in the description or search of an item (Murugesan, 2007). The term tags referred to here are social or collaborative tags, that are used for the common indexing of objects from a free-subject catalogue, otherwise tags can relate to a broad range of all types of metadata (Panke & Gaiser, 2009).

Folksonomies are taxonomies of information created by web users (Murugesan, 2007). Panke and Gaiser (2009) describe folksonomy as: “The complete body of tags that users have entered into a system at a specific point in time”. Trant (2008) further explains the relationship between tags and folksonomy using the following description: “We can think of tagging as a process (with a focus on user choice of terminology); of folksonomy as the resulting collective vocabulary (with a focus on knowledge organization)”. In short, a tag is a marker in the index and folksonomy is a collection of the tags used in the indices. “A tag cloud is a visual depiction of the tag list in alphabetical order listing all the tags that belong to a user or to a user group, in which popular keywords are highlighted typographically, and tag browsing. Initially, they were commonly found on blogs being indexed to show the content via RSS technology” (Murugesan, 2007. Panke & Gaiser, 2009). Any tagging tool consists of

three pieces of information: users, objects, and keywords. By selecting a tag one can access all the posts relating to that item.

Murugesan (2007) defined the application of tags as an exercise called social bookmarking: the process by which different users bookmark interesting pages and assign tags to each. She adds that this is a great way of capturing contextual knowledge as users with a common interest can share knowledge targeted at the same or similar interests. The same can be said of all the available tagging tools. They have the same benefits as RSS technology combined and they provide an extensive mechanism of categorizing and classifying. Once categorized knowledge can be easily accessed, updated, or applied. There is some concern about the lack of standardized vocabulary. Schill, Truyen, & Coppens (2007) argue that: "What tagging essentially does is to link a concept to its social practice. Tags connect the objects involved and the correlated concepts to activity clusters in a community". Their argument demonstrates the role of tags on making knowledge context visible therefore enhancing the management of knowledge in projects. Not only does cataloguing the information assist in identifying ownership and as a result of its social nature it can help establish relationships amongst the creators themselves which in turn enhances information discovery and knowledge creation (Trant, 2008).

2.6 Managing knowledge with Social Media

Traditionally the management of knowledge employed a centralized knowledge repository knowledge from specific disciplines is no longer provided and assessed solely by the domain experts, it has since shifted to peers who also possess the same capabilities in a more interactive conversational approach (Lee & Lan, 2007).

Unlike classical KM tools, these new technologies focus not on capturing knowledge, but on enhancing knowledge work by facilitating collaboration (Razmerita, Kirchner & Sudzina, 2009). Chatti et al., (2007:3) states that, "Unlike traditional centralized learning object repositories, blogs and wikis build distributed community information stores with up-to-date, context-rich, and searchable learning assets. RSS is a technology that makes it easy to share resources across networks, as it brings content from different sources to a learner's personal space, once subscribed to the feed source". Information gathering capabilities like those of RSS feeds enable the combination process through the reconfiguration of existing explicit knowledge through adding, reorganizing, and combining, which leads to new knowledge. According to Chatti et al., (2007), the socialization mode starts with building a "field" or a "space" of social interaction. Social media provides great opportunities to build

such spaces and distribute tacit knowledge from one person to another through its capability to facilitate the creation of online communities.

A versatile alternative to a project blog is a project wiki. Wikis provide more structure and are not tied to the reverse chronological posting sequence and are open to authorship by all team members. Wikis appeal to managers, who deal with information structured as documents, slides, and spreadsheets. However, wikis lack some of the advantages of blogs in a project context. Grudin (2006) suggests that wikis are not as lightweight—they require some up-front design, may require restructuring, and generally demand some ongoing oversight. Information that does not fit well into the overarching conceptualization may be omitted. Someone not familiar with the layout logic can have difficulty browsing; determining key features such as the authorship or the currency of material that can require digging. Finally, distributed authorship can reduce the incentive to contribute, creating a prisoner's dilemma. "The next person will do it" attitude. A project wiki is particularly appropriate when a deadline drives participation and a clear division of labour is in place; for example, it could be a great choice for planning a conference. KM requires merging structured and less structured, more conversational information. Many proposed solutions, including wikis, stress efforts to add structure and filter out conversation although wikis often do provide places for discussion.

2.6.1 The Web 2.0 Driven SECI Model Based Learning Process

The socialization process is usually the hardest to capture and yet it is key to the dissemination of tacit knowledge in a project. Social media facilitates such communication by enabling free exchanges that give users a chance to interact in a less structured manner. Exchanges are made freely through social media, enable activities such as collaboration and commenting, essentially social media allows dialogue (Treem & Leonardi, 2012). One of the characteristics of tacit knowledge has been the difficulty experienced in trying to codify it (Mahroeian & Forozia, 2012). However, if it is difficult in capturing then the knowledge management system (KMS) should create an environment that is conducive for knowledge transfer. Social media is one such open platform that is inclusive of project stakeholders who will play a key role in creating a conducive environment. "What we can gather from the collective input of knowledge into social media, is the addition of value derived from the contributed content that comes not from a subject matter expert, but rather from individuals whose small contributions add up to create a source of valuable information" (Lytras et al., 2009: 6).

2.7 Chapter Summary

The research focuses on how to use social media, a Web 2.0 based technology, to manage knowledge in a project-based environment. The literature review looked at the facets of KM and activities used to manage it, social media platforms and their capabilities, and of course the nature of project-based environment.

The review commenced by seeking to understand what knowledge is, in what forms it can be found, how it is synthesized and the possible strategies that can be employed to manage it. The aim of breaking down the management of knowledge is so that one can understand what is being managed, in this case knowledge, and how to manage it.

The next step was to look at project environments. This is in order to establish what the peculiarities of the project environment are. The comparison and the contrast of the PBE with other organizational structures highlighted the difference in dynamics and their influence on creation, consumption, and transfer of knowledge. Subsequently, social media and its foundation were explored. The capabilities of select social media is key to managing knowledge therefore several platforms were looked into by outlining defining characteristics.

In Chapter three, the design and methodology that was applied during the analysis phase of the study, is presented.

CHAPTER THREE: RESEARCH DESIGN AND METHODOLOGY

3.1 Introduction

This chapter outlines the research design and methodology used during the research. Research design is defined as the sequence that connects the empirical data to a study's initial research question and, ultimately to a conclusion (Yin, 2003:21). Leedy and Ormrod, (2016:75) stated that: "the research design provides the overall structure for the procedures that the researcher follows, the data the researcher collects, and the data analyses the researcher conducts". Research methodology is defined as: "the techniques one uses to collect and analyse data" (Leedy & Ormrod, 2016:75). As such Chapter three will outline the overall planning for the research, how the research methodology was chosen, how it was applied to population and sample set selection, and finally the method used to collect data, the choosing of the data collection tool, it's reliability and validity will also be addressed, as well as relevant ethical considerations in an effort.

3.2 Research Design

The research methodology is a general framework from which research is approached (Leedy & Ormrod, 2016:32), and the research design provides the overall structure, rationale and process behind the application of a particular methodology (Leedy & Ormrod, 2016:107). Research design is the blueprint outlining the conditions for collection and analysis of data in a manner that aims to combine relevance to the research purpose with minimal expenditure of effort, time and money (Khotari, 2004: 31; Pandey & Pandey, 2021). The literature review shows a general idea that Web 2.0. based social media through their various capabilities. However, there is little understanding on the ground concerning the practical application of social media for this purpose can be applied to enhance the collection, dissemination, updating and storage of knowledge in project environments. There was therefore a need for an objective study of the current use to gain a clearer picture since there is already some use of social media in organization for communication purposes. It is for this reason, that the survey method was considered a suitable instrument for the collection of data for the study.

3.3 Instrument for Data Collection

The research made use of an experience survey to collect quantitative data. An experience survey means the survey of people who have had practical experience with the problem to be studied (Khotari, 2004: 36). Surveys are useful in gathering data from a large number of respondents and the data gathered usually focuses on the views, ideas, attitudes and their

reporting of their experiences and/or behaviours in relation to the research topic (Wilkinson, 2017, 41; Leavy, 2017: 101).

Drawing from Khotari (2004:17), Wilkinson (2017) and Leavy (2017) who discuss the different ways in which survey data is collected; the data collection was conducted via a web-based questionnaire from an online survey website Survey Monkey. The selection of a web-based survey was due to its reach, discreteness, user-friendliness to possible respondents and the vast User Interface (UI) elements (tables, rating scales, dialogue box, text boxes, matrices) available for survey design. Examples of survey websites one can simply access via a search in their browser include but not limited to Survey Monkey, Zoho form, Google Forms, Submittable and 123 Form Builder. The array of UI elements allowed for easy formatting. The online survey was sent to IT consultants at the City of Cape Town ERP Support Centre (SAP ESC) as a link contained in an email.

Data collected via paper based and electronic surveys have shown to yield the same results in terms of the quality of data collected (Bordens & Abbott, 2011: 270-271). Therefore, the online survey provided the same reliability of a paper-based survey. Furthermore, the online survey could reach a larger number of potential respondents while also providing an easy yet non-intrusive way to answer questions and a rapid turnaround in data collection (Creswell, 2018). The survey distribution was conducted via an email. Included in the email was the link, the purpose of the survey and a brief explanation of what social media is. A further explanation of the research was included in the consent letter contained on the first page. Ethical concerns about data and use were also addressed in the cover letter via a disclaimer.

The reason for the explanation of social media is that the respondents might have made use of the Web 2.0 based platforms without even knowing it, and to the general public social media is a euphemism for the popular platforms Facebook, Instagram and Twitter. The electronic survey included tools to code and analyse the data therefore the data was collected and retained online. The online platform made use of Web 2.0 technology enabling coding via tools in the analysis view such as word cloud that would highlight terms frequently used by the respondents. The pre-coding would speed up analysis (Wilkinson, 2017: 44). The survey used a combination of close-ended and open-ended questions. In some instances, the close-ended questions were followed up by a contingency of questions for clarity on multidimensional concepts. The close-ended questions came in the form of a Likert scale and multiple-choice questions. A sentence length was imposed on the open-ended questions to facilitate detailed yet concise responses for better analysis (Wilkinson, 2017:

46).

Both objective (demographic data) and subjective data (opinions, belief, experiences) were collected. The demographic data was used to establish the respondents' history working in the project environment, whereas both objective and subjective data was used to gather data on the management of knowledge and the use of social media. The structured questionnaire gathered quantitative data for analysis.

3.4 Research Methodology and Data Collection Method

In a research paper, the methodology section allows the reader to critically evaluate the overall validity of how the research data was collected and how it will be analysed? The aim of the research was to determine how the management of knowledge in project-based environments like the SAP ESC unit at the City of Cape of Town can be enhanced through the capabilities of social media tools. The questionnaire focused on the following matters regarding the use of social media for the purposes of managing knowledge in a PBE namely: project participation experience, social media use while working on a project, knowledge strategy at the beginning, during the project and at the close of the project. The strategy category was meant to highlight the different knowledge needs and team dynamics at each point in the project lifecycle.

The validity of a survey speaks to how well the survey questions address the research, while reliability speaks to how well the results can be replicated (Bolarinwa, 2015). To establish the validity and the reliability of the survey, the questions revolved around KM activities in the project environment and the application of social media tools. With the abovementioned a general consensus of what activities are part of managing and the features of social media applications that have a general consensus even though without a standardized framework can be reliably measured. They are also components of the research and are therefore valid.

There was no pilot survey as there were a limited number of possible respondents at SAP ESC, and there was a stipulation not to unnecessarily disrupt the work environment. However, the survey was proofread by research practitioners. Furthermore, the survey was also reviewed for comprehensibility by non-survey subjects similar to the respondents.

The questionnaire was exclusively distributed via the official City of Cape Town work emails of the IT consultants in the SAP ESC. Preceding dispatches of the email a brief preamble was given in person explaining the exercise as a prenotification to counter non-response bias (Bordens & Abbott, 2011: 275). The preamble served as a means; of getting

consent, creating awareness and encourage participation. Spamming would have discouraged responses.

The result was a hundred percent response to all requests. Even though the floor SAP ESC had a staff compliment of over a hundred and forty IT consultants of which only sixty-five responses were sought. The selection of the participants was random. The reason for this was that there is a limited amount of time in which the survey could be conducted, consequently a realistic target number of correspondents had to be set. It is also important to note that the IT consultants are fixed term employees who are highly mobile (*they move from project to project)* and as such their responses were not limited to the SAP ESC project alone but to their whole career experiences. All respondents were anonymous.

3.5 Sampling

The research made use of simple random sampling. The focus of study was to explore using social media as a potential KM tool to enhance KM in PBOs. An optimum sample size should representative, reliable, flexible, and also meeting the efficiency requirements (Khotari, 2004: 56). According to Vasileiou et al., (2018) scope of study, the nature of the topic (i.e., complexity and accessibility) and quality of data should be taken into account when determining a sample size. As such the population of the research were individuals who had worked in organizations that had the following characteristics: 1) project-based environments meaning projects are used as a primary means of production, 2) KM activities are practiced as part of the development of IT solutions, and 3) individuals had prior experience when it came to using KM systems. The SAP ESC is a PBO that uses projects as its primary means to maintain and develop the SAP ERP solution. Furthermore, the majority of the staff work consistently in such environments as they move to different projects being implemented across the world. At the time of the survey more than sixty percent of the 140 staff in the SAP ESC were fixed term contractors.

The City of Cape Town runs one of the largest implementations of SAP ERP by a public entity in the world and as a means of maintaining this project infrastructure (SAP, 2014), IT consultants are brought in from all over the world to implement the change giving the validity beyond the survey site. The IT consultants within the SAP ESC were selected using simple random sampling therefore any one of the IT consultant had an equal chance of being selected (Khotari, 2004: 16). Factors considered in determining the sample design were:

- Criteria – how the organization fits the aforementioned criterion.
- Volume – the number of respondents still eligible after the criteria had been met.

- Access – the access to the qualifying survey subject. The ease with which permission to carry out the survey was granted.
- Representation – if the subjects were representative of the research population.

The sample size of sixty-five consultants represented 46.4% of the population consisting of a hundred and forty consultants. No target number at during of the survey. However, a data collection termination criterion was set based on time constraints, response rate, quality of data: based on percentage of questions completed and informational redundancy. Information redundancy is when no information is elicited by sampling more units (Vasileiou et al., 2018:2).

3.6 Data Analysis

The data collected was analysed as a single set of data. The data was analysed the data spiral strategy (Creswell & Poth, 2018:186). The data analysis spiral can be summarized as: managing and organizing data breaking it into smaller unit, reading and creating memos of emergent ideas to get an overall sense of the data, describing and classifying codes into themes, developing and assessing interpretations, classifying the data into categories and representing and visualizing the data, the finally synthesizing a hypothesis (Bayne, 2020 :41; Leedy & Ormrod, 2016:390). The responses were saved online on the survey website. The website provided data analysis tools. There was a further categorization of respondents beyond the initial sampling. The respondents who held project manager roles were asked additional questions on the same questionnaire as they have the extended responsibility of overseeing KM activities in the project. The responses will be analysed with the rest of the data despite being seen as additional KM activities but are KM activities, nonetheless. Inductive reasoning was to arrive at a conclusion (Leedy & Ormrod, 2016:43).

3.7 Chapter Summary

The research design and methodology were discussed in this chapter. The sampling strategy, data collection and analysis were also outlined.

The survey was conducted via an online questionnaire. The questions were aimed at exploring the use of social media in the management of knowledge while working in a project environment. The questionnaire was presented to IT consultants at the SAP ESC at random. The assumptions as well as the findings are detailed in the next chapter.

CHAPTER FOUR: DATA PRESENTATION AND FINDINGS

4.1 Introduction

In Chapter three the research design and methodology were discussed, the research population, sampling procedure and the methods used to collect data. This chapter presents the data that was collected using a questionnaire and the resulting findings. The questionnaire had three sections, divided in terms of project experience, project environment and project administration. The first section looked at the individual experiences to established whether the respondents met the criteria. The questionnaire consisted of structured, semi-structured and open-ended questions.

The sections were structured in a manner to encourage respondents to complete the survey. The questionnaire with their personal experience working within projects. The aim was to gather their familiarity with the environment before diving into questions around the broader project environment. Management of knowledge starts off with the individual then it expands to the wider organization (Foote & Halawi, 2016:90). The project environment addresses section the interactions within the environment, the current project they are actively others running concurrently or in the future and even the past. This is due to the transient nature of project in the PBO which uses project as its primary means of production resulting past, present, and future projects and related project knowledge. Within the project environment section respondents also highlighted the social media-based tools they have used for KM activities: source, capture and disseminated the required knowledge, and which of the capabilities they found most useful and why. The final section which was directed at project managers who have the responsibility of steering the project as a whole. The oversight role includes managing knowledge: practices and approaches related to generating, disseminating, and applying knowledge, developing new knowledge, sharing knowledge, combining existing knowledge, and valuing knowledge (Ondari-Okemwa & Minishi-Majanja, 2013: 137).

4.2 Data Presentation

The data and results presented in the various graphs, word clouds and tables reflect the outcome of the responses received. All the submitted questionnaires were usable even though some of the respondents skipped some of the questions that were deemed applicable to them.

4.3 Project Based Environment

The questionnaire was presented to sixty-five SAP consultants in the SAP ESC at the City of

Cape Town. The projects pool together individuals of varying skills and experience from different disciplines to achieve a common goal for a limited amount of time resulting in often-unique knowledge and knowledge creation activities. The respondent should have participated at least in one project. The SAP ESC consultants were from all over the world with a third having worked on over 10 different, and 72.19% having participated in more than 3 project. While these figures show wide project participation it does detail whether participation whether it only considered full project participation. Respondents had varying skillset: Project managers, Team lead, Business analyst, configuration specialist. Furthermore, the respondent held multiple roles while they Developer that it shown by the multiple roles. The SAP ESC is a PBE therefore the second criteria specified in Chapter three was fulfilled as the respondents were drawn from multiple projects within the SAP ESC floor at the City of Cape Town. The abovementioned characteristics stand to show that the SAP ESC is a PBE.

4.3.1 Roles

The questionnaire asked questions spanning the consultants' whole project career. Different roles require and produce different types of knowledge, and the different types of knowledge that are required at different stage of the project and lifecycle (Hanisch et al., 2009). The roles in the SAP ERP support are on a continuum that runs from administrative on one end to technical on the other end. Administrative consultants' focus on people, timelines, documentation and presentations. One the other hand the technical consultants are more focused on making physical changes in the system. Consequently, the different roles have different KM tools and practice. For example, developers as part of their KM activities they make notes within the code that they write while business analysts and project managers liaise with different stakeholders outside of the software code through meetings, presentation and so forth. The significance of their roles is to show the kind of participation they had in the project environment and the interaction amongst the different personnel in the PBE. The consultants were asked what their latest project role was at the time. The majority, a combined 63.1 percent of the respondents, were either business analysts (26,2%) or developers (36.9%) at the time that the survey was conducted.

Q2. Current project roles

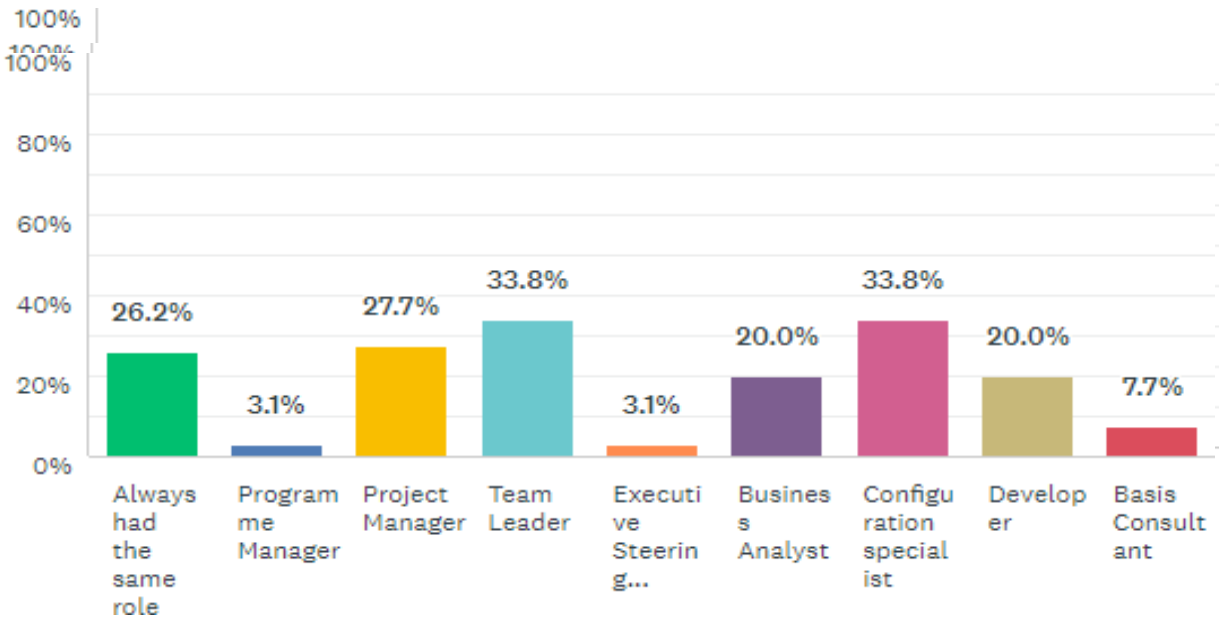


Figure 4.1: Current project roles

Q3. Secondary roles

The question asked if there were any other roles the consultants have held while working on other projects. For the purposes of the research, these were considered secondary roles. as shown in Figure 4.2 below, out of the sixty-five respondents, 26.2% had always held the same role at the time, meaning the overwhelming majority of 73.8% held various positions in projects during their careers. The most common secondary roles were team leader (33.9%), project manager (27.7%), developer 20% and configuration specialist (33.9%) roles. The respondents could select more than one secondary role. The percentages showed how many of the respondents held a specific the specific secondary role, but it did not mean that they did not have any other secondary roles. This showed that experience in technical and administrative roles in the project environment were evenly distributed therefore the results would not be biased towards one type of role.

Figure 4.2: Secondary roles

Q4. Full project implementations

The respondents were asked how many full implementations they have participated in. The survey criteria required that they should have completed at least one project lifecycle. The significance of participation in a projects full lifecycle implies participation in preliminary, interim and close out KM activities within the phases of the project lifecycle. All respondents met the criteria. Figure 4.3, depicts that 32.3% respondents had participated in over ten full project implementations. A combined 73.9 percent had participated in five projects or more showing how personnel move around working on different projects.

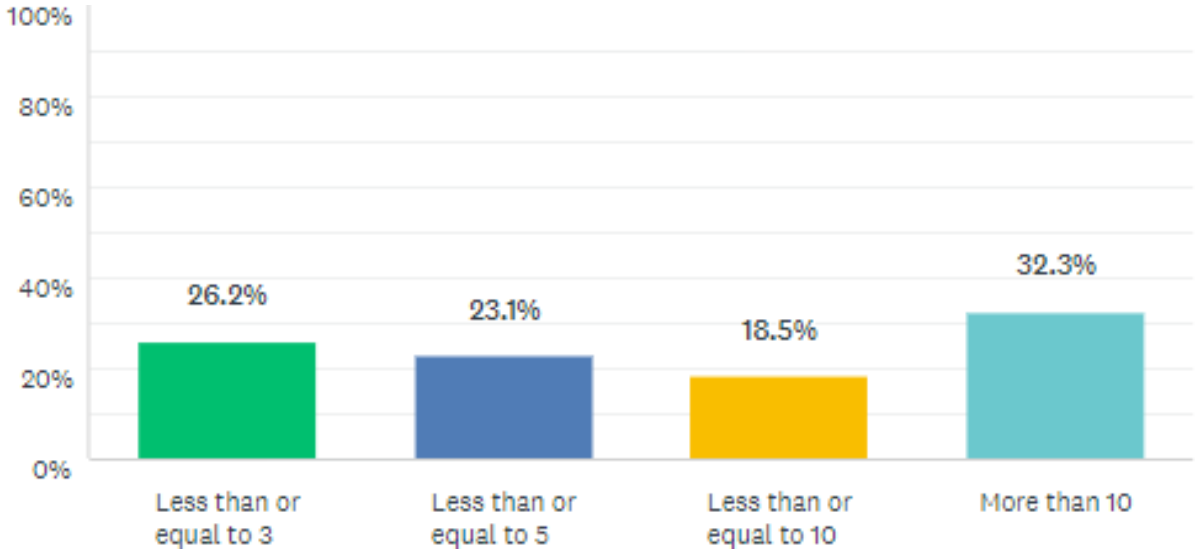


Figure 4.3: Full project implementations

Q5. Project magnitude and team size

This question was about the size of the teams that the respondents have been part of was asked in order to ascertain the magnitude of projects that the respondents worked on. Larger projects tend to have larger teams. The average team size is seventy-eight. The team size range varied from as little as three to as large as nine hundred. It is worth noting that the team size of nine hundred is an outlier even in everyday practice. Although the average team size is seventy-eight, excluding the anomaly of nine hundred project members it dropped to fifty-eight. The median team size was fifteen and the mode was five with a frequency of eleven, meaning that most respondents participated in teams of fifteen individuals or less.

Q12. Finding individuals from previous or related projects

This question asked how easy it was to find people who have worked on previous or related projects. One of the key characteristics of a PBE is that it brings people together for a limited amount of time and then they move on. Even though they might have left the project, they might still hold valuable knowledge or be able to provide context about the project they have worked on. Of the expected sixty-five responses for this question sixty-four responses were received. Figure 4.4 shows that the majority of the respondent found it manageable 57.8% while a combined 25% found it either difficult or extremely difficult.

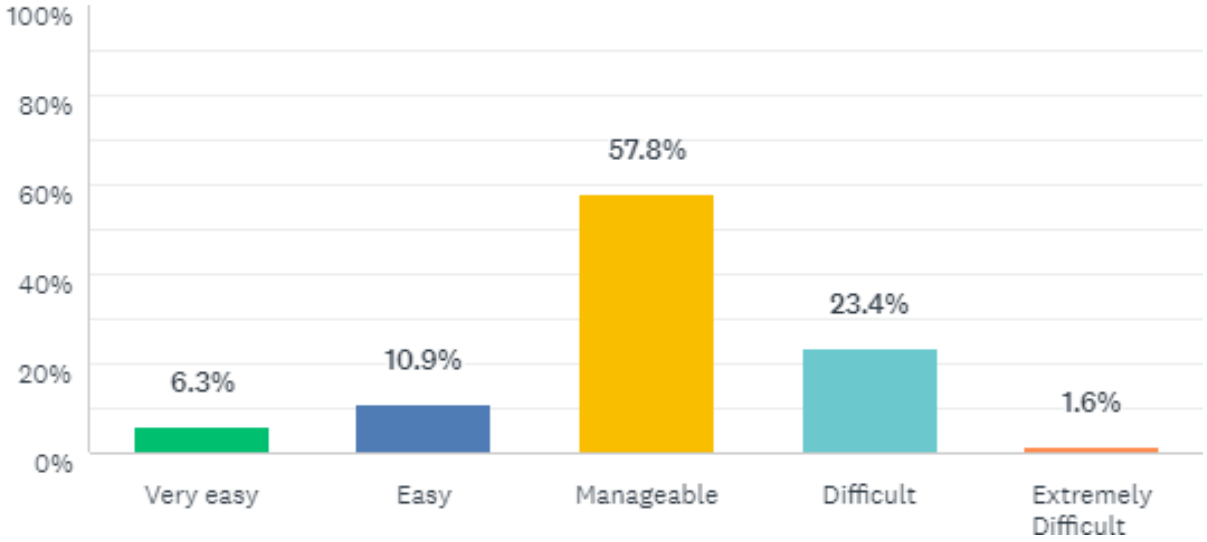
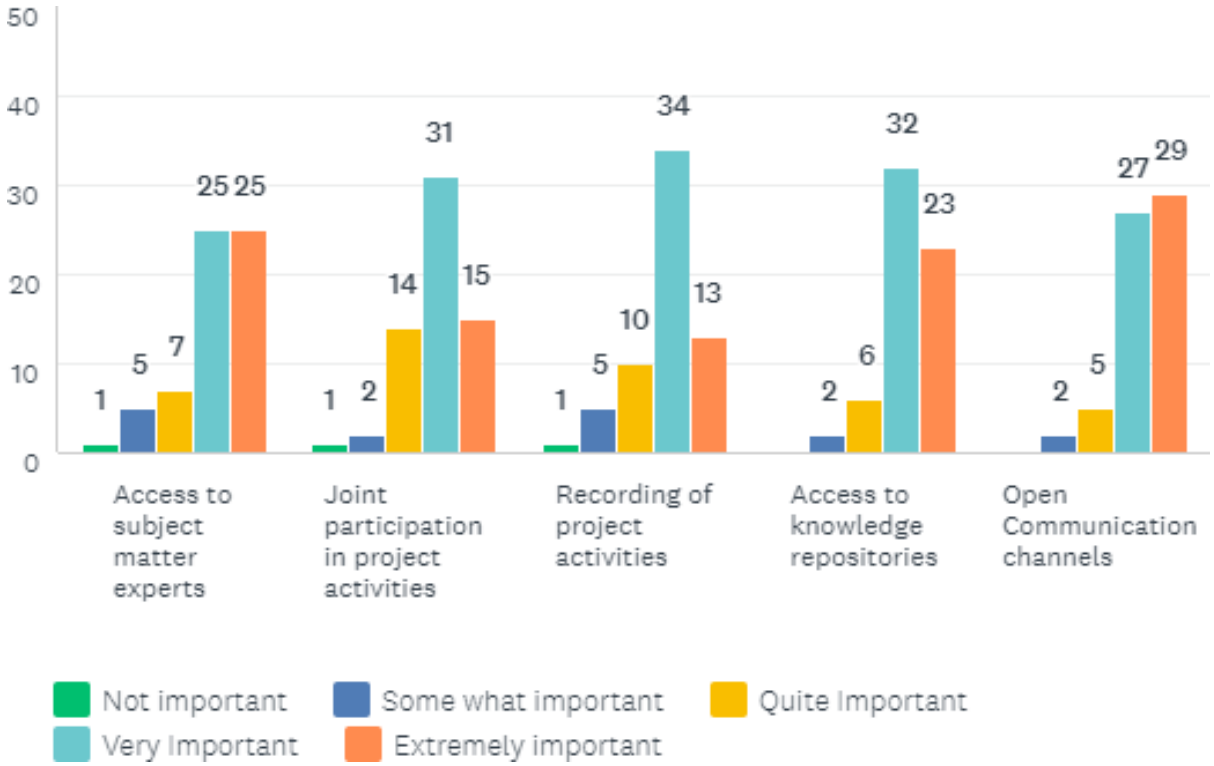


Figure 4.4: Finding individuals from previous or related projects

Q14. Problem resolution

The respondents were asked which factors were the most important when attempting to resolve a problem quickly. Sixty-three responses were received for this question. The outstanding responses were accounted for as “not important” responses to the factor. Open communication channels were considered an extremely important factor by 46 of the



respondents, closely follow by access to SMEs and access to knowledge repositories with

	NOT IMPORTANT	SOME WHAT IMPORTANT	QUITE IMPORTANT	VERY IMPORTANT	EXTREMELY IMPORTANT
Open Communication channels	0.00% 0	3.17% 2	7.94% 5	42.86% 27	46.03% 29
Access to subject matter experts	1.59% 1	7.94% 5	11.11% 7	39.68% 25	39.68% 25
Access to knowledge repositories	0.00% 0	3.17% 2	9.52% 6	50.79% 32	36.51% 23
Joint participation in project activities	1.59% 1	3.17% 2	22.22% 14	49.21% 31	23.81% 15
Recording of project activities	1.59% 1	7.94% 5	15.87% 10	53.97% 34	20.63% 13

39.7% and 36.5%, respectively. Generally, all factors were deemed important.

Figures 4.5

4.6: Problem solving

4.3.2 Social media usage

Q6. Social media usage

The respondents were asked what type of social media platforms they have used while working on projects. At least one of the respondents had used each of the platforms at least once, except for one. The single unused platform for purposes of disseminating, collecting or storing knowledge by any of the respondents was virtual worlds.

As illustrated in Figure 4.7 the most commonly used platforms in order of frequency of the respondents were as follows: email, chat also known as instant messaging, file sharing repositories, blogs, discussion forums, social networks, teleconferencing and wikis. Almost half of the respondents used the aforementioned platforms. Frequent use ranged from

	NEVER	ONCE	RARELY	OFTEN
Email (e.g. MS Outlook/GMail)	1.5% 1	1.5% 1	13.8% 9	83.1% 54
Chat (e.g. Skype/MS Lync/Whatsapp)	13.8% 9	1.5% 1	18.5% 12	66.2% 43
Filesharing repositiories (e.g. Google drive/Dropbox/SharePoint)	9.2% 6	4.6% 3	23.1% 15	63.1% 41
Blogs (e.g. SAP developer network/Mashable)	15.4% 10	3.1% 2	20.0% 13	61.5% 40
Discussion Forums	4.6% 3	7.7% 5	30.8% 20	56.9% 37
Social Networks (e.g. Facebook or SAP community network)	15.4% 10	4.6% 3	24.6% 16	55.4% 36
Teleconferencing (e.g. Skype)	15.4% 10	7.7% 5	26.2% 17	50.8% 33
Wikis (e.g. Wikipedia)	20.0% 13	7.7% 5	24.6% 16	47.7% 31

47.7% to 83.1%.

Figure 4.7: Social media usage

The platforms that were seldom used by the respondents in order of frequency were found to be the following: Content Tagging, Podcasts, Social Bookmarking, RSS Feeds, Widgets, Collaborative Document Editing, Microblogs and Video Sharing. The list is based on platforms that were never used at all by the respondents or only used once.

	NEVER	ONCE	RARELY	OFTEN
Content Tagging (e.g. TagCloudCreator/Jumper 2.0)	83.1% 54	7.7% 5	7.7% 5	1.5% 1
Social Bookmarking (e.g. del.icio.us/digg/Furl)	80.0% 52	7.7% 5	9.2% 6	3.1% 2
Podcasts (e.g. podOmatic)	75.4% 49	7.7% 5	12.3% 8	4.6% 3
Widgets (e.g. Like buttons)	66.2% 43	7.7% 5	10.8% 7	15.4% 10
RSS Feeds (eg. Google Reader/Feedly/Flipboard)	58.5% 38	13.8% 9	16.9% 11	10.8% 7
Collaborative Document Editing (e.g. Google Docs/typewrite.io/Stackedit)	47.7% 31	13.8% 9	18.5% 12	20.0% 13
Microblogs (e.g. Twitter/Tumblr/Posterous)	46.2% 30	9.2% 6	30.8% 20	13.8% 9

Figure 4.8: Social media usage

Q7. Most used/preferred social media platform

This question asked which was the preferred social media platform. A survey website was used in the research to generate an automatic word cloud and a custom list of tags from the open responses. The feature highlights the word frequency. The more frequent words are larger and bolder. The responses were in the form of free text.

Figure 4.9: Most used/preferred on social media platform

The three most preferred platforms were chat, forum, and SAP Community Network (SCN). It is worth noting that SCN is a proprietary social network. It is a mashup platform that

consists of discussion forums, blogs and social networks designed to specifically assist the SAP consultants. The bar graph is an alternative presentation of the word cloud. The responses were group by related and labelled using tagging. The frequency of the words against the tags is shown in absolute numbers.

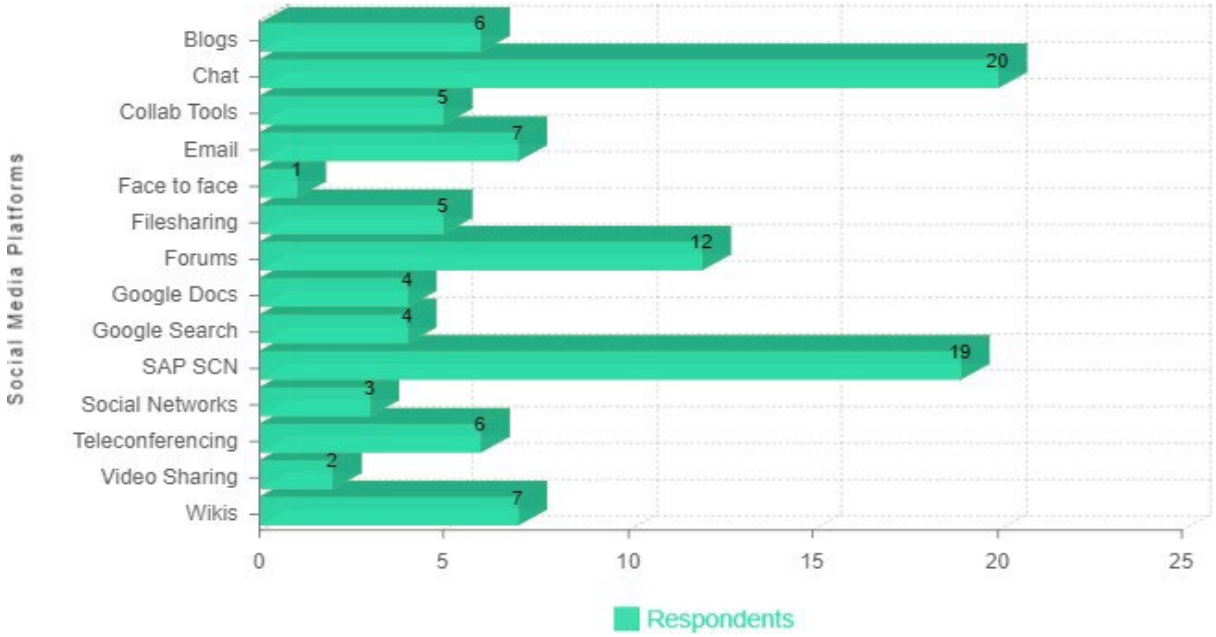


Figure 4.10: Most used/preferred on social media platform

4.3.3 Knowledge in PBE

Q8. Importance of access to previous or related projects

This question asked how the respondents accessed previous or related projects because consultants working projects access previous or related project knowledge for several reasons that included work unit estimation, planning and troubleshooting. The reuse of project knowledge and lessons learned from previous or related projects is used to synthesize new knowledge, and thus improve future project performance (Lee et al., 2016).

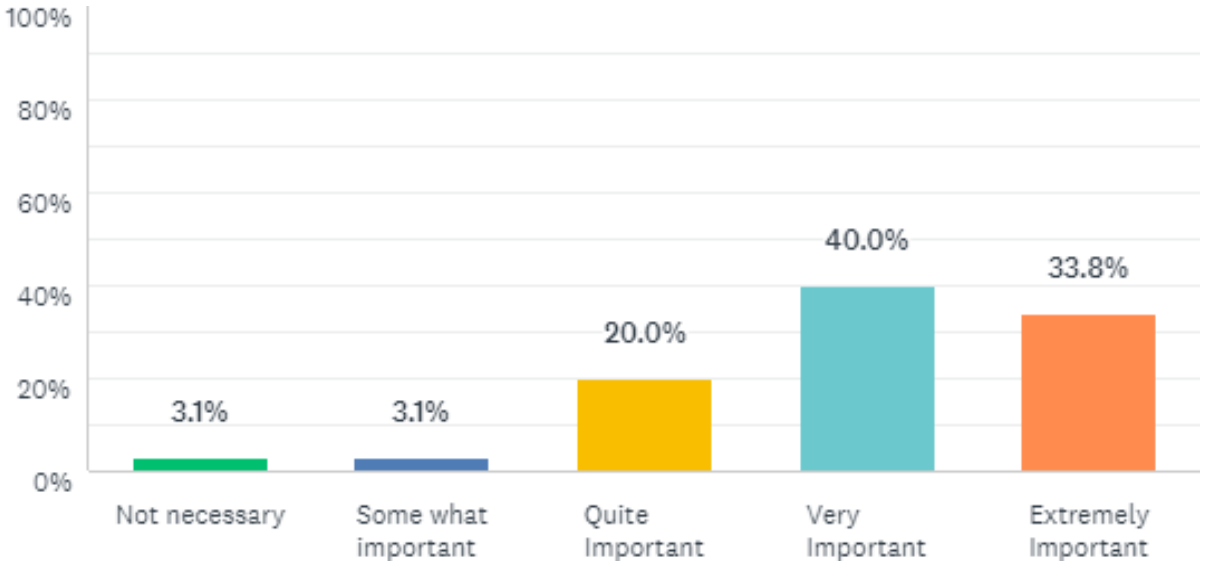


Figure 4.11: Importance of access to previous or related projects

There was a general agreement that accessing information from previous or related projects is important. Only two of the respondents said that it was not important or somewhat important to access previous or related projects. Thirteen of the respondents or 20% considered it quite important, twenty-six of the respondents or 40% considered it important and twenty-two of the respondents or 33.8% considered it extremely important. Of the respondents 93.8% found some importance in information from previous or related projects.

Q9. How to access information from previous or related projects

The respondents were asked how they accessed information from previous or related projects. They were presented with three options as responses: talking to project personnel, accessing internal project records repositories and searched the internet. The personnel retain tacit, the internal repositories and the internet retain codified explicit knowledge. However, the World Wide Web extends beyond the organization. At least half of the sixty-five respondents used all three methods. The most accessed internal repositories source was 80%. The use of the World Wide Web was the least used out of the three. This is consistent with the usage social media in the abovementioned section where the use of social media repositories where one of the most frequently used forms of social media. The most frequently used approach is accessing internal records from repositories. In the open responses, the respondents also mentioned making use of their own personal repositories and tacit knowledge from job experience. There is a strong reliance on codification.

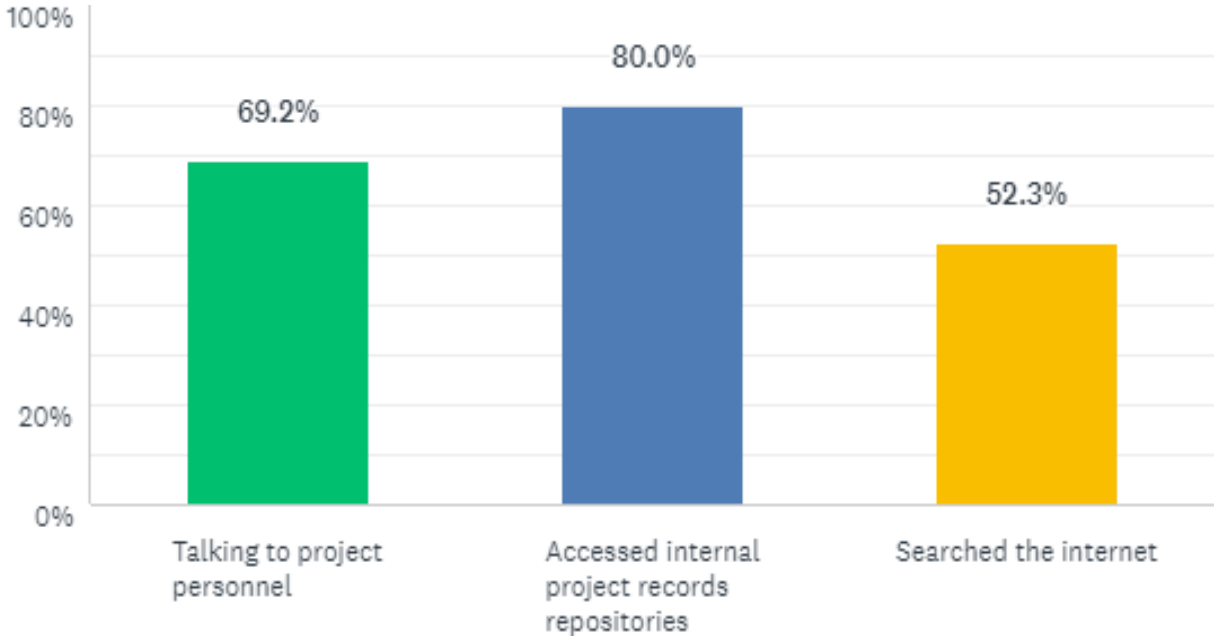


Figure 4.12: How to access information from previous or related projects

Q10. Ease of access information from previous or related projects

When poised with the question how easy it was to find information from previous or related projects, 57.8% of the respondents found it manageable. A combined 17.2% found it easy or very easy. When the project experience of the same respondents was analysed, all had worked on at least five projects. Experience could have been a factor in making it easy to find knowledge from previous or related projects. A combined 25 percent found it difficult or very difficult to get data from previous or related projects.

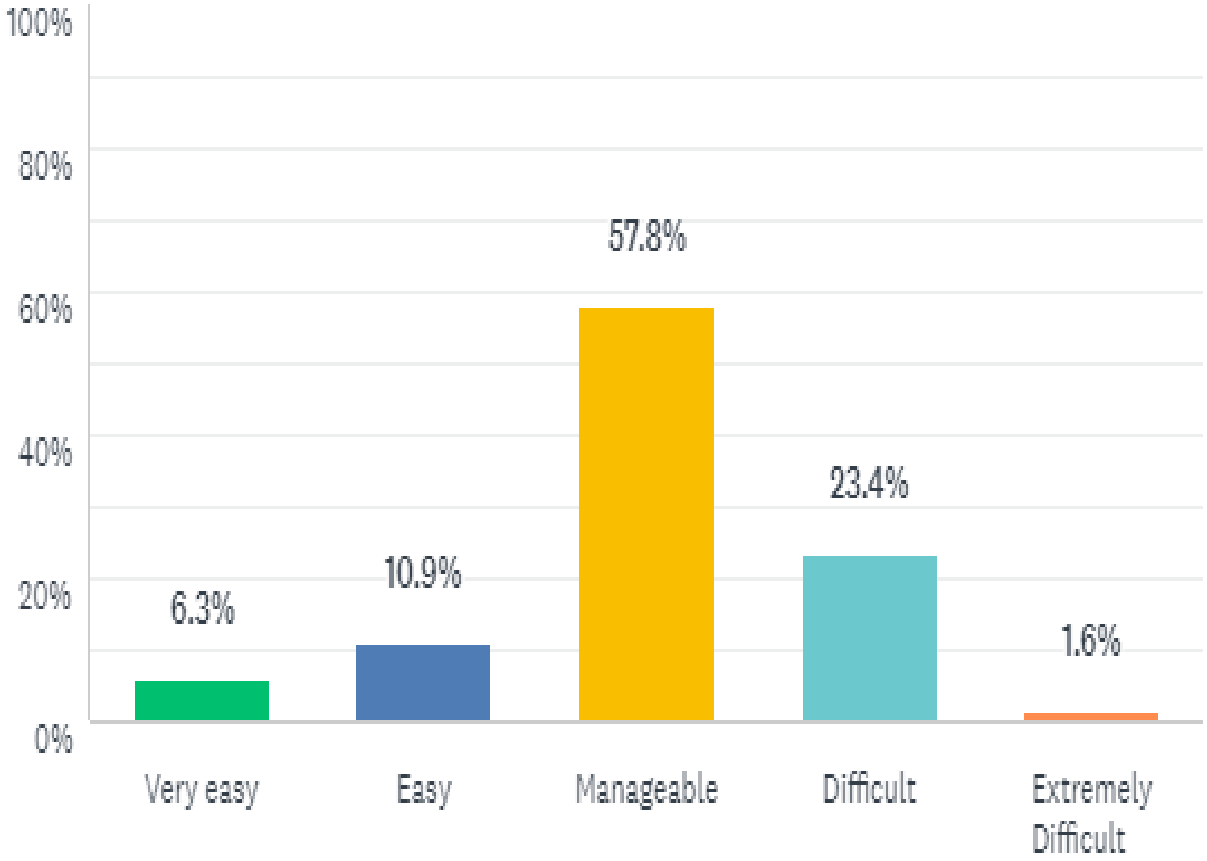


Figure 4.13: Ease of access information from previous or related projects

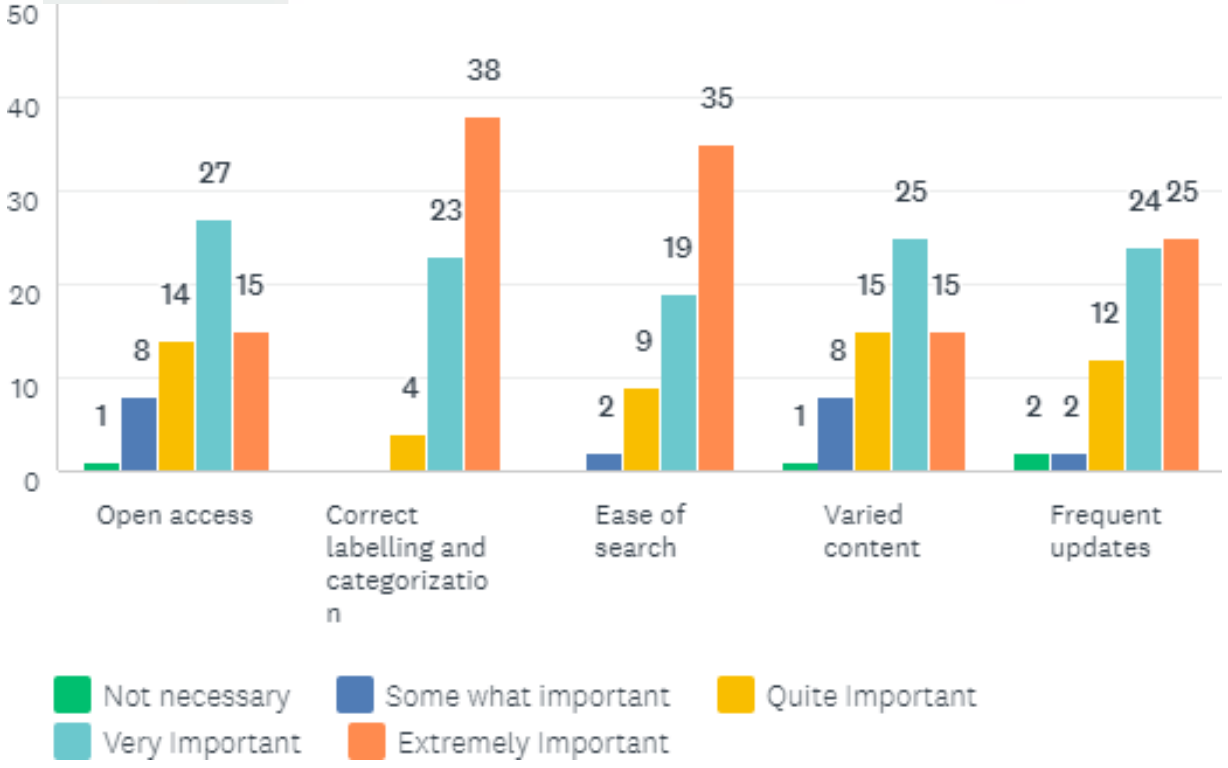
Q11. Accessing information in repositories

The respondents were presented with the following important factors when seeking information stored in repositories namely:

1) Open access.
2) Correct labelling and categorization.
3) Ease of search.

4) Varied content, and
5) Frequent updates.

	NOT NECESSARY (1)	SOME WHAT IMPORTANT (2)	QUITE IMPORTANT (3)	VERY IMPORTANT (4)	EXTREMELY IMPORTANT (5)
Correct labelling and categorization	0.00% 0	0.00% 0	6.15% 4	35.38% 23	58.46% 38
Ease of search	0.00% 0	3.08% 2	13.85% 9	29.23% 19	53.85% 35
Frequent updates	3.08% 2	3.08% 2	18.46% 12	36.92% 24	38.46% 25
Open access	1.54% 1	12.31% 8	21.54% 14	41.54% 27	23.08% 15
Varied content	1.56% 1	12.50% 8	23.44% 15	39.06% 25	23.44% 15



Figures 4.14 and 4.15: Accessing information in repositories

Correct labelling and ease of search are the factors that were considered extremely important by more than half of the respondents. They got 58.5% and 53.9%, respectively. No respondent saw them as unnecessary. Open access and varied content were ranked the lowest, yet they were still found to be important by respondents. They were the only categories that had at least one “not necessary” response.

	MINIMUM	MAXIMUM	MEDIAN	MEAN
Open access	1.00	5.00	4.00	3.72
Correct labelling and categorization	3.00	5.00	5.00	4.52
Ease of search	2.00	5.00	5.00	4.34
Varied content	1.00	5.00	4.00	3.70
Frequent updates	1.00	5.00	4.00	4.05

Figure 4.16: Accessing information in repositories

Correct labelling, frequent updates and the ease of search were the highest rated factors in terms of importance. The mean of all the responses in each ranged from quite important to extremely important with most of the responses under extremely important with a mean ranging from 3.7 to 4.52.

4.3.4 Problem solving

During the project lifecycle unique problems are experienced which are often resolved using innovative methods or specialized skills. The respondents were asked when the problems solutions were documented.

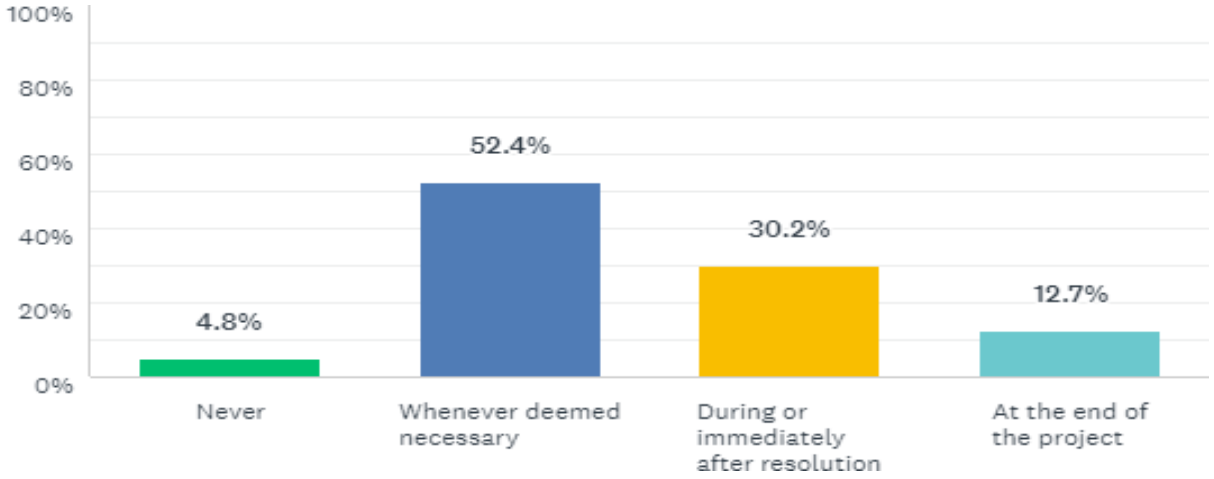


Figure 4.17: Problem solving

The majority (52.4%) of respondents were of the opinion that the problems and the solutions documented should occur whenever deemed necessary. Implying an ad-hoc approach to documenting solutions. The next most common response was that the issue and solution should be recorded during or immediately after resolution with 30.2% of the respondents. This is similar to “whenever deemed necessary” in that they are both ad-hoc since problems

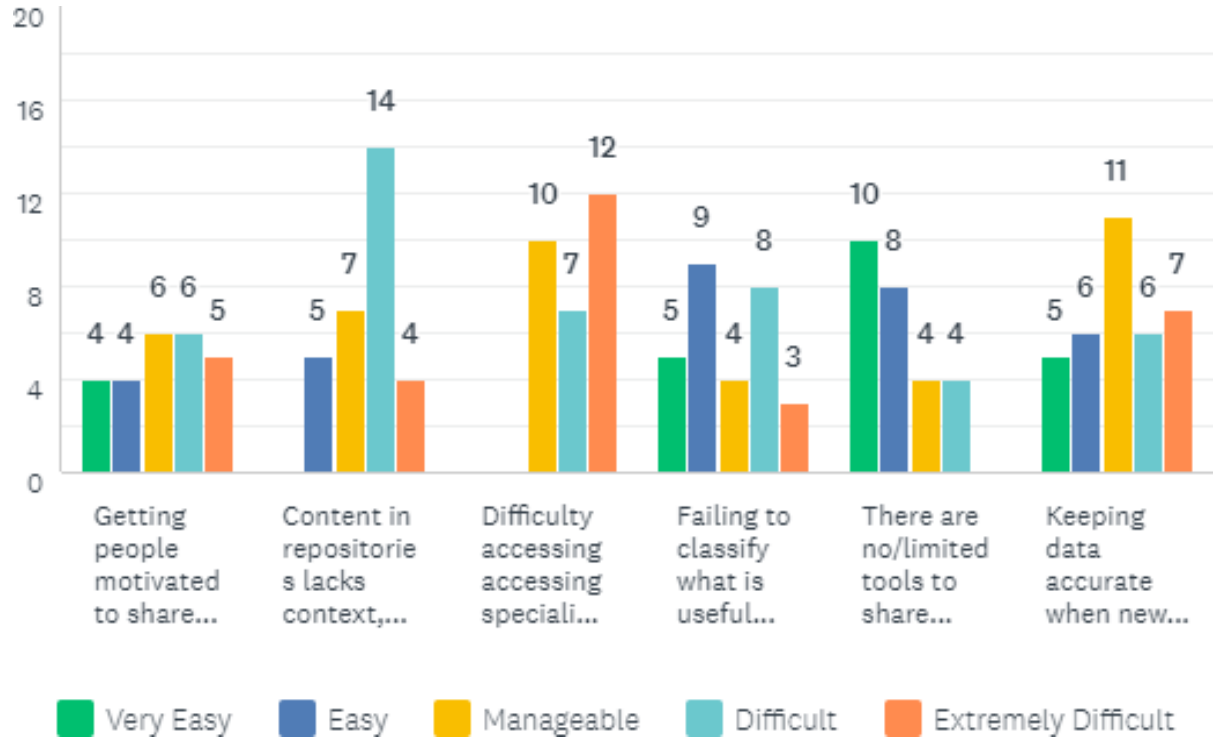
are experienced anytime. Contrary to the belief that the project knowledge is only documented at the end of the project's lifecycle, in this case, only 12.7% of the respondents suggested this. The question answers how often but does not give a criterion for when knowledge is worth documenting.

4.3.5 Managing knowledge

Programme managers, project managers and team leaders oversee and co-ordinate the whole project environment. They have to co-ordinate knowledge activities and the knowledge created while navigating the challenges of the project environment where new knowledge is created in recurring project lifecycles. In order to do this, they have to pick the right strategy to address the challenges and the opportunities. The aim of the research question was to understand how they manage the entire project team's participation in KM activities.

Q15. Challenges of managing knowledge

This question was only poised to programme managers, project managers and team leaders due to their roles as project overseers. Some of the questions were skipped so the total number of respondents on each question varies therefore the percentage and the results will be calculated as a function of the number of responses received for that question. This is to be expected as the quality responses sometimes deteriorate towards the end of an interview due to fatigue (Blasius & Thiessen, 2012: p.124).



	VERY EASY (1)	EASY (2)	MANAGEABLE (3)	DIFFICULT (4)	EXTREMELY DIFFICULT (5)	TOTAL
Difficulty accessing accessing specialist knowledge once experts once they leave the project	0.0% 0	0.0% 0	34.5% 10	24.1% 7	41.4% 12	29
Keeping data accurate when new data is generated.	14.3% 5	17.1% 6	31.4% 11	17.1% 6	20.0% 7	35
Getting people motivated to share knowledge creating a knowledge	16.0% 4	16.0% 4	24.0% 6	24.0% 6	20.0% 5	25
Content in repositories lacks context, making documents difficult to understand	0.0% 0	16.7% 5	23.3% 7	46.7% 14	13.3% 4	30
Failing to classify what is useful data.	17.2% 5	31.0% 9	13.8% 4	27.6% 8	10.3% 3	29
There are no/limited tools to share project knowledge.	38.5% 10	30.8% 8	15.4% 4	15.4% 4	0.0% 0	26

Figures 4.18 and 4.19: Challenges of managing knowledge

The lack of context in repositories and access to specialist knowledge once SMEs have left were seen to be the most difficult challenges to address when managing knowledge; fourteen out of thirty of the respondents (46.7%) and twelve out twenty-nine (41.4%) respondents, respectively. Accessing knowledge had a combined 65.5% rating as either difficult or extremely difficult. Classification between what information or knowledge is useful was considered easy by 48.2% of the twenty-nine respondents; 17.2% percent of the respondents considered it very easy and 31% easy. On the other hand, a combined 37.9% also found it difficult or very difficult to classify useful data. This limitation was due to the lack of tools to manage knowledge it was found to be easy or very easy by eighteen (67.3%) of the respondents out of a total of twenty-six respondents.

	MINIMUM	MAXIMUM	MEDIAN	MEAN
Difficulty accessing specialist knowledge once experts once they leave the project	3.00	5.00	4.00	4.07
Content in repositories lacks context, making documents difficult to understand	2.00	5.00	4.00	3.57
Getting people motivated to share knowledge creating a knowledge	1.00	5.00	3.00	3.16
Keeping data accurate when new data is generated.	1.00	5.00	3.00	3.11
Failing to classify what is useful data.	1.00	5.00	3.00	2.83
There are no/limited tools to share project knowledge.	1.00	4.00	2.00	2.08

Figure 4.20: Challenges of managing knowledge

The lack of tools was found to be an easy challenge to address. As shown in Figure 4.20 the mean response was 2.08. The implication is that project managers perceive the current tools to be adequate. Accessing specialist knowledge once they have left the project was seen as the most difficult with responses ranging from a minimum response of 3.00 (manageable) and a max of 5.00 (extremely difficult). It was the only challenge with a mean above 4.00. This can explain the coding in the next section.

Q16. Access to knowledge before, during and after the project

The programme managers, project managers and team leaders were asked how they make sure that the project has the relevant information and that it is accessible before, during and after the project. The responses were coded by means of a word cloud, bar graph and tag list. The word cloud is generated by highlighting the most frequently used words. A total of twenty-three of the responses were received for this section. The bar graph depicts overall results codified free text responses from three sections of the question. The relevant types of

knowledge differ along the project lifecycle as a result the application might be more interesting during the implementation phase (Hanisch et al., 2009).

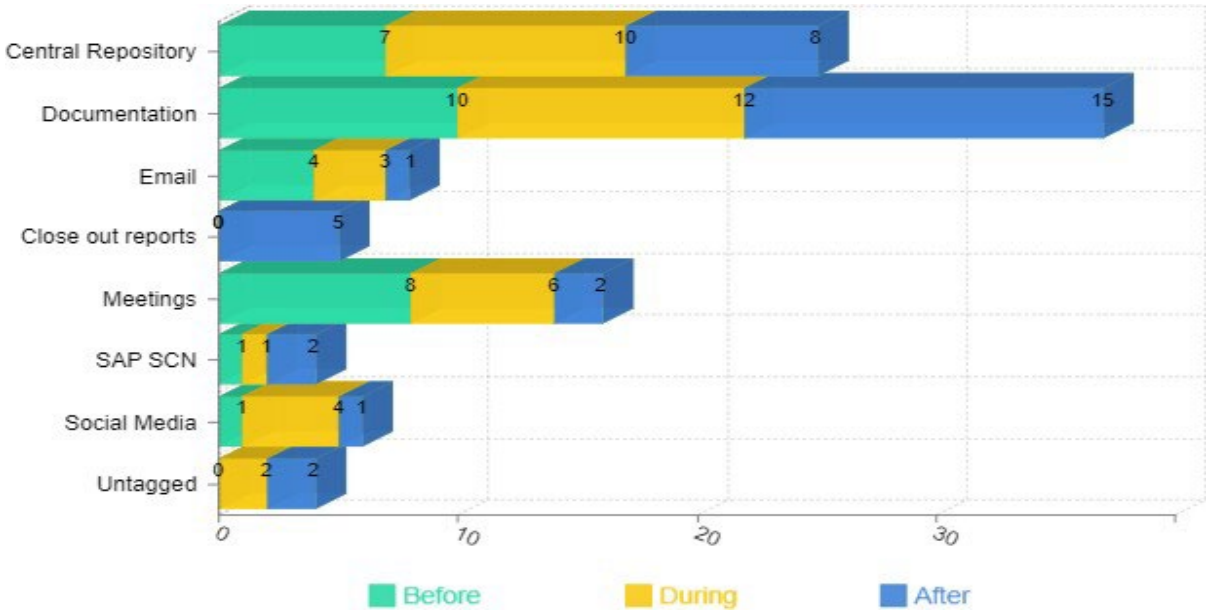


Figure 4.21: Project knowledge management lifecycle responses overview

Before

Of the respondents ten out of the twenty-three (43.5%) of the responses given point out that respondents preferred an approach for availing project information at the start of using documentation. Three of the responses combined documentation with meetings and one other response added email to their response. The next preferred means of availing information in preparation for the project had seven out of twenty-three responses, this was by way of meetings and a central repository. The seven responses that favoured email included the three that mentioned documentation as a preference. The SCN had the least number of responses; it only had one response in favour.

During

The preferred means of storing and disseminating information during the project was

documentation (52.2%) followed by a central repository (43.5%). Even though a central repository was the most cited platform it was mostly in combination with documentation. Based on the word cloud the words updated, emails and meetings were also mentioned frequently.

After

The most mentioned approach of managing knowledge at the end of the project lifecycle was documentation and shared repositories. They made up 65.2% and 34.8% of the responses, respectively. Only two out of the twenty-three (8.7%) respondents spoke about meetings, and a single respondent mentioned emails. The words lessons learnt, documentation, shared and repository were highlighted in the word cloud. The common practice is to focus on codifying the knowledge at the end of the project by means of lesson learnt documents. It is also worth noting that lessons learnt and close out reports are a form of documentation.

4.4 Summary of Chapter Four

Chapter four focused on presenting the data from the respondents to the survey. Sixty-nine9 responses were received from which sixty-five survey responses were deemed usable for the research. The four submissions were erroneously submitted during the survey review process. The data from the survey was depicted by means of word clouds, charts, and tables. The data was drawn from both qualitative and quantitative as a result of responses to closed and open-ended questions. The qualitative data was used to qualify the data collected from the closed questions.

The next chapter will focus on the analysis of the data that has been presented in Chapter four. Recommendations will be made based on the findings.

CHAPTER FIVE: FINDINGS AND DISCUSSION

5.1 Introduction

This chapter will outline the key findings of the data collected through the online survey as part of this research. The chapter will seek to interpret and find meaning in the data collected in relationship to the phenomenon that was under investigation and correlated literature. The presentation of the findings will go according to different themes in reference to research problems and sub-problems.

5.2 Findings and Discussion

The study takes into account the dynamic nature of the project environment, the types of knowledge consumed in that type of environment and the different types of knowledge that results from that process. From the social media perspective, the research looked at understanding the different types of social media and the features that define it. Ultimately leading to the aim of the research is to investigate the enhancement of the management of knowledge in a project-based environment using the capabilities of Web 2.0 based social media.

For analysis and discussion, this was drawn on the literature and the data gathered from the survey. The findings are grouped into themes for analysis and discussion.

1) the characteristics of PBE,
2) the types of knowledge to manage in the PBE,
3) to investigate the functionality of Web 2.0 to facilitate the management of knowledge in a PBE, and
4) to propose a set of guidelines to manage knowledge in PBE using web 2.0.

5.3 Characteristics of the PBE

In Chapter three the defining characteristic of a PBO is that it uses projects as a primary means of production. One of the key characteristics of projects is that their personnel and other resources are assembled for a limited amount of time. This finite the existence of the project staff who tend to move around between projects, which results in them working on several projects. The data showed that most of the respondents had worked on at least five projects confirming the movement of project personnel around and in between projects. This can be within the PBO or past it. The high mobility between projects was also confirmed by the fact that the minority of the project personnel (26.2%) had held a single role while working on projects. This implies that 73.8% held more than one role. In the literature the

continuous gathering, disbandment, and role rotation result in weak ties between team members. Research studies investigated in the literature suggested that the strength of these ties are in direct proportion with how much team members are willing to share their knowledge.

The size of teams varied throughout the PBE. The smallest team size had three members and a maximum of nine hundred members. The team size can be linked to the extent to which KM activities and strategy take centre stage in the project's lifecycle. According to Milton (2018) megaprojects are fraught with complexities, unknowns, and political pressures therefore KM becomes essential whereas in smaller projects, it is relatively easier to establish relationships.

5.4 Type Knowledge to Manage in the PBE

The studies used in this research characterise the PBE as an environment consisting of several projects occurring at the same time. During the projects lifecycle resources are combined to achieve a predefined result in a limited amount of time. In this period, new and old knowledge are created, shared, and retrieved by the project resources. This occurs within projects and across the PBE as a whole. Based on the SECI model by Nonaka and Takeuchi (1995) the different exchanges create and use different types of knowledge. Moreover, for successful knowledge creation the four processes that facilitate the exchange of tacit and explicit knowledge between personnel and physical repositories should occur. The different exchanges of knowledge and knowledge types within project and across the PBE were looked at as a part of KM activities in the PBE to highlight the types of knowledge managed in the PBE.

Majority of the respondents agreed that access to knowledge from previous or related projects was important. However, the majority found it manageable to access, while a quarter found it difficult. Manageable implies can be done but with difficulty. This implies that there is room for improvement in how knowledge from previous or related projects are documented. The most used means of sourcing information from previous or related projects was by accessing explicit knowledge through internal repositories followed by talking to personnel. The internet as a source had the lowest usage by the respondents. The two preferred approaches to sourcing knowledge show an affinity of knowledge that can be sourced in explicit and tacit form.

Access to project personnel requires that there must first be a means of locating the people. It was referred to as the "know who". This is where social media can help. Documents often only

contain names which is only a starting point. Social network provides access to a profile and to a contribution in one swoop. If unable to communicate in person messaging capabilities in social network, enable communication, or alternatively other forms of social media that include instant messengers or teleconferencing. The use of social media requires provides all three methods of accessing a project. However, this requires an increased use of the web as a knowledge source. It is worth noting that the most preferred source of knowledge is old project repositories while the most preferred platform of use is instant messaging. This spotlights a need of expediency that comes with instant messaging and the richness of knowledge drawn from project repositories.

Based on the responses tacit and explicit knowledge are created in the project. However, the focus is on retaining explicit knowledge. This shows a disconnect between knowledge created during the project lifecycle and future usage. In the PBE exchanges are quick by virtue of the nature of the environment: unique problem solving and limited time. How much of this knowledge is transferred to codified documents? How much context is retained?

Several factors had to be considered when accessing the knowledge. The most important factors when accessing knowledge from previous or related projects according to the respondents was correct labelling, categorization and the ease of search. Tags, RSS Feed, and folksonomy's key strength is organizing content making it retrieve, search or traverse. The collective will still need to play a role to make sure that common labels or tags are used. Open access and frequency depends on an organization's policy on KM. They set permissions to who, what or when can be accessed. Forums and wikis have moderators to oversee the permissions.

The information from previous or related project enhances performance by providing solutions or insights into problems experienced in the project environment. In the project environment solutions or counter measures need to be found quickly due to the limited time. While all factors presented to the respondents were considered important the recording of activities was not the highest-ranking factor despite the emphasis on retaining codified knowledge or as a source of related project knowledge. Open communication channels were the most important to encourage the exchange of knowledge which in turn leads to problem resolution. Open communication is the foundation of Web 2.0. thus, social media. This is also in line with the preferred use of instant messaging.

5.5 Social Media

Social media is a Web 2.0 enabled technology that facilitates the creation of online

communities and exchanges information via the capabilities of the different platforms. In Chapter three we looked at the capabilities of different types of social media. The aim of the research is to highlight and investigate how the capabilities can be used to capture, store, and disseminate knowledge. Social media and the underlying functionality have the capacity to establish communities and facilitate the creation, transfer, and storage of knowledge. The project environment is one such environment where communities in the form of project teams come together to create, consume, and share knowledge as part of the exercise of yielding a specific result.

The project team members were asked to show how often they have used the different social media tools to share, store and retrieve knowledge while working on a project. The most often used social media in order were; email, chat, filesharing, blogs, discussion forums, social networks, and wikis. All the platforms were used often by close to half of the respondents at the least.

This showed that there is significant use of social media for KM activities in their project experiences. However, the two most frequently used platforms, email, and chat, facilitate direct communication between project personnel with the potential of exacerbating the problem of weak ties between a project team as a whole. It enabled siloed communication between individuals with strong ties already.

As stated in Chapter three a strong relationship ties foster the exchange of information and knowledge, and as such KM tools need to nurture strong ties between team members for effective KM. Furthermore, despite this the platforms having the benefit of expediency but also presented a challenge once project members have moved on. This seems to be resolved by the latter five most popular platforms namely filesharing, blogs, discussion forums, social networks, and wikis. In contrast with email and chat, the capabilities include relatively open access that is accessible once the individual has left the project.

A further question was asked to see what the respondents preferred social media for sharing, storing, and retrieving knowledge was while working on a project. This is different to the most commonly used in that the other platform might be used due to the fact that it is organizational policy, but it might be what the team members find most useful. The responses were open ended thus the respondents could state more than one platform. The most preferred platforms were chat, forum, and SAP Community Network (SCN). Email dropped to sixth. This is referring to instant messaging platforms like WhatsApp and Skype, which is the same as Lync. Where a reason was given for the preference of “chat” it was

because of the immediacy. Information is sent back and forth quickly and received instantly via the instant messenger. Forums and the SCN platforms were preferred by most developers due to the relevance of their content in troubleshooting. Developers work with technical issues that need solution specific knowledge thus the need for relevant content from sources like Stack Overflow.

The same platforms that were most used were the most preferred. However, the order was different; most used Email, Chat also known as instant messaging, File sharing repositories, blogs, discussion forums, social networks, teleconferencing and wikis, most preferred chat, forums, SCN, wikis and emails. If it can be argued that preferred social media implies usefulness to the users, then there is a disconnection between what the respondents find useful in the project and what they use.

The most preferred used platforms have several capabilities in common. They send information in short bursts and the information is targeted. SCN and forums had the capability to share diverse content. The respondents preferred platforms that could transmit or record short messages that is organized and has a diverse content. The same applies to wikis which are tied at sixth place with emails.

Notably there was less preference for repositories, which stored information for longer, despite their frequent use. In addition to the respondents mentioning their preferred social media platform, some of the respondents pointed out their reasons for selecting a social media of choice.

A summary of the reasons given for their preferred social media are listed below:

1) Expediency,
2) Varied content,
3) Volume of content or large database,
4) Pre-existing solutions to problems,
5) Information relevancy,
6) Idea swopping or solution crowd sourcing,
7) Interactivity between members, and
8) A wide reach.

5.6 Knowledge management in PBO

Managing knowledge in a PBO in which projects are the primary means of production is a unique scenario due to several factors including the finite lifecycle outside of routine

business activities. In the limited time in which the project resources are gathered with the common goal of solving a development that has been deemed worthy of such attention as a result, specialized knowledge is created, shared, retrieved, and consumed. The information is often organized according to the immediate operational needs and social context but once the team disperse it loses its direct usefulness (Almeida & Soares, 2014). The preferred social media tools varied during the lifecycle (before, during and after) of the project. Email and documentation were the only forms of social media consistently used throughout the lifecycle. However, email correspondence tends to be inaccessible once the participants have left the response.

5.7 Challenges

Programme managers, project managers and team leaders, who serve as overseers in the PBO, were asked to rank the challenges faced in the project environment by difficulty. They are responsible for the KM strategy. According to Nath (2021), “a team’s leader essentially facilitates or constraints free flow of information and ideas for his team's KM”. The challenges they saw as the most difficult were accessing specialist knowledge once the SME is gone and documents being difficult to understand because they lack context. 65.5% of the managers considered the accessing specialist knowledge as difficult or extremely difficult, while 60% percent found the lack of context in documents as difficult or extremely difficult. Ganesh and Kumar (2011) mention how technology can be used to locate knowledgeable people and enable direct communication. Social media can assist with the location of SMEs, whether it is the same one or another one, through profiles and linked content that is created on platforms like social networks for example.

The lack of KM tools was said to be an easy challenge to resolve with a mean score of 2 out of 5 by eighteen out of the twenty-six managers (69.2%). The results can be translated to mean that the current tools in the PBE are seen to be a minor challenge.

The other challenges that were presented to the managers is keeping data accurate when new data is generated. Eleven out of the thirty-five (31.4%) responses received found the challenge manageable while the rest of the responses were evenly spread out on both sides of easy or difficult. The overall response was considered inconclusive. However, social media has proven to be useful for frequent updates in informal settings. Such features can be found in blogs with timestamped posts or timelines on social networks or hashtags. There are social media platforms like GitHub that are specifically designed for versioning.

5.8 Knowledge Management Strategy

The supervisors where asked how they ensure that project related knowledge is available before, during and at the end of the project. The aim was for them to spell out the means, activities and tools that form part of their knowledge strategy in the project environment. The open-ended responses cited emails, a central repository, documentation, meetings and the SCN as a means to ensure that project knowledge is available at the beginning of the project. The most popular means was documentation in the form of requirements and project scope that implies codification strategy. Further proof of the leanings towards codification was the establishment of central repositories. The file repositories serve as storage facilities and thus go hand in hand with the documentation. They can also store other knowledge artefacts.

Only two managers suggested the use of social media. One suggested the SAP proprietary social media platform SCN, while the other response suggested the use of Jira and research on Wikipedia. The closest reference to the personalization strategy was a single manager who stated that at the start of the project to schedule regular meetings. The meetings provide direct interactions where primarily tacit knowledge can be shared which is equated to the socialization of the SECI knowledge model.

In the middle of the project is when the amount of activity has picked up and most of the knowledge is now created, shared, and consumed. Documentation and a central repository were still the most popular platforms. The emphasis on the use of central repository increased from 30.4% to 43.4%. Google drive and SharePoint were often mentioned as repositories. The two are similar in that they are both internet-based repositories. However, at the time of the research the former was a web based social media repository that enables cloud-based file sharing, collaboration, labelling, creation of user community and tagging, while the latter is a LAN network-based application and database that allows control access to the uploading and downloading of documents. SharePoint lacked the other interactive features at this point.

Emphasis on documentation increases during a projects lifecycle where project activity is at its peak. This presents a challenge. Projects operate outside the traditional business structure. In this phase of the project lifecycle problems are faced and potentially innovative solutions are used to resolve the problem. However, the resolution can take multiple iterations in their resolution leading to little time to document every iteration. The word “update” was presented in the word cloud as several managers pointed out the need for frequent updates because in middle of the project’s lifecycle most of the new knowledge is being exchanged. This relates back to the combination and the internalization process in the

SECI model. Furthermore, project personnel potentially with specialist knowledge coming and going. The mentions of social media increased to almost 20% of the responses from 4% in the initiation phase of the project. The social media platforms raised were Jira, ZOHO, Wikis, Google Drive, and chat applications like Lync (now Skype for business) and WhatsApp. While it is not an indication of global integration of social media into the strategy it is significant in that the increase occurs at the most active time in the project's lifecycle. This is when knowledge creation and sharing is at its peak.

At the end of the project the activities are winding down and the team is about to disband. The focus from a KM perspective is on making sure that the knowledge is committed to the institutional memory. Most supervisors still emphasized the use of documentation and a central repository. The prominence on documentation went up from 8% to almost 52.2%. The documentation was in the form of close out reports. Close out reports are akin to the lesson learnt documents at the end of the project. Lessons learnt are in fact a subsection in the close out report. It is worth noting that this is largely composed by the project manager or business analyst and not the whole team. According to literature this is where most of the codification happens. However, this is also where context is lost.

Repositories are emphasized in KM throughout the project stages. The emphasis on the documentation can be linked to the challenge of being able to access knowledge from individuals once they have left the project. However, a similar emphasis needs to be placed on the other KM activities that enable the sharing of KM activities as shown in the SECI model. Whether it is the collaborative creation and editing of documentation or the conversation of documentation. Tools can allow for easy capturing, sharing and storage can assist in retaining context.

5.9 Summary

The most difficult challenges faced by the supervisors on projects are retaining specialist knowledge and the lack of context of knowledge that they try to use to resolve this by ensuring information despite the emphasis on documentation and storing them in repositories. Furthermore, supervisors continue to find difficulty in the fact that the information in repositories still lacks context. The difficulties extend to when the need to access information from previous or related projects by project personnel.

The codification strategy extends throughout the project's lifecycle. Evidence showed that accessing knowledge from previous or related projects is important to consultants. The majority of the consultants sourced the information via talking to personnel and searching

internal repositories. Furthermore, there is evidence to show that there is a use of social media in the project environment even though there is little emphasis to do so in the KM strategy. This could imply informal use of the social media platforms.

The preferred social media platforms facilitate quick exchanges and provide easy access to relevant knowledge. The most preferred and popular social media, which are email and chat, are closed communication platforms that make it difficult to access knowledge once the individuals have left the project. However, these preferred platforms are not ranked the same as the most used platforms. The project personnel move around from one project to another frequently. Not only do they change projects, but they also change roles. Most of the respondents have worked on several roles over the years and have held multiple roles. The team size varied from three to nine hundred.

CHAPTER SIX: CONCLUSION

6.1 Introduction

Chapter 6 will conclude the thesis based on the empirical findings and literature. In this chapter, a summary of the objectives, contributions, recommendations, limitations of the study and conclusion of the research will be presented by a brief outline of the steps taken to draw the conclusion below.

Chapter one served as an introduction to the topic and to the roadmap that was going to be used to investigate the use of social media as a tool to manage knowledge in PBE. The problem statement was established, aims and objectives, research questions and research background were introduced.

Chapter two looked at the existing literature that addresses aspects of the research topic. The topic was broken into subtopics covering KM, social media and PBEs. The literature review regarding the management of knowledge started off by defining knowledge, the types of knowledge, the synthesis of knowledge based on Nonaka's (1994) SECI model and the two KM strategies. The literature reviewed also covered the defining characteristics of the PBE and how it differs from the traditional organization. The defining characteristics were that projects are the primary means of production and as a result there is movement of resources across and within the PBE which has bearing on how knowledge activities occur. The chapter closed off by exploring what Web 2.0 based social media is, the different platforms and the defining capabilities of each of these platforms.

Chapter three focused on the research design and methodology. The research collected quantitative data by means of a survey as a data collection instrument. The structured survey questionnaire was presented online where users completed them. The questions included a mixture of open ended and closed questions. The SAP ESC was chosen as the research site because they run and maintain an SAP ERP system within a PBE. Sixty-five questionnaires were completed and analysed in the next chapter.

Chapter four focused on the presentation of the collected data. The data presentation was grouped according to the research questions that were introduced in Chapter one. The data from the responses that fit under more than one research question was referenced in the other sections. Key findings from the data showed that the respondents used all the platforms except for one. In the project, the KM strategy's main focus was the retention of explicit knowledge and has little emphasis on social media. The findings also showed how project team members find knowledge from previous or related project importance and was

sourced in tacit or explicit form. The chapter focused solely on the findings.

Chapter five was dedicated to creating a connection between the findings through analysis and discussion. The analysis suggested that even though there was use of social media it lacked a formal mandate as it was not included in the formal strategy. The use of social media focused on the retention of explicit knowledge despite the capacity to source of explicit and tacit knowledge from previous or related projects or the mix of social media platforms such as instant messengers.

6.2 Importance of the Research Findings

The aim of the research was to explore the use of social media in a PBE for managing knowledge.

The data collected showed that there is use for social media by the majority of the consultants. However, if the data collected on how knowledge managers ensure the sharing, storage, and retrieval of knowledge in the different project phases the emphasis is on the use of documentation and codification. The selection of tools to codify the data are still network-based repositories like SharePoint that have little to no Web 2.0 enabled capabilities at the time of the study. Therefore, from this one can deduce that even if there is use of social media by the project team members it is not by a formal mandate or fully embedded into KM strategies.

The research has shown that information from previous or related projects is deemed important to project personnel. They source the knowledge mostly from repositories, but they also make use of project personnel. However, web-based sources are the least likely to be used for this knowledge exercise. Social media can facilitate such exchanges by either facilitating the location of the personnel or the actual communication between individuals.

The use of social media for KM activities by project team members shows that there is value that can be derived from the use of social media. Based on the findings social media has the capability to facilitate quick communication and feedback, varied content and provided relevant content. Examples of social media that are popular among project members are instant messengers, and platforms that organize and allow the crowd sourcing of knowledge such as forums, social networks, and blogs. Accessing knowledge from previous or related projects is important. The findings showed that it is of almost equal importance to access tacit knowledge through person-to-person interaction or through explicit knowledge in repositories. Social media has shown the capacity to facilitate record and organize knowledge exchanges

online through the different features. This includes person to person exchanges that do not necessarily mean face to face for socialization to occur instead of just codification.

The KM strategy must not only focus on the retention of explicit knowledge by way of codification. Using the SECI model as a framework, an effective KM strategy needs to facility the synthesis of tacit and explicit knowledge. The broader focus will ensure that knowledge is created, applied, and updated by the projects in the PBE.

The findings have shown that there is a use for social media in projects by personnel and why it is used by personnel. They have shown the match between the challenges still being in the project environment and the potential of social media capabilities must resolve them. It has also explored the KM strategy employed by the managers or supervisors and if social is a part of it. The integration of social media into the project KM strategy, or the lack thereof, can be looked into in the future. The findings have shown current use of social media in PBOs and a potential use in projects to resolve specific problems.

6.3 Contribution

Presthus and Munkvold (2016) states that research should contribute to “a new or improved product, a new theory, a re-interpretation of an existing theory, a new or improved research tool or technique, a new or improved model or perspective, an in-depth study of a particular situation, an exploration of a topic, area or field, or a critical analysis.” Presthus and Munkvold (2016) further stated that part of the outcome of research is that it contributes to the theoretical understanding of the studied phenomena, and to practice in the field. This research will contribute to the existing study of managing knowledge, social media, and KM in organizations where projects are the primary means of production. The literature included in the study and the data collected resulted in findings and conclusions that make it theoretical, methodological, and practical to the field of the study.

6.3.1 Methodological Contribution

The study was exploratory therefore it sought to examine the current environment. The methodological contribution stems from the experience gained through the techniques applied for data collection. The online survey enabled a quick and wide collection of research data. The data was retained and analysed online for during the research study.

The collection and analysis using research data through online tools demonstrated efficacy of online questionnaires being used to reliably collect research data in this study could be presented as evidence in other studies for the same purposes.

6.3.2 Practical Contributions

The findings of the study provide several practical implications for the adoption of social media as a tool to manage knowledge.

First, the study showed that knowledge from previous related projects was important. The knowledge was sourced from both codified knowledge in repositories and individuals. The two types of sources showed that knowledge is needed in both formats. As a result, it is important that the project managers promote KM activities that facilitate the creation, updating and exchanging of both types of knowledge across projects in the PBE. The current approach only focuses on codified explicit knowledge. The combined capabilities of social networks, forums, file sharing and tags can be applied to cater for the needs of such exchanges.

Second, the study revealed that social media is in use even though it is not fully incorporated into the KM strategy. The practical contribution is what project supervisors will need to include in social media and in their KM strategy if it is to be used to manage knowledge. On the practical implementation of social media as a tool to manage knowledge, steps need to be taken to individual usefulness and organizational policy. The inclusion will allow the knowledge in the personal repositories to be added to the organization's knowledge repositories.

6.3.3 Theoretical Contributions

At the start of the study there was a limited amount of literature regarding the use of social media for managing knowledge, let alone using it to manage knowledge in the PBO. Studies have since been established to research the implementation within organizations under the branch of Enterprise 2.0. Enterprise 2.0 looks at the integration of Web 2.0 technologies into the organization extranet, intranet, and business process. The study extends this body of knowledge to analyse the specific application of social media in the enterprise. The research shows that there is current use and affinity of social media KM activities. The study of Enterprise 2.0 does not necessarily relate to KM.

The dissertation extensively examines the capabilities of social media platforms and their capacity to facilitate the creation of knowledge. The study assessed the features different social media platforms and the related knowledge activities in the PBE. The survey data highlighted the most used platforms and the preferred platforms. Therefore, the study contributes to the further understanding of the varying capabilities of the Web 2.0 based technology, and specifically as a technology that can facilitate the knowledge activities. The

study extends the understanding of the SECI model for knowledge synthesis. As part of the study, the SECI model is applied to the different phases of the project's lifecycle: before, during and after. The study highlighted which of the four knowledge synthesis processes are most active dependent on the project phase. The theory from the literature and the empirical findings contributed to the understanding of how social media can be used to influence the knowledge process within the PBE. The study also provided insight into how management versus the practice of how knowledge is created, shared, and consumed in the project environment.

6.4 Conclusion in Terms of the Summary of the Findings

The study investigated the application of Web 2.0 based social media capabilities to manage knowledge in PBOs. The aim was to see how the capabilities of social media can influence KM activities in a project driven environment such as the SAP ESC at the City of Cape Town. The research looked at the dynamics of the PBE from a KM perspective. The summary of the findings is presented below.

The research findings presented the reality that project team members do not only move around as asserted by the literature, but their roles also change as they move around from one project to another. Furthermore, the sizes of the teams varied widely, with a median of fifteen, a minimum of three and a maximum team size of nine hundred. The research findings showed that there is social media usage in the KM activities within the PBO. Of the social media platforms presented all of them except for one had been used by the respondents at least once, and more than half were used often. The rate and variety of social media usage by the respondents led to the conclusion that the different platforms have the capacity to manage knowledge. This was based on the assertion that individuals use tools that they find helpful.

However, the order of preference differed from the order of usage. The most popular and still most used of these platform types were chat or instant messaging. In the literature, the qualities of the different platforms were taken into account. Based on these capabilities presented in the literature the most preferred platforms from the findings had specific qualities that include expediency, varied content, volume of content or large database, pre-existing solutions to problems, relevant information, idea swopping or solution crowd sourcing, interactivity between members and a wide reach. These factors should be considered when deciding which social media tool to include in the PBE for managing knowledge. The research revealed that access to previous or related project knowledge is

significantly important in the PBE. It is primarily sourced from repositories but seeking it from individuals is also significantly high.

The findings showed that the most difficult challenges to resolve were accessing specialist knowledge once the SME is gone and understanding documents due to the lack context. The tools to manage knowledge were seen to be adequate by the respondents. Instead of drawing a conclusion, it opens the question whether social media should replace or be integrated into the existing traditional KM tools. The research brought to light that while there is social media usage in the PBE even though it is not a part of the project supervisors KM strategy before, during and after the project. Emphasis on social media usage was low in all phases of the project. The findings also showed that the primary strategy in the PBE is codification that emphasizes the retention of explicit knowledge. The emphasis is on documentation and storing information in repositories. This is even though SECI models are needed for knowledge creation as part of the management of knowledge. The full value of knowledge is not realized due to the loss of context, and a weakness of the codification strategy.

6.5 Recommendations in Terms of what is to be done

The recommendations are drawn from the descriptive statistical data presented in Chapter four and the findings in Chapter five which highlighted several key findings, combined with the literature reviewed in Chapter three. The following will need to be considered for the effective implementation of Web 2.0 based social media platforms to manage knowledge in the PBE namely:

- Project members move from one project to another. Not only that, but they also switch projects they switch roles too. The relationship ties between project team members and the knowledge creation during the brief interactions that generate knowledge should be promoted, not only the retention of explicit knowledge. It is important that knowledge exchanges remain accessible as much possible after the project has ended. The exchanges in forums, chat groups and comments are made within a contextualized environment resulting in tacit and explicit knowledge from previous or related knowledge is important in the project environment. This is context being one of the most important factors of the project knowledge.
- The use of social media as a tool by which knowledge is managed needs to be guided by strategy for it to effectively add to the organizational memory. The strategy can provide a structure that ensures knowledge in personal silos is accessible to the

project team and the PBE at large. It will make sure that the right tools are used to resolve challenges in managing knowledge. The strategy should factor in the intensity of knowledge activities during the different phases of the project's lifecycle.

- As part of the intentional implementation of social media as a tool to manage knowledge in the PBE it will need to look at whether the Web 2.0 based technology will either augment or replace current KM tools. The current tools are found to be useful by the individuals and structures in the project environment therefore cannot be simply discarded. The recommendations highlighted the essential factors of an effective management knowledge in a PBE on the research findings. In summary the KM strategy needs to look at aspects of knowledge creation and consumption beyond codification. It must factor the interplay between tacit and explicit knowledge as shown in the SECI model.

6.6 Limitations and Future Research Opportunities

The research was executed in a finite time within which it had to be completed therefore parameters had to be set about what is achievable. A research study like a project occurs in a limited time and limited resources with a set goal in mind. As a result of the finite nature there are constraints in place to achieve the set goal. This chapter will outline the limitations to the study. The research has provided insight into the research topic, but the limitations could have implications on further research.

A single key limitation was identified. The limitation relates to the fact that the research was done on a single organization therefore a single type of product and industry. The limitation was imposed on the study due to the nature of the environment being explored and the administrative overheads in getting permission to interview the respondents. The individuals within a project environment are working on a deadline therefore limiting room for interruptions or efforts not directed towards the goal. It would have been a costly exercise timewise.

The SAP ESC is in the Information communication technology (ICT) sector within a government organization focused on information system development and design, which is a service that results in intangible goods. Because of this categorization there is the opportunity to expand the study further. For example, a study into other PBEs that produce tangible products instead of services. Future studies can also take this further by even providing a contrast in the different PBO environments possibly in different industries or product types and the KM dynamics within these environments.

Alternatively, the study could investigate the management of knowledge in PBEs within the private sector compared to the current one that was conducted in a public sector organization.

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Questionnaire

Using Social Media for Knowledge Management in project based

Research title:
Using Social Media as a Knowledge Management tool in project based environment

Student: Bongani Chehore

The questionnaire is part of the aforementioned dissertation in part fulfillment of Masters degree by Bongani Chehore.

Research Objective:
The aim of the research at how Social media used to capture in project based environments. Project based environment because they are primarily organized into finite projects that tend to be seen as separate entities present a unique in managing knowledge.

Key terms:
Knowledge management - the process of capturing, developing, sharing, and effectively using organisational knowledge. Davenport, T. (1994)
Social media - a group of Internet-based applications that build on the ideological and technological foundations of Web 2.0, and that allow the creation and exchange of user-generated content Haenlein, M and Kaplan, A. (2010)

Categories of Social media according to Haenlein, M and Kaplan, A
1.Collaborative projects (for example, Wikipedia)
2.Logs and microblogs (for example, Twitter)
3.Social news networking sites (for example, Digg and Leakernet)
4.Content communities (for example, YouTube and DailyMotion)
5.Social networking sites (for example, Facebook)
6.Virtual game-worlds (e.g., World of Warcraft)
7.Virtual social worlds (e.g. Second Life)

By filling in this form you are consenting to participation in this research. Your information can be use in future research paper by the student.

Your assistance is much appreciated. All questions are mandatory. The questionnaire should take about 15 minutes to complete. all questions are mandatory.

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1. What is your role on the the latest project you worked on?

2. How many full projects have you been part of?

- ◯ Less than 3
- ◯ Less than 5
- ◯ Less than 10
- ◯ More than 10
- ◯ And what was the size of the largest team you have been a member of?

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3. For purposes of this survey, the term "Social Media" refers to information and communication technologies that provide users the opportunity to participate and engage in interactive dialog. User can participate in activities such as sharing media, publishing and tagging information, posting comments, connecting with people, and designing and using composite applications. Furthermore, the use of these technologies allows users to instantly and easily switch between the roles of producers and consumers of content and applications. Among others, some examples of social media include social networks such as Facebook, microblogging tools such as Twitter, collaboartive tools such as Wikis, media sharing sites such as Youtube, and collaborative editing applications such as Google Docs (Barankevych, Enterprise Social Media Tools & Knowledge Management)

Which of the following Social Media have you used on a project ?

	Never	Once	Rarely	Often
Wikis	◯	◯	◯	◯
Discussion Forums	◯	◯	◯	◯
Blogs	◯	◯	◯	◯
Microblogs	◯	◯	◯	◯
Social Networks	◯	◯	◯	◯
Polls & Voting Tools	◯	◯	◯	◯
Mashups	◯	◯	◯	◯
Widgets	◯	◯	◯	◯
RSS Feeds	◯	◯	◯	◯
Social News	◯	◯	◯	◯
File Sharing (Repositories)	◯	◯	◯	◯
Collaborative Document Editing	◯	◯	◯	◯
Podcasts	◯	◯	◯	◯
Content Tagging	◯	◯	◯	◯
Social Bookmarking	◯	◯	◯	◯
Video Sharing	◯	◯	◯	◯
Virtual Worlds	◯	◯	◯	◯
Online Games	◯	◯	◯	◯

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4. When working on a projects how have you accessed information from previous related projects?

- [ ] Talking to project personnel
- [ ] Accessed internal project records repositories
- [ ] Used the internet

Other (please specify)

5. How important is it to have access to information from previous or related projects when starting a new project?

- ◯ Not necessary
- ◯ Some what important
- ◯ Quite Important
- ◯ Very Important
- ◯ Extremely Important

6. When project knowledge is stored repositories how important are the factors listed below?

	Not necessary	Some what important	Quite Important	Very Important	Extremely Important
Open of access	◯	◯	◯	◯	◯
Correct labelling and categorization	◯	◯	◯	◯	◯
Ease of search	◯	◯	◯	◯	◯
Varied content	◯	◯	◯	◯	◯
Frequent updates	◯	◯	◯	◯	◯

7. When starting a new project how easy is it to find information about previous or related projects?

- ◯ Very easy
- ◯ Easy
- ◯ Manageable
- ◯ Difficult
- ◯ Extremely Difficult

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8. During projects what is the most common way of sharing project information among team members?

- ◯ Email
- ◯ Face to face Meetings
- ◯ Chatroom
- ◯ Teleconference
- ◯ Online Forums

Other (please specify)

9. Listed below are some of major challenges when trying to effectively managing (store, retrieve and share) knowledge on projects. Do you agree?

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Getting people motivated to share knowledge creating a knowledge	◯	◯	◯	◯	◯
Content in repositories lacks context, making documents difficult to understand	◯	◯	◯	◯	◯
Difficulty accessing accessing specialist knowledge once experts once they leave the project	◯	◯	◯	◯	◯
Failing to classify what is useful data.	◯	◯	◯	◯	◯
There are no/limited tools to share project knowledge.	◯	◯	◯	◯	◯
Keeping data accurate when new data is generated.	◯	◯	◯	◯	◯

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10. Where in your opinion is the best time retain project knowledge and why?

On a scale of 1 to 10 how important is it to do it during this

11. The purpose of a project is create a new or unique feature. As a part of this process unique problem are experienced which are resolved using innovative or specialized skills. How often are these problems and solutions documented?

- ◯ Never
- ◯ Whenever deemed necessary
- ◯ During or immediately after resulotion
- ◯ At the end of the project

12. How important is it on a project to have the following?

	Not important	Some what important	Quite Important	Very Important	Extremely important
Access to subject matter experts	◯	◯	◯	◯	◯
Joint participation in project activities	◯	◯	◯	◯	◯
Recording of project activities	◯	◯	◯	◯	◯
Access to knowledge repositories	◯	◯	◯	◯	◯
Open Communication channels	◯	◯	◯	◯	◯