Knowledge Management Systems Support for Value Co-Creation in KIBS Engagement

By

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Abstract

Collaborative value creation (otherwise known as value co-creation) is a concept that has been explored over the years in the context of knowledge-intensive business services (KIBS) such as management consulting, engineering services, etc. A body of studies has investigated how to foster value co-creation among KIBS providers, clients, and partners during KIBS engagements. Knowledge processes have been identified as an important enabler of value co-creation. In organizations more generally, knowledge management systems and related ICT tools (referred to as KM tools in this research) have been identified to support knowledge processes. However, the support provided to knowledge processes in the specific context of KIBS engagements is yet to be explored. Through the development of a conceptual framework that examines the linkages between KM tools, knowledge processes, and value co-creation in the context of KIBS engagements, this research investigates how knowledge management systems provide support to value co-creation in KIBS engagements.

We adopt a multiple case study research design. Using eight semi-structured interviews, we obtained data on knowledge processes and KM tools in KIBS engagements. The result is a refined framework that illustrates the type of KM tools currently used in KIBS engagements, the knowledge processes they support, and their relationship to value co-creation. We also present a discussion of how this framework can be applied practically.

At a conceptual level, this study contributes to the field of KIBS by identifying how exactly knowledge processes provide support to value co-creation processes in KIBS engagements, and how KM tools provide support to knowledge processes. At a practical level, this study contributes to the field of knowledge management systems design by providing guidance on the KM tools that can meet the specific needs of service providers, clients, and partners in the domain of knowledge-intensive services.

Keywords: knowledge processes; value co-creation processes; knowledge managements systems; knowledge management tools; knowledge-intensive business services

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List of Abbreviations

VCC: Value co-creation

KIBS: Knowledge-intensive business services

KM tools: Knowledge management tools

KMS: Knowledge management systems

T-KIBS: Technology-oriented KIBS

P-KIBS: traditional professional services

1. Introduction

1.1. Research background

Over the years, there has been a growing interest in research within the domain of knowledge-intensive business services (KIBS). This interest is because of the contribution that KIBS make towards knowledge and innovation in organizations and the economy in general (Corrocher, Cusmano, & Lenzi, 2013; Miles & Miles, 2005). Indeed, KIBS provide knowledge-based services such as consultancy, engineering services, research and development, and technical services to other organizations (Miles et al., 1995; Miles & Miles, 2005; Muller & Doloreux, 2009). KIBS services are characterized by their strong dependence on professional knowledge, their primary role in the supply of knowledge-based products and services, and the competitive advantage they supply to businesses (Miles et al., 1995; Muller & Doloreux, 2009). Their services are not conventional, and they aim at producing innovation for their clients (Miles et al., 1995). In fact, more than facilitating innovation, KIBS are co-producers of innovation (Muller & Doloreux, 2009). However, in other to realize the optimal benefit in terms of knowledge and innovation from KIBS service delivery activities, clients must also actively participate in co-creating and co-producing the solution (Bettencourt, Ostrom, Brown, & Roundtree, 2002; Muller & Doloreux, 2009). This participation happens through a substantial amount of interaction and collaboration which is important for value co-creation during knowledge-intensive business services (Aarikka-Stenroos & Jaakkola, 2012).

The service dominant logic principle stresses the collaborative nature of value creation in service delivery. In this view, the value of a good or service is not just in its offering (i.e., the delivered goods or service) but also obtained from its use (Payne, Storbacka, & Frow, 2008). It is therefore required that users of these goods such as the clients, participate in the service delivery process.

Participating actors are required to develop collaborative relationships so that they can create and determine value together (Ramirez, 1999). Value co-creation, therefore, involves the active collaboration and involvement of clients, provider and partners in creating and determining the value (Vargo & Lusch, 2004). The concept of value co-creation has particularly generated research interest in service-oriented organizations such as knowledge-intensive business services (KIBS). The engagement between KIBS providers, clients and other participating actors such as partners (referred to as KIBS engagements) often involve collaborative and joint problem-solving activities between actors (Aarikka-Stenroos & Jaakkola, 2012). These activities make up the value co-creation process for KIBS engagement. Value co-creation process begins with the identification of the clients needs and interests (Aarikka-Stenroos & Jaakkola, 2012). Through a series of negotiations, these needs and interests are aligned with the value propositions of the provider, and a commitment to proceed is reached (Aarikka-Stenroos & Jaakkola, 2012; Lessard, 2014). Resources are then organized and actors work together to collaboratively produce a solutions/deliverable that meets the clients requirements (Ordanini & Pasini, 2008). The solution is then implemented, and the value propositions might be actualized (Stucky, Cefkin, Rankin, Shaw, & Thomas, 2011). Following, there is a valuing of new deliverables/solutions which could then be integrated as new resources for providers, clients and partners (Lessard, 2014). These activities make up the three processes of value co-creation – Aligning, Actualizing, and Integrating

Going further, there are certain mechanisms that support the collaborative creation of value in KIBS engagements. One of such mechanisms is knowledge. For value to be co-produced in KIBS engagements, service providers, clients and other network actors need to share and contribute their knowledge (Ordanini & Pasini, 2008; Sarker, Sarker, Sahaym, & Bjørn-

Andersen, 2012). Indeed, knowledge is a core resource for knowledge-intensive business services (KIBS). It is therefore of particular importance that actors contribute and use this resource during KIBS engagements (Toivonen, 2004) because it can result in the development of innovation (Amara, Landry, & Doloreux, 2009). During KIBS engagements, certain knowledge activities (knowledge processes) are required to support the collaborative creation of value between providers, clients and other partners (Hakanen, 2014; Muller & Zenker, 2001). To develop a solution for the client, knowledge regarding the clients requirements and a probable solution needs to be obtained (Muller & Zenker, 2001). Following, clients, providers and partners share and combine previous knowledge, skills and competencies with the knowledge recently acquired to develop a solution for the client (Strambach, 2001). Afterward, knowledge is shared and applied to use the solution/deliverable that has been produced which often includes much learning among actors (Hakanen, 2014). These knowledge activities make up the three (3) core knowledge processes – knowledge acquisition, knowledge combination, knowledge application.The presence of knowledge processes during KIBS engagement can foster intense interactions between the provider and client which can lead to innovation (Gallouj, 2002; Muller & Zenker, 2001; Strambach, 2001). Given the importance of knowledge processes for KIBS providers and their clients, there is a need to provide adequate support to these processes during engagements.

One way of supporting knowledge processes in organizations is through the use of information and communication technologies (ICTs), specifically knowledge management systems (KMS) (Alavi & Leidner, 2001). Knowledge management systems are often designed to assist knowledge-intensive processes (Detlor, 2002; Maier, 2007). They can facilitate knowledge processes by assisting managerial and professional workers in achieving their knowledge

activities (Alavi & Leider, 1999; Carlsson, 2003; Maier, 2007). These systems do not necessarily manage knowledge since, they do not directly handle knowledge itself, however, they integrate sets of ICTs that can directly handle knowledge (Maier, Hädrich, & Peinl, 2009). Such ICTs are referred to as knowledge management tools and includes tools such as communication systems, document management systems, workflow management systems, etc. (Maier, 2007; Maier et al., 2009). Thus, in as much as this study generally focuses on knowledge management systems support for value co-creation, our emphasis will be on how knowledge management tools (KM tools) can provide support to knowledge processes in KIBS engagement.

Indeed, previous studies have focused on value co-creation processes and knowledge processes in KIBS engagements. However, many questions remain about how these knowledge processes can directly support value co-creation processes. In addition, previous research has not focused on the how these processes are supported by information communication technologies (ICTs) such as KM tools. This thesis thus proposes to investigate how knowledge management systems support knowledge processes that enable value co-creation in KIBS. This problem leads us to the objectives of this study

1.2. Research objectives

The study first aims to improve our understanding on how knowledge processes enable collaborative value creation in KIBS engagements. We will focus on empirically identifying what particular value co-creation process(es), knowledge processes in KIBS engagements support. By doing this, we will understand how knowledge processes directly support the value co-creation process.

The second objective of this study is to improve our understanding of how knowledge activities in KIBS engagements are supported by KM tools. We will focus on empirically identifying KM tools that are used during KIBS engagements and the knowledge processes they directly support. By doing this, we will understand how KM tools directly enable knowledge processes for value co-creation in KIBS engagements.

1.3. Research questions

To achieve the above objectives, this thesis aims at answering the following question articulated as a general research question and two sub-questions:

General research question:

How do knowledge management systems support value co-creation in knowledge-intensive business services (KIBS) engagements?

Specific (sub) research questions

a) What knowledge processes are present to support value co-creation in KIBS engagements and what is their relationship to value co-creation processes?
b) What KM tools are available to support knowledge processes for value co-creation in KIBS?

1.4. Research contributions

While previous research as shown that value co-creation is important to KIBS engagements, and knowledge processes can support value co-creation, the exact way in which this happens empirically has not been investigated. This research contributes to the literature on value co-creation in KIBS by providing an empirical understanding of how knowledge processes exactly

provide support to value co-creation processes in KIBS. The findings of this research help us to identify what particular value co-creation process(es) each knowledge process supports. By doing so, KIBS professionals and other actors in an engagement can have a better understanding of what knowledge processes are more significant during a particular value co-creation process and to pay more attention to such activities during the process.

This research also contributes to the literature on knowledge management systems support to value co-creation by providing empirical understanding on 1) what kind of KM tools generally support these knowledge processes, and 2) what knowledge processes do these KM tools support. The findings of this study could help KIBS professionals to have a better understanding of which KM tools can best support a specific knowledge process. This could in turn guide them to select the most appropriate KM tools for given knowledge activities.

The findings of this research may also be of interest to knowledge management systems solution designers and providers. These designers might have questions about what KM tools are used to support value co-creation during KIBS engagements. The findings of this research will provide a better understanding of the type of tools that service providers, clients, and partners use to support their knowledge activities. Knowledge management systems solution providers and designers could use this research as a guide when designing solutions for KIBS engagements or knowledge-intensive activities more generally, or estimate how well their current solutions support the needs of KIBS providers and their clients.

1.5. Summary of chapters

The remainder of the thesis is organized into five chapters. Chapter 2 presents a review of literature on the key concepts for this research – KIBS, knowledge processes, value co-creation,

and knowledge management systems. The chapter ends with a framework that helps to conceptualize KMS support for value co-creation in KIBS engagements. Chapter 3 then provides details on the methods that the study followed in meeting its objectives and answering its questions. We will discuss the research design and research activities such as instruments, participants, data collection, data analysis and validation techniques. The chapter ends with a summary of the cases that we studied. Chapter 4 reports the results of the study. Chapter 5 presents a discussion of the study by drawing the implication of our findings to the extant literature and ends with the revised framework. Finally, Chapter 6 concludes with the limitations of this research and directions for future work.

2. Literature review and conceptual framework

Our research questions are designed to provide answers on how knowledge management systems can provide support to the co-creation of value in knowledge-intensive business services (KIBS) engagements. To answer these questions and to advance knowledge within this domain, we will need to develop a strong theoretical foundation (Webster & Watson, 2002). This foundation will guide our research. The literature review presented in this chapter aims at achieving this objective through the following:

I. Reviewing literature in the domain of KIBS to give us an understanding of what they are, what they do and why they are important.
II. Reviewing literature about knowledge processes that are specific to KIBS engagements to understand the knowledge processes that are carried out in the activities of KIBS engagements. These processes will also be discussed in relation to knowledge processes more generally to identify the differences and similarities between these processes.
III. Reviewing literature in the domain of value co-creation in KIBS to understand the activities and processes required for value co-creation to happen within KIBS engagements. Based on this, we will be able to identify the how knowledge processes support the activities and processes of value co-creation in KIBS engagement.
IV. Reviewing literature in the domain of knowledge management systems (KMS) so as to understand what they are and identify they can support knowledge processes.

These four complementary reviews serve as a basis for a conceptual framework that explains the linkages between these concepts. The last section of this chapter will present the conceptual framework that guides this research.

2.1. Knowledge-intensive Business Services (KIBS)

Knowledge-intensive business services (KIBS) have received the attention of scholars in literature over the years. These discussions have been motivated by the growing number of firms that provide this kind of services to other organizations (Miles & Miles, 2005), and the contribution of KIBS providers towards the innovation capacity of their client firms (Muller & Doloreux, 2009). In this section, we present different definitions of KIBS from literature, the characteristics that have been identified, and the importance of value co-creation for KIBS engagements.

2.1.1. Definition of KIBS

There is no commonly accepted definition of KIBS (Muller & Doloreux, 2009). However, some descriptions can be found in literature. For example, KIBS can be understood as "*Services that provide knowledge intensive inputs to the business processes of other organizations*" (Miles & Miles, 2005, p.39). They are *"specialised in knowledge intensive services, which means that the core of their service is contribution to the knowledge processes of their clients, and which is reflected in the exceptionally high proportion of experts from different scientific branches in their personnel*" (Toivonen, 2004, p.36). These knowledge intensive services consist of value added activities that include the "*accumulation, creation, or dissemination of knowledge for the purpose of developing a customized service or product solution to satisfy the client needs*" (Bettencourt et al., 2002, p.100). So, therefore, "*they supply intermediate products and services that are knowledge based*" (Muller & Doloreux, 2009, p. 65) to their clients.

Moreover, KIBS scholars have come to agree on the key characteristics of KIBS, summarized as:

Their strong dependence on professional knowledge: This characteristic means that KIBS are highly reliant on domain and expert knowledge. This knowledge mostly has an intellectual/tacit nature (Hertog, 2000; Miles et al., 1995; Muller & Doloreux, 2009).

Their supply of knowledge-based products and services: This characteristic means that KIBS deliver services and products to their client. These services will either generate knowledge directly for clients or indirectly contribute to the knowledge of client's activities and processes (Hertog, 2000; Miles et al., 1995; Muller & Doloreux, 2009).

Their major client base are other businesses: This characteristic means that KIBS services are of competitive importance, and they are usually provided to other businesses (Miles et al., 1995; Muller & Doloreux, 2009).

A list of services that are considered to be KIBS can be found in varied sector-based classifications, in particular NACE (Nomenclature générale des activités économiques dans les Communautés Européennes) (commission, 2010), a general industrial classification of economic activities within European communities, and NAICS (North American Industry classification system) (Canada, 2012). Authors in literature mostly draw from the NACE list (Corrocher et al., 2013; Miles et al., 1995; Miles & Miles, 2005; Muller & Doloreux, 2007, 2009). While the range of type of service providers that can be categorized as KIBS is vast, typical types of KIBS found in the literature include computer and related activities, engineering services, hardware and software consultancy, research and development, and legal activities.

These services can be divided into two types: Traditional professional KIBS (P-KIBS) and new-technology-based-KIBS (T-KIBS) (Miles et al., 1995). P-KIBS are the more traditional professional services that help users navigate complicated systems such as administrative rules

(Miles et al., 1995). Thus, they act more like users of new technology such as legal, accounting, and management services (Muller & Doloreux, 2007). On the other hand, T-KIBS are mostly related to information and communication technology (ICT) as well as other technical activities such as engineering, R&D consulting and other IT related services (Muller & Doloreux, 2007, 2009). They are thus considered to be more involved in the development of the new technology (Miles et al., 1995).

2.1.2. Importance of KIBS

The main importance of KIBS lies in their contribution to their clients' knowledge base and innovation capabilities. KIBS add to and increase the intensity of knowledge in client organizations (Miles et al., 1995). As service providers, KIBS make available their domain knowledge to clients; indeed, clients might not have the capability to deploy the knowledge, they may be too busy with job functions from other business processes, or they may consider that the best way to obtain the solution they require is through external consultation (Miles & Miles, 2012). Irrespective of why KIBS services are used, there is an intention of building upon or developing new knowledge for organizations. KIBS are referred to as "knowledge angels" because knowledge is one of the core assets they provide; they also have the capability of perceiving what knowledge is required, most relevant, and applicable to an organizational setting (Muller et al., 2012).

Alongside their knowledge-development role, KIBS contribute importantly to their clients' and economy's innovation. Initially, KIBS were just seen to accompany and help support their client to achieve innovation and not to be innovators themselves (Muller & Doloreux, 2009). Thus, KIBS were seen to be facilitators and carriers of innovation (Hertog, 2000; Miles et al., 1995). As *facilitators*, KIBS were seen to support clients with their innovation processes and the

innovation itself did not come from the KIBS provider but the client (Hertog, 2000). KIBS are deployed to provide the knowledge processing competencies that are required for innovation in the client's organization (Gallouj, 2002). As *carriers*, KIBS help transfer existing innovations from one organization to their clients (Di Maria, Grandinetti, & Di Bernardo, 2012).

It was later understood that in as much as KIBS contribute to their clients' innovation processes, they also innovate internally (Gallouj, 2002) and thus are *sources* of innovation (Hertog, 2000; Miles et al., 1995). As a source of innovation, KIBS develop and create innovations (Hertog, 2000). In order to produce innovation, the service provider needs to have comprehensive knowledge of the client's problem, which requires close interaction and relationship with the client organization (Gallouj, 2002; Hertog, 2000). There has, thus, been a shift in understanding of the role of KIBS in innovation, from KIBS as facilitators and carriers of innovation to KIBS as co-producers of innovation (Gallouj, 2002; Muller & Doloreux, 2009).

2.2. Definition of Knowledge

There have been different arguments on the meaning of knowledge. Often, these arguments relate to the distinction between the concepts of data, information, and knowledge (Bhatt, 2001; Zins, 2007), in particular to the perception that knowledge is neither data nor information (Davenport & Prusak, 1998). The term *data* can be seen as simple raw facts representing objects, events, or their properties, which lack clarity in purpose and may be unusable (Ackoff 1999; Bellinger, Castro, & Mills, 2004; Zeleny, 2002). On the other hand, the *information* refers to meaningfully processed data with a clear purpose (Ackoff 1999; Bellinger, Castro, & Mills, 2004; Davenport & Prusak, 1998; Zeleny, 2002). Knowledge refers to the processing and application of data and information (Bellinger, Castro, & Mills, 2004; Zeleny, 2002). Using a more operational definition, "*knowledge 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. It originates and is applied in the mind of the knowers. In organizations, it often becomes embedded not only in documents or repositories but also in organizational routines, processes, practices, and norms (Davenport & Prusak, 1998 p.5)." Therefore, unlike data and information, knowledge relates more to the personal and acquired experiences of humans that increases their ability to take effective actions (Alavi, 2001; Nonaka, 1994).

In organizations, knowledge can take a tacit or explicit form (Nonaka, 1994). Tacit knowledge is more cognitive and technical, whereas explicit knowledge is more articulate and codified (Nonaka, 1994; Popadiuk & Choo, 2006). In a more technical discipline, knowledge could either be declarative or procedural (Kogut & Zander, 1992). Declarative knowledge describes a more static state of knowledge referred to as *knowledge stock* while procedural knowledge describes knowledge as a process referred to as *knowledge flow* (Rao, 2005). Similarly, knowledge can be viewed as an object or as a process (Alavi, 2001). According to Blackler, (1995), knowledge in knowledge intensive firms specifically, can either be 1) *embrained (know that)* - knowledge that depends on cognitive and conceptual skills, 2) *embodied (know how)* - knowledge that is action oriented, thus, practical and problem-solving knowledge, 3) *encultured* – knowledge achieved through shared understanding which depends on language and culture, 4) *embedded* – knowledge which is encompassed within standard organizational routines and competencies, or 5) *encoded* – knowledge that is revealed through signs and symbols such as books, manuals, etc. Since knowledge-intensive business services (KIBS) aim at contributing to the development of knowledge and innovation in their client's organization, there is a higher possibility of having the embrained and embodied type of knowledge. However, the idea of viewing knowledge as an

object or stock for knowledge workers' has received criticism because, here, the value of knowledge is seen with respect to it's form rather than it's content (Erik, 2007). Such criticisms has resulted to alternative approach of the view of knowledge for knowledge workers. Specifically, knowledge should be viewed as a process or flow (Erik, 2007). This study hereby focuses on the processing of knowledge as it happens in knowledge-intensive business services (KIBS) engagements.

2.3. Knowledge processes and KIBS

Knowledge is one of the key dimensions of knowledge-intensive business services (KIBS) (Muller & Doloreux, 2007). There is a variety of knowledge across KIBS skill bases which is constantly updated through the peculiarities of the task they undertake (Consoli & Elche-Hortelano, 2010). Such peculiarities contribute to a dynamic knowledge set which distinguishes KIBS firms from other routine and standardized professional service organization like professional cleaning services; the constant evolution of their knowledge base also determines the ability of KIBS providers to generate and implement new ideas (Toivonen, 2004). KIBS organizations comprise of value-adding activities such as the accumulation, creation, and dissemination of knowledge. These activities can lead to the co-creation of innovative products for clients (Bettencourt et al., 2002). Also, through these activities, KIBS can provide knowledge processing competencies which are needed for their client innovation project (Gallouj, 2002). Such competencies cater for the forms of knowledge (tacit and explicit) during knowledge activities in KIBS engagements. These are – *basic logistical, externalization, internalization, generalization, localization, association and dissociation*.

Previous research has thus recognized the importance of knowledge to KIBS and their clients, making knowledge processes vital for KIBS as a research domain. In the remainder of this

section, we will review literature on KIBS-specific knowledge processes. We will then discuss the similarities and differences between these processes and more general knowledge processes as they are presented in literature.

2.3.1. KIBS-specific knowledge processes

Knowledge processes in KIBS involve the integration of external knowledge, the acquisition of knowledge pertaining to a specific problem and needs of the client; and, the organizing, understanding, interpretation and combination of that knowledge to produce a solution for the client; and the application of newly generated knowledge (Hakanen, 2014; Muller & Zenker, 2001; Strambach, 2001). Through a constant interaction process, knowledge processes can help KIBS identify critical points in the client firm and develop feasible solutions for their client business development (Hakanen, 2014). They can also facilitate the co-creation of ideas and solutions in an engagement (Bettencourt et al., 2002; Hakanen, 2014).

Four KIBS-specific knowledge processes have been identified in literature: knowledge acquisition, knowledge recombination, knowledge application and knowledge sharing. We will now present these processes and explain why we choose to integrate the fourth process, knowledge sharing, within the processes of knowledge acquisition and knowledge application. We will also explain what these knowledge processes are and how they are different from more generic ones.

2.3.1.1. Knowledge acquisition

Knowledge acquisition refers to the process of acquiring external knowledge needed for solving the client's problem in KIBS engagements (Hakanen, 2014). For example, knowledge about the clients requirements or proposed solution. During this process, a series of activities and

interactions take place with the client. By interacting with their client firms, KIBS learn about their problems and attempts to provide a solution (Muller & Zenker, 2001). KIBS providers hence acquire tacit and explicit knowledge that enable them to develop innovative solutions to meet their clients' requirements (Strambach, 2001). The acquisition of knowledge is a primary exercise for KIBS as it can lead to the co-conceptualization and co-creation of the solution with the client (Hakanen, 2014). Since the consumption of knowledge brings about new knowledge, the process of acquiring knowledge during KIBS engagements will lead to the generation and production of new knowledge (Muller & Zenker, 2001; Strambach, 2001).

2.3.1.2. Knowledge recombination

Knowledge recombination also referred to as knowledge assimilation, can be defined as a process that involves analyzing, understanding, interpreting, and integrating knowledge acquired from external sources and different knowledge fields in order to create new innovative knowledge for the client (Strambach, 2001). This newly generated knowledge can either be of a technological or managerial nature, and results from the combination of the core skills and competencies of providers, clients, and their partners taking in the engagement (Hakanen, 2014; Muller & Zenker, 2001; Strambach, 2001).

Beyond combining knowledge that was previously acquired, knowledge recombination also involves converting tacit knowledge into explicit knowledge (Muller & Zenker, 2001). Tacit knowledge obtained during the knowledge acquisition process can be interpreted, better understood and made explicit between the KIBS provider, its client and other actors involved in the engagement through constant interaction during the process of jointly creating a solution (Hakanen, 2014). The knowledge recombination process thus provides an opportunity for the

service provider and its partners to team up, collaborate and join their different fields of knowledge in order to solve problems for clients (Hakanen, 2014; Strambach, 2001). KIBS professionals will also gain more skills and competence from the newly generated knowledge which can improve the knowledge base of KIBS organizations (Muller & Zenker, 2001).

2.3.1.3. Knowledge application

Knowledge application, also referred to as knowledge diffusion in literature, refers to the process of applying new or improved service to the client firm (Muller & Zenker, 2001). During this process, knowledge is used for commercial purposes (Hakanen, 2014) by adapting and integrating innovative solutions according to the specific requirement of the client, which leads to the transfer of knowledge within the client firm structure (Strambach, 2001). Therefore, knowledge application is said to encompass the process of knowledge transfer from KIBS provider to their client (Muller & Zenker, 2001). The knowledge application process involves interacting with the client, which can also improve the knowledge bases of KIBS through the process of learning; this can in turn open up opportunities for having new interactions and long-term relationships with the client (Muller & Zenker, 2001; Strambach, 2001). Also, clients are provided with solutions or other deliverables that can be utilized for the creation of value in their organization (Hakanen, 2014).

2.3.1.4. Knowledge sharing

Knowledge sharing is another knowledge process that has been discussed in KIBS literature. Since knowledge is a key resource for KIBS (Ordanini & Pasini, 2008), the creation of an environment that supports the sharing of knowledge for actors during a KIBS engagement is particularly important (Hakanen, 2014). Through the sharing of knowledge, clients can gain

competitive advantage through the network resources of other participating actors (Dyer & Hatch, 2006). Moreover, knowledge sharing can foster the acquisition of more tacit knowledge such as technical skills from other actors (Hertog, 2000). This tacit knowledge can enable service providers to assist the clients in producing innovation (Gallouj, 2002). Thus, knowledge sharing supports KIBS' innovative activities (Sarker et al., 2012).

To better understand what is at play in knowledge sharing, we adopt a more operational definition of this process:

> *"Knowledge sharing is the process of one person (source) (1) deciding to share knowledge (2) remembering a portion of knowledge, (3) explicating it to a contextualized information on a medium, (4) actively or passively transferring it to another person (recipient), which (5) perceives the information and (6) interprets it in the given context so that the knowledge is reconstructed and integrated into the person's knowledge base. (7) Finally, newly acquired knowledge is evaluated by the recipient. (Maier et al., 2009 p.412),"*

This definition shows that knowledge sharing encompasses processes of knowledge acquisition and knowledge application. Firstly, the first four points are a part of the knowledge acquisition process. Here, knowledge sharing includes the willingness and decision of an actor to share and transfer knowledge to another actor. This knowledge could be technical knowledge such as skills and competencies that have been previously acquired (Strambach, 2001). Knowledge is then transferred and received by the recipient who becomes an acquirer of knowledge. The last three points (5,6,7) are comprised within the knowledge application process as it handles the use, integration, and evaluation of new knowledge that could happen through learning (Muller & Zenker, 2001). Taking this definition further, knowledge sharing can also encompass the knowledge recombination process since it allows for constant interaction and sharing of resources between KIBS providers, clients, and other actors when creating a solution (Hakanen, 2014).

For the purpose of this study, we will incorporate knowledge sharing within the processes of knowledge acquisition, knowledge recombination, and knowledge application. Indeed, knowledge sharing takes place within knowledge acquisition initially while knowledge concerning the client's problem and requirements is discovered. Knowledge sharing is then part of knowledge application when new knowledge is generated from application of the solution.

2.3.2. Knowledge management processes in general

This study focuses on KIBS and their related knowledge processes. However, knowledge management processes have been subject to lengthy discussions in academic literature as they relate to a more general context of an organization. Knowledge management processes are said to exist at different levels – individual, group, and organizational (Sabherwal & Becerra-Fernandez, 2003). At an individual level, knowledge could either be tacit or explicit (Alavi & Leidner, 2001; Nonaka, 1994). This knowledge could be converted from one form to another in organizations using knowledge conversion/creation processes - socialization, combination, externalization and internalization (Nonaka, 1991, 1994; Nonaka, Toyama, & Konno, 2000; Nonaka, Umemoto, & Senoo, 1996). To manage this knowledge internally, organizations rely on knowledge management processes (Alavi & Leidner, 2001). They could be grouped into four dimensions: acquisition, conversion, application, and protection (Gold & Arvind Malhotra, 2001). The *acquisition process* is geared towards obtaining new knowledge from the knowledge that is already in existence. The *conversion process* aims at integrating and combining different individual types of knowledge so that they become useful for the organization. The *application process* aims at using and sharing organizations knowledge, and the *protection process* aims at guarding knowledge against illegal and unauthorized use.

2.3.2.1. Difference/similarities between KIBS knowledge processes and general knowledge processes

At the level of processes, general knowledge management processes in section 2.2.2 and knowledge processes in KIBS engagements (see section 2.2.1) appears to be similar. However, there is a slight difference coming from the organizational level at which they function. While general knowledge processes handle knowledge within organizations, knowledge processes in KIBS, account for complex cross-organizational interactions. This type of interactions is based on the high number of alliances that are involved in knowledge intensive industry (Ciborra & Andreu, 2001). Knowledge-intensive firms such as KIBS often include networks of firms which make up a more complex form of learning among participating actors (Ciborra & Andreu, 2001). A high degree of interaction takes place between the client, provider and network actors (Hakanen, 2014). Therefore, knowledge is not easily produced and captured with the boundaries of a certain firm, and knowledge will need to be shared, combined and transferred from different dispersed sources (Ciborra & Andreu, 2001). KIBS specific knowledge processes do handle the interactions that take place between different participating actors organizations. For example, knowledge acquisition in KIBS engagements accounts for the acquisition of knowledge across the service provider and client organizations (Muller & Zenker, 2001).

2.4. Value co-creation

Knowledge is a key resource for KIBS in the co-creation of value. When solutions are co-created in KIBS engagements, knowledge is seen to be the most important resource that actors contribute and use (Hakanen, 2014). Also, knowledge is a key resource for KIBS, especially when

developing innovation. The development of different forms of innovation by KIBS also requires the use of different knowledge resources (Amara et al., 2009). These knowledge resources need to be jointly provided by the service provider and when a solution is developed for the client (Ordanini & Pasini, 2008). The joint contribution of resources is among other activities that are required to collaborative create value among actors (Lessard, 2014). Thus, there are commonalities between these two concepts.

One of the underlying concepts of value co-creation is that value cannot be created by the contribution of a single actor – client or provider, but emerges from collaborative work among several actors (Ramirez, 1999). The principle of value co-creation draws from the marketing principle of Service-Dominant logic, which states that clients are not just passive actors in the delivery of services but active collaborators and co-creators of value (Payne et al., 2008). From this perspective, providers are required to collaborate jointly, work, and learn from their clients for value to be derived (Vargo & Lusch, 2004). This principle resides in the understanding that it is the beneficiary of a service that determines its value (Vargo, Maglio, & Akaka, 2008). Thus, providers only have the ability to add value, and will also require resources (e.g. knowledge and competencies) from clients to be applied before the value is co-created and determined (Vargo et al., 2008). This principle has a contrary view Goods-Dominant Logic, a predecessor principle in marketing (Ramirez, 1999; Vargo et al., 2008). Service are thus, defined as the application of competencies, knowledge, and skills for the benefit of another actor (Lusch et al., 2008; Maglio & Spohrer, 2008; Vargo & Lusch, 2004). Service then rely on the contributions and collaborative creation of value by all actors involved, including providers and clients (Maglio & Spohrer, 2008).

This process, where the active collaboration and involvement of clients, providers, and partners is required to determine and create value, is referred to as value co-creation (VCC) (Vargo & Lusch, 2004). For value co-creation, the co-creation experience depends on the collaborative level of the engagement, and there is hardly a clear distinction between the roles of actors (Ramirez, 1999). The co-creation of value helps providers to better understand their clients requirements, enabling the development of solutions that are well adjusted to their needs (Payne et al., 2008).While the concept of value co-creation has been developed for services, in general, we will now turn to literature discussing value co-creation in the specific context of KIBS.

2.4.1. Value co-creation in KIBS

Previous research has shown that value co-creation has specific characteristics in the context of KIBS engagements. Service relationship of KIBS are considered to be more relational than transactional (Briggs & Grisaffe, 2010). The relational nature of KIBS services points to the possibility that the way value co-creation happens in KIBS differs from other services. For example, activities such as the participation of clients in the co-production of solutions, which are considered as optional in value co-creation literature (Vargo & Lusch, 2008), have been shown to be necessary for KIBS engagements (Bettencourt et al., 2002; Ordanini & Pasini, 2008).

Value co-creation as a whole is dependent on the intensity of collaboration that takes place in a specific KIBS engagement – synergistic, addiction, exchange (Lempinen & Rajala, 2014; Sarker et al., 2012). It is as a result of the interaction that take place between providers and clients during the collaborative joint problem-solving process for the client (Aarikka-Stenroos & Jaakkola, 2012). This joint problem-solving process consists of a series of activities that make up the value co-creation process. The value co-creation processes are summarized into three major

processes – aligning, actualizing and integrating (Lessard, 2014; Stucky et al., 2011). Consequently, from the review of empirical research on value co-creation within KIBS engagements, we find that value co-creation has certain enablers whose presence or absence affect the processes of value co-creation (Lempinen & Rajala, 2014; Natti & Ojasalo, 2008; Nätti & Still, 2007; Ordanini & Pasini, 2008; Sarker et al., 2012; Smals & Smits, 2012). One of such enablers is knowledge processes (Muller & Zenker, 2001; Nätti & Still, 2007; Ordanini & Pasini, 2008; Powell & Swart, 2010). It is, therefore, important that we review this processes the so as to better understand how they can be supported by knowledge processes. In the rest of the section, we discuss the individual processes and the specific activities within these processes.

2.4.1.1. Aligning

The process of aligning takes place at the beginning of KIBS engagement. It involves interactions and negotiations between the mechanisms of: *developing high-level interests, perceiving benefits, creating value propositions, organizing resources, and articulating deliverables,* which, when successful, lead to the commitment of actors to a KIBS engagement (Lessard, 2014). Before service provider, clients and partners come into a new relationship, they have certain high-level interests which are beyond the engagement (Lessard, 2014; Lempinen & Rajala, 2014}. Based on the value propositions offered by the actors (Aarikka-Stenroos & Jaakkola, 2012), expected benefits from the engagement are perceived (Lessard, 2014). These value propositions also influence the resources that are organized (Aarikka-Stenroos & Jaakkola, 2012); Lessard, 2014). Expected deliverables are then articulated by all participating actors (Lehrer, Ordanini, DeFillippi, & Miozzo, 2012; Lessard, 2014). Actors commit to the engagement once alignment is successful (Lessard, 2014). This commitment marks the beginning of the actualization of the engagement. However, there are possibilities of changes

which could lead to a re-alignment of some mechanisms in the engagement, thus leading to a feedback to the aligning process (Lessard, 2014; Stucky, Cefkin, Rankin, Shaw, & Thomas, 2011).

2.4.1.2. Actualizing

Actualizing is the stage where actors deliver service (Stucky et al., 2011). It involves activities and interactions of mechanisms (*co-production of deliverables, implementing solutions, organizing resources*) that will lead to the generation of the solution, and the achievement of propositions that were made at the aligning process (Stucky et al., 2011). Deliverables are co-produced with participating actors (Aarikka-Stenroos & Jaakkola, 2012; Ordanini & Pasini, 2008). During co-production, actors organize required resources such as knowledge, facilities, and skills together (Aarikka-Stenroos & Jaakkola, 2012). Afterward, the co-produced solution is implemented, and it may not include all actors. (Aarikka-Stenroos & Jaakkola, 2012; Ordanini & Pasini, 2008). All actors might not participate in the implementation stage. For example, Service providers might be asked only to deliver the solution, while the client solely implements it (Aarikka-Stenroos & Jaakkola, 2012). However, having high interactions between actors during this stage is seen to be important and necessary (Lehrer et al., 2012). There may be feedbacks to the aligning process during the actualizing process; this feedback could result in a break in commitment from actors (Stucky et al., 2011). However, if the actualizing process is successful, it will lead to expected outcomes such as deliverables or strong relationships that will need to be further integrated so that value can be realized (Lessard, 2014).

2.4.1.3. Integrating

Value can only be determined and co-created after the outcomes of the actualizing process are integrated and put to use by actors in the engagement (Aarikka-Stenroos & Jaakkola, 2012; Lessard, 2014; Ordanini & Pasini, 2008; Wilkin, Campbell, Moore, & Van Grembergen, 2013). For example, the deliverables or results of the collaborative process (e.g. learning) are valued to see if it meets the expectations of the actors (Lessard, 2014). If the actor's expectations are fulfilled (Stucky et al., 2011), the deliverables and process results are integrated with new resources for the actors (Ordanini & Pasini, 2008). Also, other resources could be organized when using the new resource (Aarikka-Stenroos & Jaakkola, 2012). After resources have been fully integrated and organized as new resources, value is then determined by the actors. This value could be either direct financial value, indirect financial value, or/and non-monetary value (Aarikka-Stenroos & Jaakkola, 2012; Lempinen & Rajala, 2014; Smals & Smits, 2012; Bettencourt et al., 2002; Chen, Tsou, & Ching, 2011; Sarker et al., 2012; Suh, Jung, & Smith, 2012; Smals & Smits, 2012).

2.5. Knowledge Management systems

From the review of literature in the previous sections, we have seen that value co-creation processes are important for KIBS engagements, knowledge is a key resource for value co-creation and that knowledge processes are vital for KIBS engagements. Going further, One way of supporting knowledge processes in organizations is through the use of information and communication technologies specifically knowledge management systems (KMS) (Alavi & Leidner, 2001). Knowledge management systems consist of KM tools that are designed to assist knowledge intensive processes (Carlsson, 2003; Detlor, 2002; Maier, 2007). They do this by acting as enablers to the management of knowledge in organizations (Carlsson, 2003). In the

remaining section, we will discuss knowledge management systems (KMS), their classes, and how they support knowledge processes.

2.5.1. Definition of Knowledge management systems (KMS)

Knowledge management systems (KMS) are designed to support knowledge processes in an organization (Maier et al., 2009). A seminal definition of KMS defines these systems as "*a class of information systems that are applied to managing organizational knowledge. These systems are IT applications to support and enhance the organizational processes of knowledge creation, storage, and retrieval, transfer and application*" (Alavi & Leidner, 2001). They consist of tools that assist the organization in practicing knowledge management (Gallupe, 2001), thus helping the organization to become more competitive (Carlsson, 2003). KMS are also defined as information and communication systems designed to support the smooth flow of knowledge (Maier et al., 2009). Based on these functionalities, they have been classified into different classes. In the next section, we will present the different classes of knowledge management systems

2.5.2. Classes of knowledge management systems

Knowledge management systems have been classified in different ways. They have been classified according to the knowledge process(es) they support using the tacit to explicit knowledge transformation framework developed by Nonaka (Marwick, 2001). They have also been classified according to their core functions from literature (Maier, 2007, 2009). For this study, we will focus on the classifications of KM tools as regards to their functions. Particularly, we adopt the classification based on (Maier, 2007, 2009), because it provides a more direct linkages between KM tools and knowledge processes as presented in the conceptual framework (see Appendix 2).

Knowledge management systems are solutions that consists of integrated functions that are carried out by different KM tools (Maier, 2007; Maier et al., 2009). Therefore, this study will focus on how each knowledge management tools (KM tools) can provide support to knowledge processes in KIBS engagement. These KM tools can be classified according to their functions, grouped into two classes: *basic KM tools* and *advanced KM tools* (Maier, 2007; Maier et al., 2009). Also, knowing that not all KM tools are computer-based, a third class of functions, can be referred to as *non-ICT means* (Maier et al., 2009). Examples of tools in each category include communication systems, data access tools, presentation tools, document management systems, content management systems, workflow management systems and search tools for basic functions; knowledge discovery and mapping tools, meta-search systems, collaboration tools, visualization systems, community builder, push oriented systems, enterprise knowledge portals, e-learning platform, and knowledge repositories for advanced functions, and meetings, workshops and debrief, phone calls, and documents and reports for non-ICT functions. Each KM tool is defined and explained in more details in Appendix 1.

In the next section, we present a conceptual framework that shows the relationships among KM tools, knowledge processes, and value co-creation processes in KIBS engagements. These relationships conceptualized from literature will be empirically verified through a multiple case study, the results of which are presented in Chapter 4.

2.6. Introduction to conceptual framework

The guiding conceptual framework helps to conceptualize how KM tools support value co-creation processes for knowledge intensive business service (KIBS) engagements. It is derived from the concepts of KM tools, knowledge processes, and value co-creation (VCC) processes presented in the previous section. The framework integrates these concepts and offers a

conceptualization of the linkages between them. Figure 2.1 presents a visual illustration of the framework.

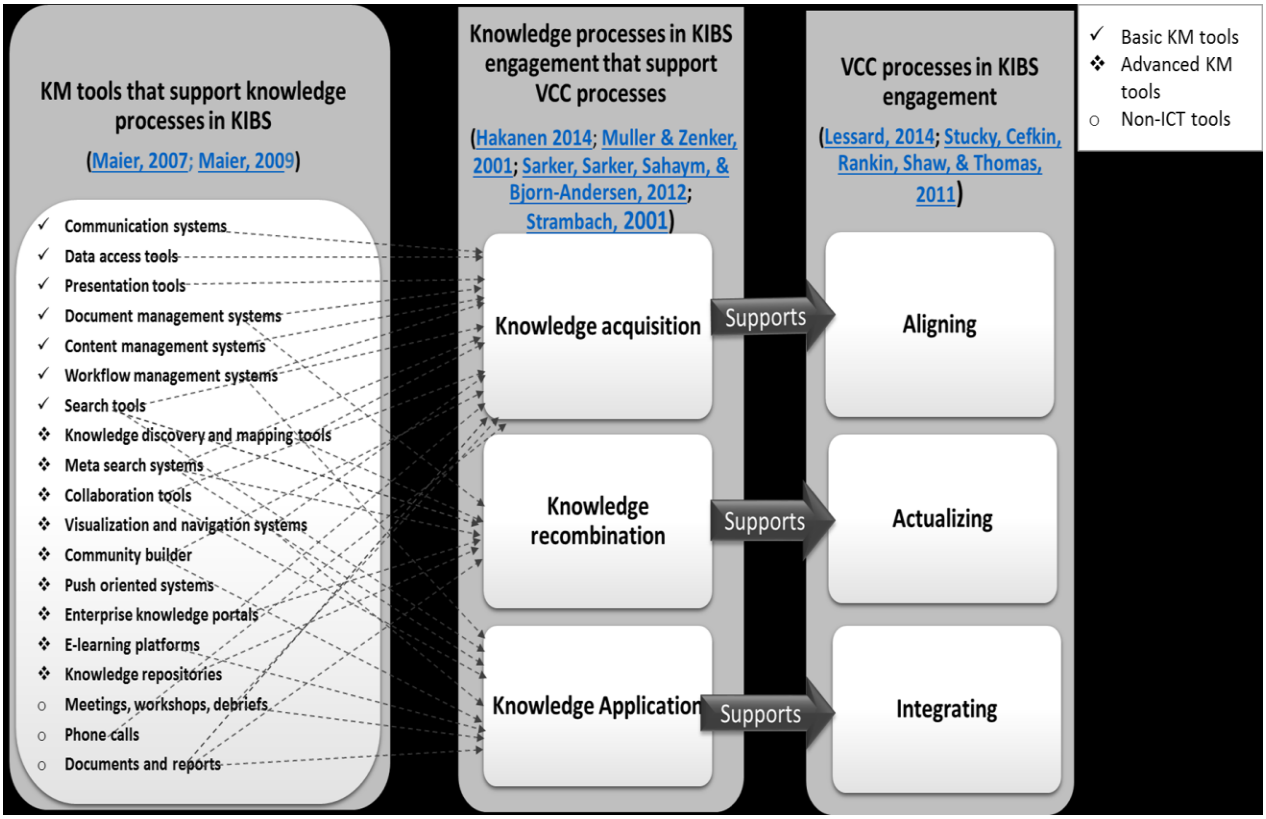

Figure 1: Framework for knowledge management system support for value co-creation

Generally, value co-creation processes in KIBS engagements describe the activities that take place for value to be collaboratively created by actors in an engagement. Knowledge processes consist of knowledge activities that occur within KIBS engagements KM tools are used to aid the management of knowledge within and across organizations. Overall, the framework shows us that KM tools can support value co-creation by providing support to knowledge processes. The explanation of the links are presented in the following sections

2.6.1. Explaining of the linkage of value co-creation processes to knowledge processes

Knowledge processes particularly facilitate and enhance the co-creation of value for actors that participate in knowledge intensive business service (KIBS) engagements (Fosstenløkken, Løwendahl, & Revang, 2003). They are key resources that are important for the collaborative production and creation of value during these engagements (Ordanini & Pasini, 2008). This is because interactive knowledge development during an engagement facilitates learning among actors (Fosstenløkken et al., 2003) and the degree of interactions are an important component for the production of innovation (Gallouj, 2002). Thus, knowledge processes have a relationship to value co-creation processes that can further lead to innovative activities. The conceptual framework developed in this chapter depicts a relationship among the processes i.e. knowledge processes and value co-creation processes.

First, we conceptualize that the ***knowledge acquisition process supports the aligning process within value co-creation.*** Indeed, as explained in Section 2.2.1.1, knowledge acquisition happens at the beginning of an engagement when there are initial negotiations and questions about the clients' requirements and the solutions that actors can create (Hakanen, 2014; Muller & Zenker, 2001). Thus, we conceptualize that based on the knowledge acquired, actors will be able to align their value propositions with respect to the *high-level interest* and *perceived benefits* of other actors. The knowledge acquired could also enable actors to identify the resources that are required to be organized for the engagement, thus, supporting the activity *organizing resources*. Also, knowledge acquisition helps actors to collaboratively design expected deliverables with their clients (Hakanen, 2014). This is also a part of the aligning process (*articulating deliverables*).

Second, we take the ***knowledge recombination process to support the actualizing process within value co-creation.*** As explained in section 2.2.1.2 knowledge recombination involves analyzing, understanding, interpreting, and integrating knowledge that has been acquired from external sources and different knowledge fields with the core skills and competencies of KIBS providers and other actors (Hakanen, 2014; Muller & Zenker, 2001). The objective is to create new innovative knowledge. This process requires the client and other actors to work together to create the solution. Since the *co-production of deliverable* activity, as explained in Section 2.3.1.2, is a part of the actualizing process, we conceptualize a relationship between these two processes.

Third, we conceptualize that the ***knowledge application process supports the integrating process within value co-creation.*** Knowledge application, as explained in Section 2.2.1.3, involves the application of new knowledge as new improved services from the service provider to the client organization (Muller & Zenker, 2001), or among other actors since value co-creation can involve third-party collaborators as well (Lessard, 2014). Knowledge application makes it possible for actors to provide feedbacks to other actors and also learn new knowledge from the process, an activity that is critical for value co-creation (Sarker et al., 2012). Thus, conceptually actors can carry out a valuation of the engagement's deliverables and collaborative process (Lessard, 2014), and possibly integrate the new knowledge learned as new resources; this suggests that knowledge application can support the integration of value.

2.6.2. Explaining of the linkage between KM tools and knowledge processes

As presented in Section 2.4, KM tools can be classified into three different classes: basic KM tools, advanced KM tools, and Non-ICT means. Previous studies also explain that knowledge management systems are enablers for knowledge processes (Carlsson, 2003). From the study of

literature, we have inferred the relationship between each knowledge management tool and the knowledge processes that they support. The first class of KM tools are taken to provide support to the knowledge acquisition process. For example, the linkage between communication systems and knowledge acquisition process is justified through their ability to support the sharing and exchange of knowledge among actors (Alavi & Leidner, 2001; Jarrahi & Sawyer, 2013). Most advanced KM tools are seen to support the knowledge acquisition and/or the knowledge application processes. For example, collaboration tools can enable actors to both develop and apply knowledge together (Maier et al., 2009). Most non-ICT means support the knowledge acquisition. For example, face-to-face meetings enable the sharing of explicit and tacit between actors (Alavi & Leidner, 2001; Maier et al., 2009). These linkages are summarized in Table 2.1and described in more details in Appendix 2.

Table 2-1: Linkage between KM tools and knowledge processes from derived literature

	KM Tools (Maier, 2007; Maier et al., 2009)	**Knowledge processes supported**
Basic KM tools	Communication systems	KA
	Data access tools	KA
	Presentation tools	KA
	Document management tools	KA, KR
	Content management systems	KA
	workflow management systems	KR
	search tools	KA, KR, KAP
Advanced KM tools	Knowledge discovery and mapping tools	KR
	Meta-search systems	KA, KR, KAP
	Collaboration tools	KA, KAP
	Visualization systems	KA
	Community Builder	KA
	Push oriented systems	KAP
	Enterprise knowledge portals	KA
	E-learning platform	KAP
	Knowledge repositories	KA, KR
Non-ICT means	Meetings, workshops, debrief	KA, KAP
	Phone calls	KA
	Documents and reports	KA, KR, KAP

2.7. Chapter summary

In this chapter, we reviewed the key concepts that are related to this study: knowledge intensive business services; knowledge processes; value co-creation processes; and, knowledge management systems and their associated classes of knowledge management tools. We also developed a framework that conceptualizes how knowledge management systems can provide support to value co-creation processes in KIBS engagements. Specifically, we established linkages between knowledge processes and value co-creation processes, and between knowledge management tools and knowledge processes. The next chapter will explain the methods we took to validate this framework.

3. Research Methods

The previous chapter reviewed literature on knowledge intensive business services, knowledge processes in KIBS, value co-creation processes and knowledge management systems. We also introduced a conceptual framework on how knowledge management system can provide support to value co-creation processes in KIBS engagements. This chapter presents the research methods used to answer the research questions of this study. As a reminder, the research question and sub-questions are:

1. How do knowledge management systems support value co-creation (VCC) in knowledge-intensive business services (KIBS) engagements?
    a. What knowledge processes are present to support value co-creation in KIBS engagements and what is their relationship to value co-creation processes?
    b. What KM tools are available to support knowledge processes for value co-creation in KIBS engagements?

The rest of this section is structured as follows: First, we discuss the overall research design guiding the research activities of this study, Next, we present the research activities, and finally, we conclude with how the findings were validated.

3.1. Overall research design

Overall, we adopt a case study research design (Yin, 2002). Case study research is generally used to carry out a thorough investigation of a certain situation or event based on particular contexts and processes in a real life situation (Johnston, Leach, & Liu, 1999; Yin, 2002). This research design, therefore, enables us to better understand these situations and events (Yin, 2002). In addition, case studies are useful where there is an intention to confirm or falsify a

certain theory (Yin, 2002). However, such situations require the development of a strong theoretical background (Johnston et al., 1999).

Given that there is no existing framework that specifically links the concepts presented in our conceptual framework, we developed an initial theoretical foundation from the review of literature on how knowledge management systems can provide support to value co-creation processes. This conceptual framework proposes specific relationships between the concepts of knowledge management systems, knowledge processes and value co-creation processes particularly in the context of KIBS engagements (see Chapter 2, Section 2.5). Going further, we intend to test the validity of these propositions. Since case studies are well suited for confirming or disconfirming theory (Johnston et al., 1999), we adopt this research design to validate our framework empirically. In addition, the overall research question of this study focuses on discovering how knowledge management systems provide support to value co-creation processes. For such "how" questions, a case study research design is seen to be more appropriate than other methods such as surveys; our goal is to develop certain propositions on the relationship between the concepts (through the framework) (Yin, 2002).

Given that the way KIBS innovate varies from context to context, we adopted a **multiple case study design** in order to increase the generalizability of the results of this study (Yin, 2002). Our empirical study can thus be understood through the following characteristics:

- **Case**: Multiple case designs provide more substantial analytical benefits compared to single case studies (Yin, 2002). This study adopts a multiple case design in order to arrive at a more robust conclusion. This study, therefore, adopts a multiple case design, where the overall case is defined as "a case study of knowledge management tools for the support of value co-creation in KIBS engagement".

- **Context**: The case study research design analyzes contextual conditions in relation to the case (Yin, 2002). For this study, we choose two contexts based on how KIBS are generally distinguished: "traditional professional services" **(P-KIBS)** and "new-technology based services" **(T-KIBS)** (Miles et al., 1995; Miles & Miles, 2005; Muller & Doloreux, 2009). This aimed at gathering both comparable data within contexts and contrasting data across contexts, which could highlight differences between the use of KM tools in each context.
- **Unit of Analysis**. The unit of analysis is the level being addressed by the main study questions (Yin, 2002). Since the objective of this research is to study the use of KM tools within KIBS engagements, the unit of analysis are the individual KIBS engagements. Thus, each case has one unit of analysis. Figure 3.1 illustrates our research design. N.B.: Each case is represented by a "c".

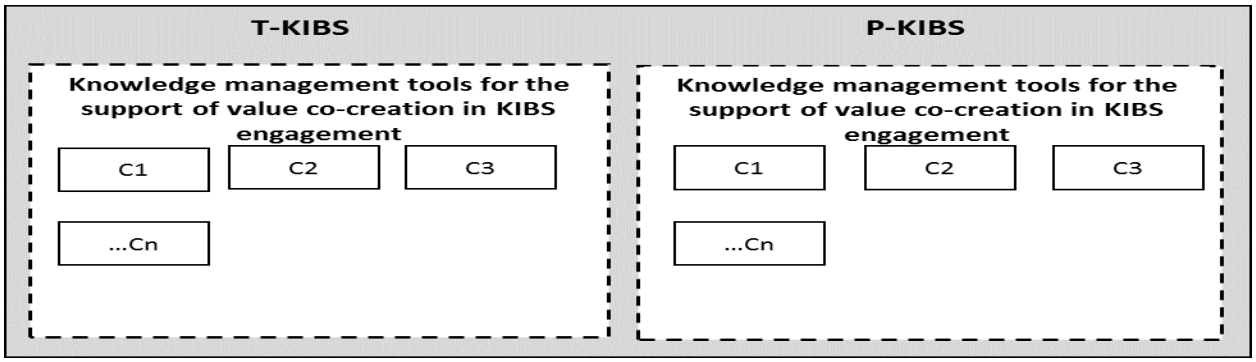

Figure 2: Thesis case study design (RQ1) (Adapted from page 46 (Yin, 2002))

While case study research can be undertaken using varied data collection and analysis methods (Yin, 2002), this study uses qualitative data collection and analysis techniques (Miles & Huberman, 1994). Qualitative data analysis methods are well known for testing and validating hypothesis (Miles & Huberman, 1994). Since the major objective of collecting data during this study is to validate the linkages between concepts in our initial framework, we find that qualitative data collection and analysis methods are appropriate for this study.

3.2. Research activities

In this section, we present the research activities that were carried out during this study. We present them in a sequential manner, and they are composed of activities starting from the specific research design and conceptualization; data collection; coding; data analysis; drawing and validating conclusions; and, reporting the result (Miles & Huberman, 1994). Table 3.1 summarizes these activities. The first step towards multiple case study design should include the development of theory (Yin, 2002) which we have explained in chapter 2 (see Chapter 2, Section 2.5). Following next is a series of activities to test and validate the theory. We describe these activities (see Table 3.1) in detail in Sections 3.2.2 to 3.3.5.

Figure 3: Summary of research design activities

No	Steps	Application
1.	Develop conceptual framework	• A conceptual framework linking the concepts of KM tools, knowledge processes for KIBS engagements and value co-creation processes for KIBS engagement was developed from literature (see Chapter 2, Section 2.5)
2.	Define Research Design	• The overall research design is a multiple case study design. • The case is "A case study of knowledge management tools for the support of value co-creation in KIBS engagement". • The two contexts are T-KIBS and P-KIBS. • The unit of analysis is the KIBS engagement.
3.	Participants	Eight research participants (KIBS professionals) were recruited based on their involvement in establishing and monitoring KIBS engagements.
4.	Data Collection	• Data was collected from participants i.e. KIBS professionals using semi-structured interviews. Eight semi-structured interviews were conducted. • Each interview session was conducted with one KIBS professional from a KIBS provider organization. • An interview protocol was used across all eight cases • Each interview lasted for 45 to 90 minutes.

5.	Data Analysis	All cases were coded using paper codes, Transana software and Microsoft Excel. Descriptive codes deduced from the conceptual framework were used Data was analyzed in three steps: 1. Checklist matrices. There were eight checklist matrices, one for each case. 2. Meta-matrices. Meta-matrices were developed to do an overall analysis across cases. We used the partially-ordered meta-matrix. 3. Variable properties-oriented matrices. They were used to analyze relationships variables properties.
6.	Validate the results of the findings	• Findings were validated using objectivity, reliability, internal, external and application validation

3.2.1. Participants

We aimed to recruit research participants across different types of KIBS so as to increase generalizability: either traditional professional KIBS (experts that belong to certain professions e.g. accountancy) or technological-oriented KIBS (experts that belong to technological professions such as engineering) (Muller & Doloreux, 2009). However, during the recruitment process, we found that a number of engagements fit within both categories (i.e. T-KIBS and P-KIBS). In other words, the participants in these cases, belonged to the information management consultants profession and assisted in both the redesign/implemention of IT, as well as the provision of managerial support to users.

We recruited eight participants in total; our data set comprised of three cases from T-KIBS contexts, one case from a P-KIBS context, and four cases that fell within both categories. Participants were recruited based on their involvement in establishing and monitoring KIBS engagements, for example, project managers, or client consultants. While KIBS engagements often involve various stakeholders, interviews were limited to participants in KIBS provider organizations since they mostly orchestrated the relationships and had a broad knowledge of the events that took place during the engagement.

3.2.2. Data collection

First, it is important to note that this study is a part of a larger research project with the objective of developing modeling requirements for value co-creation processes. Knowing that knowledge processes are key enablers for value co-creation (Hakanen, 2014), this study focuses particularly on knowledge processes for value co-creation and the knowledge management systems that could support these processes. Data was thus collected for this study as part of data gathering for the larger research project. This enabled us to better understand the concepts of this study (knowledge processes, knowledge management systems) in relation to that of the larger research project (value co-creation). The larger research project focused specifically on value co-creation processes while this study focuses on knowledge processes and knowledge management systems. In order to ensure that collected data could answer the research questions of this study, each participant was asked questions related specifically to knowledge processes and knowledge management tools in addition to questions related to value co-creation. Moreover, the analysis of data was carried out independently for this study and for the larger research project. An ethics approval letter for the collection of data was obtained from the University of Ottawa Ethics Board (see Appendix 3). In the rest of this section, we present the methods we used to collect data.

Conceptual frameworks and research questions are good guards against data overload (Miles & Huberman, 1994). As mentioned earlier, our data collection was guided by the initial framework we developed. We asked questions that aimed at validating the conceptual framework. Data were gathered through the conduct of semi-structured interviews. Each interview session was conducted with one KIBS professional from a KIBS provider organization. A standard research protocol was used for each interview in order to compare data across cases (Miles & Huberman,

1994). The full protocol can be found in Appendix 4. However, this study focuses only on questions pertaining to knowledge processes and KM tools within the protocol. These questions were generated from the conceptual framework presented in Chapter 2. An initial mock interview session was carried out at the beginning of the data collection stage to identify possible problems in the simulation protocol. In addition, a test analysis of the mock data was performed. Afterward, we systematically used the simulation protocol to collect data from every participant in each case.

Each participant interview lasted between 45 and 90 minutes. Sessions were recorded based on consent obtained from the participant. In addition, written notes were taken during each session. There were four main activities during the session. First, participants were asked to recall a recent KIBS engagement in which they had participated. Second, participants were asked to answer a number of questions about the engagement they had recalled. These questions included those of interest for this study, questions about knowledge processes such as: "What knowledge was acquired during the engagement" and "who acquired the knowledge and what kind of knowledge was obtained". We also included questions about KM tools such as: "Were there any KM tool used during knowledge recombination? If yes, what particular tools were used?". Finally, participants were asked to discuss the possible insights that they could gain from using the framework developed for the larger study, which includes knowledge process components (see Appendix 4).

3.2.3. Data Analysis

The analysis of our data started with the development of a coding scheme (see Appendix 5). The coding scheme utilized "Descriptive codes" (master code and some sub-codes) (Miles & Huberman, 1994). The codes were deductively developed from our conceptual framework

Two levels of coding were carried out for this analysis. At a higher level, Transana software was used to code just the knowledge processes (master codes). Then, individual subcodes (who, what, when, how and impact) were coded for within each knowledge process so as to attribute individual interpretations to the data. Coding was carried out both manually on paper and using an excel spreadsheet. First, coding was carried out on paper, and then the coded data with master codes were applied in Transana software while coded data with sub-codes were transferred to excel. This process ensured a double checking on the coding of the data.

After coding the data, we began to analyze the it using a checklist matrix and meta-matrices (Miles & Huberman, 1994). First, we used **checklist matrices** to analyze the data in each case irrespective of KIBS context. Checklist matrices consist of several components and are used to examine data that is collected from the field about a particularly important variable or a more general area of interest (Miles & Huberman, 1994). Our variables are the knowledge processes and each checklist matrix contained properties on: who participated in the process, what type of knowledge was involved in the process, when the knowledge process happened, through what means was the process carried out, and the impact of the process. These properties enabled the in-depth understanding of each process. We used the variables (i.e. knowledge processes) as the rows so that we could easily follow the responses of the individual components (who, what, when, how and impact) across the knowledge processes.

After a checklist matrix had been created for each case, we needed to aggregate the data into one big view so as to enable a cross case display of all the data. We, therefore, choose to use a **partially ordered meta-matrix**. A Meta matrix is suitable for putting together descriptive data from several cases in a standard format (Miles & Huberman, 1994). The partially ordered meta-matrix was ordered according to the knowledge processes. Questions to be answered and

validated (who, what, how, when, impact) in the framework were used as corresponding columns. On the other hand, rows were grouped according to variables (knowledge processes) with the data been aggregated by cases. For example, we have knowledge acquisition, and then all the data from every case in knowledge acquisition, and then we repeated the same for knowledge recombination and knowledge application, this resulted in a mega-matrix. Relationships between variables were then observed and compared. Based on this, we created matrices that involved only specific variables properties (variable properties oriented matrices). Matrices were each created for 1) The number of instances of knowledge processes present in KIBS (see Table 4.1), 2) the relationship of knowledge processes to value co-creation processes (see Table 4.2), and 3) KM tools used to support knowledge processes in KIBS engagement (see Table 4.3). A matrix for actors use of tools during knowledge processes in KIBS engagements (see Table 4.4).

The results of our analysis led us to validate the linkages that were originally conceptualized in our framework and provided additional insights and dimension to the framework. This enabled us to answer our research questions on knowledge management systems support for value co-creation processes in KIBS engagements.

3.3. Validation

Validation is important because it helps ensure that we attain quality results and conclusions (Miles & Huberman, 1994). Since this research used qualitative analysis techniques, we adopted the five standards proposed by Miles & Huberman (1994) to justify the result of our analysis. These standards include confirmability, reliability, internal validity, external validity, and utilization. All of these standards except "utilization" were also identified as tests that are used to

establish the quality of empirical research such as case studies (Yin, 2002). In the rest of this section, we present how we meet each validation standard.

3.3.1. Confirmability

This standard aims to ensure that the conclusions derived from the analysis are based on the study participants views rather than researcher's bias (Miles & Huberman, 1994). To address this, we provide a detailed description of how we collected and analyzed the data in this report. We provided example quotes from the data to support the analysis. We also attached copies of the coding scheme and some of the matrices in the Appendices. This documentation gives a complete picture of the data analysis methods that were followed in this study and thus provides the ability for readers to confirm the conclusion of the analysis.

3.3.2. Reliability

Reliability is used to determine if methods are followed in a consistent manner across researchers and methods (Miles & Huberman, 1994). The goal is to ensure that the same conclusions and results will be drawn at if the same procedures are carried out by another researcher (Yin, 2002). To achieve this, an inter-coder reliability check was carried out. A transcript of one of the interview session was coded by two researchers independently using the coding scheme. Afterward, the researchers then compared codes and discussed the matches. Based on these comparisons, coding definitions were clarified and revised. Also, a standard unit of analysis/ codable block of data was agreed on. Following, the second round of coding was carried out by the two researchers interdependently using the newly revised coding scheme. Codes were again compared, and an inter-coder reliability test was calculated using the formulae

$$reliabilty = \frac{number\ of\ agreements}{Total\ number\ of\ agreements + disagreements} \times 100$$

An 89.14% agreement and 10.86% disagreement was obtained from the result of the test. This result was satisfactory, so the coding of the rest of the transcript was carried out (see Appendix 6)

3.3.3. Internal validity

Internal validity is used to determine how reasonable, credible and authentic (true) the conclusion from our analysis are (Miles & Huberman, 1994). We provided context-rich and meaningful descriptions to ensure internal validity. Also, some of the linkages that we made in our framework were supported by empirical data, further supporting the internal validity of our research.

3.3.4. External validity

External validity is used to determine how much the conclusions from the analyzed data can be generalized or transferred to another case or context (Miles & Huberman, 1994). In our study, we addressed this by including cases from different KIBS context. Therefore, since this study involved multiple cases across KIBS context, we addressed generalization and external validity.

3.3.5. Utilization

Utilization is used to determine the practicality of the findings of a particular research for its participants and target customers (Miles & Huberman, 1994). We addressed it by applying the revised framework to an existing commercial knowledge management solution to show its potential use to KIBS professionals and KM tools developers (see Section 5.3.1.1.1 in Chapter 5).

4. Results

The previous chapter discussed the methods we used in carrying out this study, including the overall research design, and our data analysis and collection procedure. In this chapter, we focus on presenting the findings of the study. The results from the cases aim to refine our conceptual framework presented in Chapter 2 by validating the relationships that were conceptualized from literature. As a reminder, our framework shows that the processes of aligning, actualizing, and integrating within value co-creation can be enabled by the knowledge processes of acquisition, recombination, or application respectively. It also shows which knowledge management (KM) tools can support these knowledge processes and, hence, indirectly support value cocreation in knowledge intensive business service (KIBS) engagements.

Overall, our findings presented in Section 4.2.1 confirm our initial framework by showing that the three knowledge processes identified in literature were present during the engagements. However, findings also identify a variance in the degree of presence of each knowledge process.

In section 4.2.2, findings confirm our initial framework as regards the relationships between knowledge processes and value co-creation processes. However, findings also show that knowledge processes relate to more that one value co-creation (VCC) process.

In section 4.2.3, findings extend our initial framework as regards KM tools used to support knowledge process(es). First, findings identify additional knowledge processes that KM tools support. Additionally, our findings provide empirical support to the understanding of what classes of KM tools can be used to support specific knowledge processes. Indeed, findings show that it is mainly basic ICT tools and non-ICT that were used to support knowledge processes in our data set while there was a limited use of advanced tools.

In the section 4.2.4, findings extend our framework by introducing a new actor dimension to the framework. This dimension specifies which type of actors tend to use which KM tools during which knowledge process. Service providers and clients mostly used KM tools during the knowledge acquisition processes. Service providers and partners mostly used KM tools during the knowledge recombination process. Finally, clients and service providers mostly used KM tools during the knowledge application process.

The remainder of this chapter is structured as follows. First we present a summary of each of the engagement that were recalled in each case. Next, we present our results in regards to the research questions that they aim to answer: we present our findings on knowledge processes present within KIBS engagements; the relationship between these knowledge processes and value co-creation processes; KM tools used to support these knowledge processes, and we describe our observations on the use of tools by actors during each knowledge process. Finally, we present the revised framework based on our results.

4.1. Summary of cases

This section provides a summary of all the eight cases of data collected during this study. While we expected to have only cases within either T-KIBS or P-KIBS context, in the fact we actually had three (3) cases within the T-KIBS context, one (1) case within the P-KIBS context and (4) cases that fell within both categories. The four cases that fell within both categories come mainly from the information management services categories (see Section 3.2.1). Noting the difference in organizational settings, stakeholders involved during engagements, and the sectors where each engagement took place, we observed that each individual case was uniquely different and do not fit neatly within one another. Factors such as the particular client problem, the willingness of actors to participate in the engagement, the nature of the client (internal vs. external), and the

sector where the engagement took place (government vs. healthcare vs. R&D) all played a role towards the outcome of the engagement. For example, the needs of client the government sector was more concerned about conformity with standards and policies addressed by P-KIBS such as management consultants. While the needs of the client in the security sector were more concerned with the development of a technological solution secured enough to assist them in carrying out their jobs more effectively. Irrespective of the difference and uniqueness in each case, their perspectives all provided insights into the process of value co-creation within the engagements and the specific role of knowledge processes as well as knowledge management systems. In the remaining part of this section, we briefly summarize each engagement.

4.1.1. Case 1

Case 1 concerns a service engagement between Information technology consultants and their client in the healthcare sector. Here, the agile approach was used for the engagement which involved actors from both the client and service provider organization. This case thus falls within the **T-KIBS context**.

The service provider was brought in to implement and configure the vendor's technology used in business process management in the client organization. The service provider was involved in the personalization of the software for the client and in the finding of solutions to the errors and bugs in the software.

Both actors had a project team and a project manager on each team. Though the intent of the engagement was for both teams to collaborate as a team to implement the solution, the collaboration was unsuccessful because there were problems between the lower management and middle management staffs in the client team. Problem employees in the client team were

removed, but the engagement was terminated because it was not at the expected pace. and the service provider was blamed for the outcome.

4.1.2. Case 2

Case 2 concerns a service engagement between an engineering professor as a service provider and a client in the aerospace industry. The service provider had an interest in granting opportunities for his research where he could involve graduate students, and in finding an industrial partner to collaborate with. The client needed the technical expertise of the professor and his team to develop an innovative solution that could reduce its maintenance costs. Since the development of the solution required the use of advanced technologies, this case falls within the **T-KIBS context**.

He proposed a collaboration with the company that was to be funded by the granting agency. The client agreed, and the engagement was initiated. The service provider and client interacted intensely especially during the initial stages of the engagement so that they could learn about what the provider wanted

The service provider's role was first to solve a technology problem for the client and also to build a prototype for the client. The service provider, coPI, and his students worked together to solve the practical problem of the client. All the actors invested their resources in the engagement. Thus, the first part of the project was completed for the client. The service provider also graduated students and had publications as a result of the engagement. With the result of the engagement being successful, there were plans for future collaborations with the provider.

He proposed a collaboration with the company that was to be funded by the granting agency. The client agreed, and the engagement was initiated. The service provider and client interacted

intensely especially during the initial stages of the engagement so that they could learn about what the provider wanted.

4.1.3. Case 3

Case 3 concerns a service engagement with an internal client and provider in the information management industry. The clients had been having problems retrieving information from the current technology, so they wanted the provider to solve that problem for them. The client section approached the providers to redesign their information management technology. Thus, this case falls within the both **T-KIBS and P-KIBS context**.

The provider was brought in to redesign the client technology. A series of meetings were held to discover the business activities of the client with the service provider developing a mocked up solution. After the clients saw the mocked up solution, the clients gave the provider the permission to proceed with the solution. The provider then implemented the technology for the client. They configured the technology for them, transferred the files from the previous legacy system to the new technology. During the implementation, the organization IT team collaborated with the provider. The provider encountered some challenges during the transfer of files due to certain technical limitations that was not known to them. Since the IT department knew of this limitation, they let the provider know what the problem was because they were on board. At the end of the day, the new technology was implemented for the clients. The providers were also able to see how their technique was applied in the actual case study.

4.1.4. Case 4

Case 4 concerns a service engagement with an internal client and provider in the government security sector. The service provider at the time of the engagement was a temporal employee

with the client's organization. So technically, we will say the client was an internal client. The engagement was about building an information sharing and database system for the organization, thus, this case falls within both **T-KIBS and P-KIBS context**.

The aim of the engagement was for a solution portal to be developed. This solution will link all the databases in every organization unit and will be made accessible to all staffs in the organization which will enable staffs to carry out their task much more efficiently. Another idea of the engagement was to bring every of the organization staff to share information through the shared database system that will be developed. The provider managed the project and worked with several organization units during the engagement. A client team that consists of six executive members of staffs was set up as a representative of all of the other organization staffs. The result is that the solution was developed for the organization and also implemented. The client process was improved, and the engagement was a success.

4.1.5. Case 5

Case 5 concerns a service engagement with a client in the aerospace industry and a provider in the research and development sector. The service provider was brought in to develop new procedures to repair the client product parts using the provider's technology. Thus, this case falls within the **T-KIBS context**.

The client approached the service provider because they were told that the provider's technology were environmentally friendly, and they could help repair the parts of their (client) product. The engagement was a huge program that involved many projects that were focused on different areas of the product. The service provider was also into the academia, so the project also involved graduate student from the University. Furthermore, the service provider partnered with a Canadian company who produced the commercialized version of the technology. Due to this

partnership and collaboration with the Canadian company, clients also had to buy the needed equipment from the company. Thus, the engagement involved the service provider, client, students and Commercialization Company. In summary, the engagement was successful, the project is in its last phase after lasting for about five (5) years. The technology will be transferred to the client, and they will no longer have to waste parts henceforth.

4.1.6. Case 6

Case 6 concerns a service engagement with a client in the government sector and provider in management consulting. The service provider was brought in to develop an improvement plan for the client. Thus, the case falls within the **P-KIBS context**.

Before the engagement is initiated, the provider gives the client a proposal that includes the time, fees and responsibilities that will be associated with the engagement. The proposal will also include the client requirements and capability. The providers then wait to reach a mutual understanding and agreement to proceed before continuing with the engagement.

Also, the service providers educated the client staff on best practices of the high performing organization. They assessed the client organization to see what they were doing and not doing, identified the gaps, and created an actionable improvement plan that will help fill the gap. The improvement plan also included implementation guidelines that will help the client to put the plan into practice. After developing the plan, the provider assigned bits of the task to different client staffs so that they can also be part of the engagement. The Service provider gave them support when they needed it. Such support includes training and implementation assistance. Thus, both actors actively collaborated during the engagement. At the end of the engagement, the actors evaluated the performance of the client organization. They carried out a measurement of

the performance and recorded that the organization did very well. Therefore, the engagement was a success, and the client got a tremendous return on investment.

4.1.7. Case 7

Case 7 concerns a service engagement with an internal client and provider in the public sector. The provider was brought in to implement new electronic records and document management system across departments in the organization. Thus, this case falls within both **T-KIBS and P-KIBS context**.

The product that is to be implemented serves as a replacement for a previous product that were used over the years in the organization. However, the previous solution was not meeting up to expectations and was deemed a failure. Organization staff did not like it, so the provider's plan was to correct the mistakes of the previous product with the new product.

The new solution was implemented as an information management and information technology solution though the original intention was for the information management (IM) and information technology (IT) teams to collaborate. However, as the engagement went on the information management team carried out a larger part of the work because they had most of the resources. The provider implemented the first phase of the solution in different departments. They also provided training and support to the users of the solution. The service provider also requested for feedback of the product form so it can be improved in the second phase. In summary, the first phase of the engagement has been completed. The provider has pushed the new system to various internal clients so that they can have the initial use for it.

4.1.8. Case 8

Case 8 concerns a service engagement with a client in the government sector and the provider in a research and development sector. The provider was brought in as information management experts to develop a knowledge model for the organization though after two previous failures of an IT system that was supposed to have similar functions. Thus, the case falls within both **T-KIBS and P-KIBS context**.

The service provider's offer services that help the client to organize and structure their information better so that it can comply with the government standard and also be easily retrievable. Thus, the providers look at the business processes of an organization, and the business functions those processes carry out and through that, they build up a model of the organization. The model includes the documents created to support the business function of the organization and also describe the organization semantically. The goal of the model is to tag the organization content to the model in such a way that they can easily perform searches as well as generate a report on the content.

The provider managed the project and also carried out analysis of the materials produced in the organization. The engagement involved about ten (10) – twelve (12) people. However, they also worked with the client information management team. The provider usually starts by conducting business analysis in the organization so as to build the high-level functional model. This model is then broken down into more detailed processes and mapped to specific documents. The clients were totally involved during the engagement, and they had an input into the solution. They involved their data architects and solution architects. In summary, the deliverables - high-level functional model, a business process and some sub-sets of the taxonomy has been completed. The next phase is to implement and deliver the solution throughout the organization.

4.2. Results for Research question: How do Knowledge management systems support value co-creation in KIBS engagements

Overall, our findings show that indeed knowledge management systems (KMS) provide support to value co-creation in KIBS engagements through the use of KM tools which provide support to knowledge processes that enable value co-creation processes in KIBS engagement. Knowledge processes have multiple relationships to value co-creation (VCC) processes in KIBS engagements. The results of this study identify that mostly tools within the class of basic KM tools and non-ICT means provide support to knowledge processes. Additionally, findings show that different actors (service providers, clients, and partners) use of different KM tools varies according to the knowledge process at play.

In this section, we answer our main research question - How do knowledge management systems support value co-creation (VCC) in knowledge-intensive business services (KIBS) engagements? - by answering its three sub-questions:

a) What knowledge processes are present to support value co-creation in KIBS engagements and what is their relationship to value co-creation processes?
b) What KM tools are available to support knowledge processes for value co-creation in KIBS engagements?

Our findings on knowledge processes present in KIBS engagements are presented in section 4.2.1. We then present our findings on the relationship between knowledge processes and value co-creation processes in knowledge intensive business services engagements in section 4.2.2. In section 4.2.3, the type of KM tools used to support knowledge processes in KIBS engagements is described. In section 4.2.4, we describe the use of tools by actors and certain factors that were observed to affect the use of tools.

4.2.1. Knowledge processes present in KIBS engagement

Knowledge processes that were found to be present in KIBS are knowledge acquisition, knowledge recombination, and knowledge application. These findings confirm our initial conceptual framework. However, our data set shows that each knowledge process was present to a varying degree. Knowledge acquisition was seen to have the most presence, followed by knowledge recombination and then knowledge application.

Table 4-1: Number of Instances of knowledge processes

Knowledge processes/cases	Knowledge Acquisition	Knowledge Recombination	Knowledge Application
Case 1	2	2	3
Case 2	8	6	1
Case 3	14	5	7
Case 4	7	4	9
Case 5	4	10	2
Case 6	14	8	11
Case 7	9	5	3
Case 8	10	3	2
Total no of instances for all cases	**68**	**43**	**38**
Percentage of instances for all cases	**46%**	**29%**	**26%**

The number of instances in which a knowledge process happened in each case, as indicated in Table 4.1, is taken to represent the degree to which it is present in a KIBS engagement, at least within our data set. Instances correspond to the number of times an interviewee discussed the type of knowledge that was acquired, recombined or applied, as the case maybe. For example, knowledge about the client's needs is a type of knowledge obtained during knowledge acquisition. A specific example can be found in case 1, where one of the instances recorded for the knowledge acquisition process represents an event where the service provider acquired knowledge about the client's process and the reason for its failure. "*So we got to understand what the processes were, we got to understand how they are running workshops, we also got to understand why they weren't working out.*" Our results show that all three processes were

present in all of the cases, thus, supporting previous studies (Hakanen, 2014; Muller & Doloreux, 2009; Strambach, 2001) on knowledge processes in KIBS.

During the knowledge acquisition process, we found that actors mostly acquired knowledge that centered on providing a solution that is tailored to the client business needs. For example, in case 3, knowledge acquired was focused on the client business activities so that they could see if the client was going to use the solution they were proposing. *"…we shared records-keeping practices, techniques, principles and I'm not saying we got too much back, but we learned more about their business…Knowledge of their business and their activities and their willingness to use and implement what we were proposing".* Also, in case 7, knowledge acquired focused on helping the clients understand the technology solution that was offered. *"…yes, we would give them an understanding, okay this is how [technology] work. This is how this product works as [solutions]…okay this is how it worked here, but this system works this way. So, we do spend some time with them on helping them understand the product and the technology."* Since most KIBS engagements are centered on providing a solution or producing a deliverable that meets the clients requirements, actors might want to spend a lot of time and resources to enable them meet that objective. Thus, a possible reason why knowledge acquisition was highly present across cases compared to other knowledge processes.

In the cases studied, knowledge recombination concerned combining knowledge acquired from the client domain and expertise knowledge of the service provider which also included knowledge acquired from previous projects. For example, in case 6, the service provider combined existing functional knowledge with the knowledge that they acquired from the client organization. *"And, so you bring, you know, you bring all of that knowledge to the table, and you combine that process and knowledge that the client is willing to share with you too about their*

*organization."*At times, knowledge recombination concerned the combination of service provider knowledge with that of their partners rather than their client. For example, in case 5, the service provider and its commercialization partner learned each others' techniques and combined that knowledge with knowledge they had developed from previous projects: *"We had to learn some of their techniques, evaluation techniques and include them in the lab. So, there was some migration of knowledge in that way from the companies to us, for sure… And the other way around too. We developed some measurement techniques that they were not using, and they actually said well that's better than what we're doing; how do you do that."*

Within our data set, knowledge application was rather mostly concerned with knowledge about the use of the new solution or deliverable that was developed during the engagement, as well as with knowledge in the form of lessons learned or feedback from the engagement. For example, in case 4, during the testing of the solution by users, feedback about the new solution was gotten from several actors in the engagement. "*There was all sort of feedback. There's feedback from the users of the system. There was feedback from the governance body. There was feedback from the policy center because of our dealings with the clients."* In case 6, during the implementation of the new deliverable, client training was conducted, and feedback about the deliverable was given to the service provider. *"I [service provider] get a read on satisfaction level and get feedback on what they thought about the content of the workshop, on the experience of the workshop, how applicable it is to their job and their next steps…we get feedback from a workshop evaluation".*

Our results also indicate that there might be a relationship between the degree of presence of knowledge processes overall and the level of collaboration during KIBS engagements. For example, as can be seen in Table 4.1, case 1 had the lowest number of instances of knowledge

processes overall, while case 6 had the highest number of instances recorded overall. In case 1, collaboration was established between the service provider and the client at the executive level, but this relationship did not transfer to other levels within the firm; this situation prevented the provider and client from fully collaborating as planned. *"All completely on our [service provider] side and the executive side of the client to be in a co-creative way but implementers [lower management and middle management] were not co-creators."* On the other hand, case 6 showed a high level of collaboration. In that case, both the client management team and the heads of department were involved, and the service provider was able to work closely with both actors. *"...I worked with the management team ...and the individuals heading up each department, they were involved."* We also see a similar instance of a high number of instances of knowledge processes in case 3, where there was a high level of collaboration between the service provider and different departments in the client team during the engagement. While these situations indicate a correlation between the level of collaboration and the degree of presence of knowledge processes in the engagement, the sample size of our study does not permit us to prove this relationship.

4.2.2. Relationship between knowledge processes and value co-creation processes in KIBS engagements

Knowledge processes were found to be related to value co-creation (VCC) processes in KIBS engagements. However, unlike the single relationship depicted in the initial framework in figure 2.1, our data confirmed multiple relationships between each knowledge process and each value co-creation process. Knowledge acquisition provided support during the aligning and actualizing value co-creation processes except in one case where it happened during the integrating process. Knowledge recombination provided support during the actualizing and integrating processes, except in one case where it happened during the aligning process. Moreover, knowledge

application happened during the actualizing and integrating processes. These findings revise our initial conceptual framework and suggest that knowledge processes take place during multiple value co-creation processes. Table 4.2 details which knowledge processes were found to provide support during the value co-creation processes in each case.

Table 4-2: Knowledge processes relationship to value co-creation processes

Knowledge processes	Cases	Aligning	Actualizing	Integrating
Knowledge Acquisition	Case 1	X		
	Case 2		X	X
	Case 3	X	X	
	Case 4	X		
	Case 5	X	X	
	Case 6	X	X	
	Case 7	X		
	Case 8	X	X	
Knowledge Recombination	Case 1		X	
	Case 2		X	
	Case 3		X	
	Case 4		X	X
	Case 5		X	X
	Case 6		X	X
	Case 7	X	X	X
	Case 8		X	
Knowledge Application	Case 1		X	
	Case 2			X
	Case 3		X	X
	Case 4		X	X
	Case 5		X	X
	Case 6		X	X
	Case 7			X
	Case 8		X	X

An "X" in a cell of Table 4.2 corresponds to either the presence of a knowledge process during a given value co-creation process or to a knowledge process having had an impact on a given value co-creation process(es). For example, in case 1, we see that knowledge acquisition was present only during the aligning process, while, in case 2 it was present in both the actualizing and integrating processes. Doing so shows which value co-creation processes had a correlation with various knowledge processes across cases. Appendix 7 contains more details about the findings of the relationship between knowledge processes and value co-creation processes.

Our results in Table 4.2, indicate that knowledge acquisition supports the value co-creation aligning and actualizing processes in KIBS engagements. For example, in case 3, knowledge acquisition happened at the beginning of the engagement, during the first part of the project. This allowed service provider to learn about the client's business and design a mockup solution that eventually led to an agreement to proceed with the engagement: *"...and in a meeting with not everybody in the unit, but with the director and managers and employees we looked at a structure that we mocked up, and we got the okay, we got the permission to proceed. So, that was the first part of the project, getting the technical— I mean, it was a [service provider solution] structure on paper, but it was an agreement in principle to proceed with the structure"*. Also, in this case, the knowledge obtained during the knowledge acquisition process supported the value co-creation actualizing process. Through this process, the service provider was able to realize when there was a need for flexibility during the solution production process so as to enable them accommodate and represent the perspective of their client adequately in the solution.

Our results indicate knowledge acquisition supported the value co-creation integrating process in one case. For example, in case 2, the knowledge acquired during the engagement resulted in the production of a deliverable that led to valuable outcomes beyond the engagement. Specifically, the service provider developed a framework from the knowledge acquired while discovering a potential solution for the client. As a result, there were beneficial outcomes for the service provider such as further collaborations with other actors. *"Definitely, I had to spend some time going through the literature, look at possible solutions. And it was actually a profitious thing for me because that led to...You know...The framework that I acquired through this collaboration then led to other collaborations with other colleagues, and we worked"* Although this might be

an exceptional situation because this was only recorded in one case, there is still a possibility of this relationship. However, our data does not permit us to conclude on the relationship.

Our results summarized in Table 4.2, also indicate that knowledge recombination supports the value co-creation actualizing and integrating processes during KIBS engagements. Knowledge recombination supported the actualizing process by enabling both actors to collaboratively put in joint efforts and work together to produce a solution for the client. For example, in case 5, knowledge recombination happened between the service provider and their commercialization partner while developing a solution for the client. This allowed the partner to combine and incorporate the new developments of the provider into the current capability of their machines so as to produce a commercialized version for the client. *"We've collaborated with them for a decade now because every development we make, then we tell them and then they can tweak their machine so that it can do its own*." Knowledge recombination also supported the integrating process by leading to outcomes that can later be integrated into the actor's processes. For example, in case 6, the knowledge, talent, skills, experience and creativity of every actor in the engagement were combined by the service provider and client. This combination process resulted in a significant amount of learning for each actor.

Our results indicate that knowledge recombination provided support to the value co-creation Aligning process in one case. Specifically in case 7, the combination of the expected benefits of the clients with the functions of the new solution led to an alignment of the message that was proposed to the client. The service provider combined previous knowledge on the inadequacies of the client's previous solution with features of the new solution, so as to deliver a value proposition that is aligned to the client's needs. This proposition enabled the clients to agree to proceed with the engagement. In our data set, this relationship was an exception and might be

due to the context of the case itself. In this case, the provider previously supported the phased out solution and well aware of its shortcomings. However, our data does not permit us to prove this relationship.

Our results summarized in Table 4.2, indicate that knowledge application supports the value co-creation Actualizing and Integrating processes during KIBS engagements. Knowledge application supported the integrating process by allowing actors to value and improve their processes. For example, in case 4 the knowledge applied by the client led to the identification of redundant processes as well as continual learning on how to improve these processes. Also through this application process, service providers were able to value the outcome of the engagement process. *"We were writing the policy, and we were sort of using five forms to collect information from a new [CLIENT UNIT] and by the end of it, we narrowed it down to one form that was actually about one-third as much paper because really there was too much duplication, too much information. It was actually irrelevant, so it was learning about what information you actually need to be able to come on board… Compared to all the nice-to-haves that nobody actually reads, and so that was good. Even after I left and came back six months later, they had sort of improved it again. Excellent—something they did was sort of develop the skill of learning to keep improving—don't stop. Just keep improving, keep looking at things, keep asking questions"*. Knowledge application also supports the actualizing process. For example, in case 8, while the client was implementing the solution, they had to learn a lot of new knowledge to enable them to build the resources they required to implement the deliverable. *"…there's the aspect of the systems implementation…they built a bunch of new things in order to implement our stuff. I don't know how much new stuff they learned to have to build those things, but they did build something new…"*

In summary, this section presents the results of how knowledge processes are related to value co-creation processes. These results refine our initial framework and state that knowledge acquisition supports value co-creation aligning and actualizing processes while knowledge recombination and knowledge application support the value co-creation actualizing and integrating process. More details on how this affects the initial conceptual framework will be discussed in Chapter 5.

4.2.3. KM tools used to support knowledge processes

KM tools appeared to provide sufficient support to knowledge processes in our data set. However, the particular knowledge process they supported were not always the same as what we had conceptualized from literature. We found that basic KM tools and non-ICT means were mostly used to provide support for the knowledge acquisition and knowledge application processes; advanced KM tools were used in a much more limited manner across cases. For knowledge recombination, we found that basic KM tools were mostly used to provide support to this process; advanced KM tools and non–ICT means were used in a much more limited manner. Table 4.3 summarizes our results.

Table 4-3: KM tools used to support knowledge processes in KIBS engagements

	KM tools categories / Knowledge processes	Knowledge Acquisition (# of cases)	knowledge Recombination (# of cases)	Knowledge Application (# of cases)
	ICT TOOLS			
Basic KM tools	Communication systems	yes (5)	yes (1)	Yes (4)
	Data access tools	yes (3)	yes (3)	Yes (1)
	Presentation tools	yes (3)	yes (2)	Yes (3)
	Document management tools	Yes (2)	yes (3)	Yes (1)
	Content management systems	yes (2)	yes (1)	Yes (3)
	Workflow management systems	yes (1)	yes (3)	No
	Search tools	No	No	No
	Total	**16**	**13**	**12**
Advanced KM tools	Knowledge discovery and mapping tools	No	Yes (1)	yes (1)
	Meta-search systems	No	No	yes (1)
	Collaboration tools	No	No	yes (3)
	Visualization systems	yes (1)	yes (1)	No
	Community Builder	No	No	No
	Push oriented systems	No	No	No
	Enterprise knowledge portals	No	No	No
	E-learning platform	Yes (1)	No	Yes (1)
	Knowledge repositories	No	No	No
	Software development tools	No	No	Yes (1)
	Total	**2**	**2**	**7**
	NON-ICT MEANS			
Non-ICT means	Meetings, workshops, debrief	yes (8)	yes (1)	Yes (3)
	Phone calls	yes (1)	No	yes (2)
	Documents and reports	yes (2)	yes (1)	Yes (5)
	Total	**11**	**2**	**10**

The number in each of the cells in Table 4.3 indicates in how many cases if any, a KM tool was used to support a knowledge process. For example, in case 1, communication systems were constantly used by actors to provide support to the knowledge acquisition process during KIBS engagements. However, we cannot say the same for "search tools" because we had no record of its use by actors across cases. Thus, while our results support our initial framework in terms of KM tools used to support certain knowledge processes, a number of KM tools thought to support knowledge processes were not used within our data set. In the remaining part of this section, we first present our findings with respect to how the KM tools provided support for knowledge acquisition, knowledge recombination, and finally knowledge application

4.2.3.1. Knowledge acquisition

During knowledge acquisition, we found that basic KM tools - communication systems, data access tools, presentation tools, document management tools, content management systems, and workflow management systems were used. Basic KM tools were used to support the knowledge acquisition process by providing a channel for communication and knowledge sharing among actors. For example, in case 8, actors were able to communicate and acquire knowledge from each other irrespective of geographical location using video conference "… *so they had wonderful video conference technology, and we talked to people around the country*". Also, basic KM tools enabled actors to acquire technical details about the deliverable. For example, in case 2, the service provider and his partner were able to share screens and discuss technical details of the deliverable with other actors in the engagement.

Non-ICT means such as "meetings and workshops" were widely used across cases to support the knowledge acquisition process. They support this process by providing a physical environment where actors could meet face to face and have discussions that will help them to understand the client's needs and the problems they were currently facing. Non-ICT means also help actors to better explain the proposed solution or deliverable to clients. For example in case 7, the provider was able to give a detailed explanation of the proposed solution to the client during face-to-face meetings. "*When we first meet with the client representatives, we will give them more background information than we will give to the general client. So, they do get an overview of the product; why we're doing this. They do get the business case. we do present a light version of the business case in why we're even doing this project. And, for the [technology], yes, we would give them an understanding, okay this is how [technology] work. This is how this product works as [solutions].*"

Advanced KM tools such as visualization systems and e-learning platforms were used to support the knowledge acquisition process. They enable actors to communicate clearly with each other and also acquire knowledge on how the solution can be used. For example, in case 8, the client was able to provide a clear illustration of what they wanted using this tool. "*We do some mind mapping, some mind mapping tools. Mind Manager was probably the most common one we use. We had a lot so, in their communications with us, their architecture team had a lot of architectural diagrams, Visio and that kind of thing, so we used Visio*".

4.2.3.2. Knowledge recombination

We found that basic KM tools – communication systems, data access tools, presentation tool, document management tool, content management systems and workflow management systems provided support to this process. Basic KM tools were used to support the knowledge recombination process by providing a medium for actors to store knowledge contents and information. For example, in case 1, actors were able to store knowledge and reuse it in consequent projects using workflow management systems. "*Yes, because the bpm software is modular, and it houses things. So yes, that was the whole idea that we should be able to reuse parts."*

Non-ICT means – documents and reports, and meetings and workshops were used to provide support during the knowledge recombination process. For example, in case 2, sharing of documents between the service provider and partner were enabled by documents and reports. These documents are stored knowledge that was relevant and useful towards the production of a solution for the client. Also, due to the close proximity between the service provider and the

partner, face-to-face meetings provided an environment where both actors discussed and combined knowledge together, thereby aiding in proffering a solution to the client's problem.

Advanced KM tools such as knowledge discovery and mapping tools, as well as visualization systems, were used to support the knowledge recombination process. For example, knowledge discovery and mapping tools enabled clients to access knowledge that was stored in a relational database so that it can be combined with new knowledge to provide a solution for the client.

4.2.3.3. Knowledge application

We found that basic ICT tools – communication systems, data access tools, presentation tools, document management tools, content management systems and workflow management systems provided support to this process. Basic KM tools were used to support the knowledge application process by providing actors with a means of learning about the knowledge required to use the solution and also sharing that knowledge between themselves. For example, in case 3, the client was able to use a basic KM tool to access knowledge that was required to use the solution. In this case, a content management system (an internet site) was used by the service provider to share the documentation of the solution with users. This documentation was then referenced by the clients during the integration of the solution.

Non-ICT means such as "meetings, workshops and debriefs," phone calls and documents and reports were used to provide support to the knowledge application process by providing an opportunity for feedback and learning among actors. For example, in case 6, debriefs and workshops were organized to train people on the skills required for them to use the deliverable at their jobs "*A tremendous amount of learning, you know, that takes place. It's phenomenal and at the end of every workshop, let's say, I get a read on satisfaction level… and if it's not a*

workshop, then you're doing work with a client, there is always a debrief afterward about what went well, what could have improved. So, I'm always gathering that sort of information too so that I know I'm getting a lot of feedback on the work I'm doing and what's working well."

Advanced tools – knowledge discovery and mapping tools, meta-search systems, collaboration tools, e-learning platform and software development tools – also supported this process. Although the advanced tools had the least record of use among actors, they were used more within this process than within other processes. They supported the knowledge application process by providing actors with a means to share knowledge that would help them use the deliverable. For example, in case 1, collaboration tools were used by the clients and service provider to share knowledge on how to use the deliverables. "*So, we had a collaboration software we use, [client product], they had actually the tools like Lotus notes and those kind of stuffs and so theoretically what they gave us access to their tools, SharePoint and all those kind of stuff, so the how theoretically is that we would share that way and also....*"

In summary, our results show a that KM tools such as search tools, community builder, push oriented systems, enterprise knowledge portals, and knowledge repositories – present in the initial framework were not used within our data set. A revised framework illustrating the refinements and extensions from the empirical data will be presented in Section 5.3, Chapter 5. In the next section, we will discuss our observations on the actors use for tools during the knowledge processes.

4.2.4. Actors' use of tools during knowledge processes

In Section 4.2.3 above, we saw that our results both validated and refined our initial conceptual framework. In addition, the data we provided additional insight into the use of KM tools by actors during KIBS engagements and into factors that affect their use. We found that during knowledge acquisition, KM tools were used majorly by service providers, and then clients, and few partners. We found that during knowledge recombination, KM tools were used mostly by service providers, and then partners and not used by clients. For knowledge application, we found that KM tools were used mostly by the service provider and clients and few partners. Table 4.4 below illustrates our results. In the table, Y represents a yes and the numbers in the bracket represent the number of cases where an actor made use of the tool. A "-" means that there wasn't any record of the KM tool being used by the actor in the cases in our data set. In the remaining part of this section, we first present actors' use of KM tools with respect to the knowledge process where they were used, and then we present the factors that appear to affect the use of KM tools by actors.

Table 4-4: Actors use of tools for knowledge processes in KIBS engagements

		Knowledge Acquisition			Knowledge Recombination			Knowledge Application		
	Classification of KM tools	Service provider (# of cases)	Client (# of cases)	Partner (# of cases)	Service provider (# of cases)	Client (# of cases)	Partner (# of cases)	Service provider (# of cases)	Client (# of cases)	Partner (# of cases)
Basic Tools	Communication systems	Y (5)	Y(4)	-	Y (1)	-	Y (1)	Y (4)	Y (4)	-
	Data access tools	Y (3)	-	Y (1)	Y (2)	-	Y (1)	-	-	-
	Presentation tool	Y (3)	Y (3)	Y (1)	Y (2)	-	-	Y (3)	-	-
	Document management tool	Y (2)	-	-	Y (3)	-	-	Y (1)	-	-
	Content management system	Y (2)	Y (2)	-	Y (1)	-	-	Y (2)	Y (2)	-
	workflow management system	Y (1)	-	-	Y (2)	-	-	-	-	-
	search tool	-	-	-	-	-	-	-	-	-
		16	**6**	**2**	**11**	**0**	**2**	10	6	0
Advanced tools	Knowledge discovery and mapping tools	-	-	-	-	-	-		Y (1)	-
	Meta-search systems	-	-	-	-	-	-	Y (1)	Y (1)	-
	Collaboration tools	-	-	-	-	-	-	Y (2)	Y (3)	-
	Visualization systems	Y (1)	Y (1)	-	Y (1)	-	-	-	-	-
	Community Builder	-	-	-	-	-	-	-	-	-
	Push oriented systems	-	-	-	-	-	-	-	-	-
	Enterprise knowledge portals	-	-	-	-	-	-	-	-	-
	E-learning platform	-	Y (1)	-	-	-	-	-	Y (1)	-
	Knowledge repositories	-	-	-	-	-	-	-	-	-
	Software development tools	-	-	-	Y (1)		Y (1)	-	Y (1)	-
		1	**2**	**0**	**2**		**1**	**3**	**7**	**0**
Non-ICT means	meetings, workshops, debrief	Y (8)	Y (8)	-	Y (1)	-	-	Y (3)	Y (3)	-
	Phone calls	Y (1)	Y (1)	-	-	-	-	Y (2)	Y (2)	-
	Documents and reports	Y (2)	-	Y (1)	Y (1)	-	Y (1)	Y (4)	-	Y (1)
		11	**9**	**1**	**2**	**0**	**1**	**9**	**5**	**1**

During knowledge acquisition, we observed that KM tools were used by service providers, clients, and partners to support their knowledge acquisition activity. KM tools used often enabled interaction, participation, contribution and exchange of knowledge between actors. For example, in case 8, KM tools such as communication systems and presentation tools were used in exchanging and sharing knowledge between the service provider and the client. *"so they had wonderful video conference technology and we talked to people around the country with that, yeah, definitely video conferencing, constant presentations with PowerPoint, yes*.

During knowledge recombination, we observed that KM tools were used by service providers and partners to support their knowledge recombination activities. However, clients did not use KM tools during this process. This finding could be since most often, solutions or deliverables are developed by the providers and partners, clients' activities during this process could be low, and thus they might not have a need for KM tools. For example, in case 2, communications systems were used to enable the service provider and partner communicate and share resources when solving the client's problem. *"If I have a quick communication, I send email…Otherwise, if we need to discuss something more substantially we see each other, we set a meeting quickly...Yes, we share... basically. He's the one who provided the server. And then, also, when we work on journal papers together, basically we share usually, there are online tools, in which we share a project together, so when we modify...Usually we work on the same file together, so…If I have a quick communication, I send email…Otherwise, if we need to discuss something more substantially we see each other, we set a meeting quickly."*

During knowledge application process, we observed that service providers and clients used KM tools to carry out their activities during the knowledge application process. However, partners

did not use KM tools during this process. This finding is most probably because partners were not participatory during this process since it mainly involved the clients and/or service provider. For example, in case 3, the service provider and client used a content management system because it enabled them share knowledge that served as a reference guide for the new solution. *"They did have an internet site, though, where we starting posting the documentation… They started putting up the [client technology] guide, the templates"*. We also observed that more advanced KM tools were used in this process particularly by clients. We found that these clients already had similar tools before the engagement started. In fact, our data set showed that the context of the engagements where clients made use of advanced tools were all technologically oriented and mostly centered on the redesign or improvement of technology solutions for the client.

In summary, with respect to knowledge processes, findings indicate that KM tools were used by actors to supports their knowledge activities. Thus, cases where the actor's knowledge activities were low often showed low or no usage of tools during the knowledge process. The next section presents certain factors that were identified as affecting the use of KM tools by actors.

4.2.4.1. Factors affecting the use of tools by actors

Our results indicate that there might be factors that could hinder the use of certain KM tools by actors (service provider, clients, and partners). Such factors are; the difference in actors' work environment, the difference in actors' processes and activities, and tools made available for actors during the engagement. In the rest of this section, we present our observation on these different factors.

We observed that the difference in actor's work environment such as security of the organization system could affect the use of KM tools by actors. For example, in case 4, the level of security of the client organization system affected the actor's ability to use the KM tools effectively. In this case, the service provider intended to make use of a collaborative tool to combine knowledge with the client, however, the security level of the client organization prevented the use of the KM tool. "*Yeah, we used Microsoft Project. We used the enterprise edition which didn't work because they [ORGANIZATION] systems are too secure. Well, because the enterprise edition of the software is Microsoft; requires SharePoint to talk to MS… And, those three programs talk to each other, and the [ORGANIZATION] system doesn't like programs talking to each other without authorization from people… And, so it wouldn't work. It wasn't allowed."* We, therefore, observed that incompatibility of KM tools between actors work environment could result in lack of use by either or all of the actors

Another factor identified was the support of KM tools for actor's activities. We observed that certain KM tools better supported a one actor's activity over the other. For example, in case 1, the collaboration tool brought in by the service provider during the knowledge application process did not support the activities of all the actors. This KM tool was useful and productive for the service provider activities, but the client found it cumbersome. *"…Yes, but the other thing we did which was interesting was that we found an open source agile portfolio project management software from [country], and the reason it was easy to do was that they didn't have any tools to manage projects really, and this was free and so we actually slid it in during the summer and we started using it ourselves, and then they started using it, but then in effect they were defeating themselves because it forced them to surface more data than they wanted".* We, therefore, conclude that the incompatibility of tools between actors' environments could result in

a lack of use by either or all of the actors. This reason could be one of the explanations of why certain actors use specific KM tools more than other actors.

Also, another factor that influenced the use of KM tools by actors was the availability and pre-existing use of the KM tool. Actors used certain KM tools because they had been provided to them by other actors. For example, in case 4, the provider had to use the tools that the client made available to him during the knowledge acquisition process even though it was not the best of tools. *"...So, it's not magically organized into some super-duper database, but the idea is everybody's email blogs and shared documents on shared drives and all that stuff. No, it's not a lovely fancy system, but all that they have got*". Also, actors used certain KM tools because it was already in use by another actor. For example, in case 8, the service provider had to use the visualization system because that was the KM tool in use by the client. *"We do some mind mapping, some mind mapping tools. Mind Manager was probably the most common one we used. We had a lot so, in their communications with us their architecture team had a lot of architectural diagrams, Visio and that kind of thing, so we used Visio".*

In summary, we observed that three factors – difference in actor's work environment, the difference in actor's processes and activities, and KM tools that were made available for actors could influence the use of tools by actors. These factors are new insights that enhance the actor's dimension in our framework by providing possible reasons why actors might use some KM tools over others.

4.3. Revised framework

Our initial conceptual framework presented in Section 2.5 showed a linkage between three concepts: Value co-creation processes (Lessard, 2014; Stucky et al., 2011), knowledge processes in KIBS engagements (Hakanen, 2014; Muller & Zenker, 2001; Strambach, 2001), and knowledge management systems (Maier, 2007; Maier et al., 2009). While the results of our data analysis confirm the relationships depicted in the initial framework, they also refine it. In this section, we present a visual illustration (see figure 4.1) of the revised framework and summarize the changes made to the initial framework based on empirical data. We use a Venn diagram to clearly illustrate the linkages among the three concepts (KM tools, knowledge processes, and value co-creation processes).

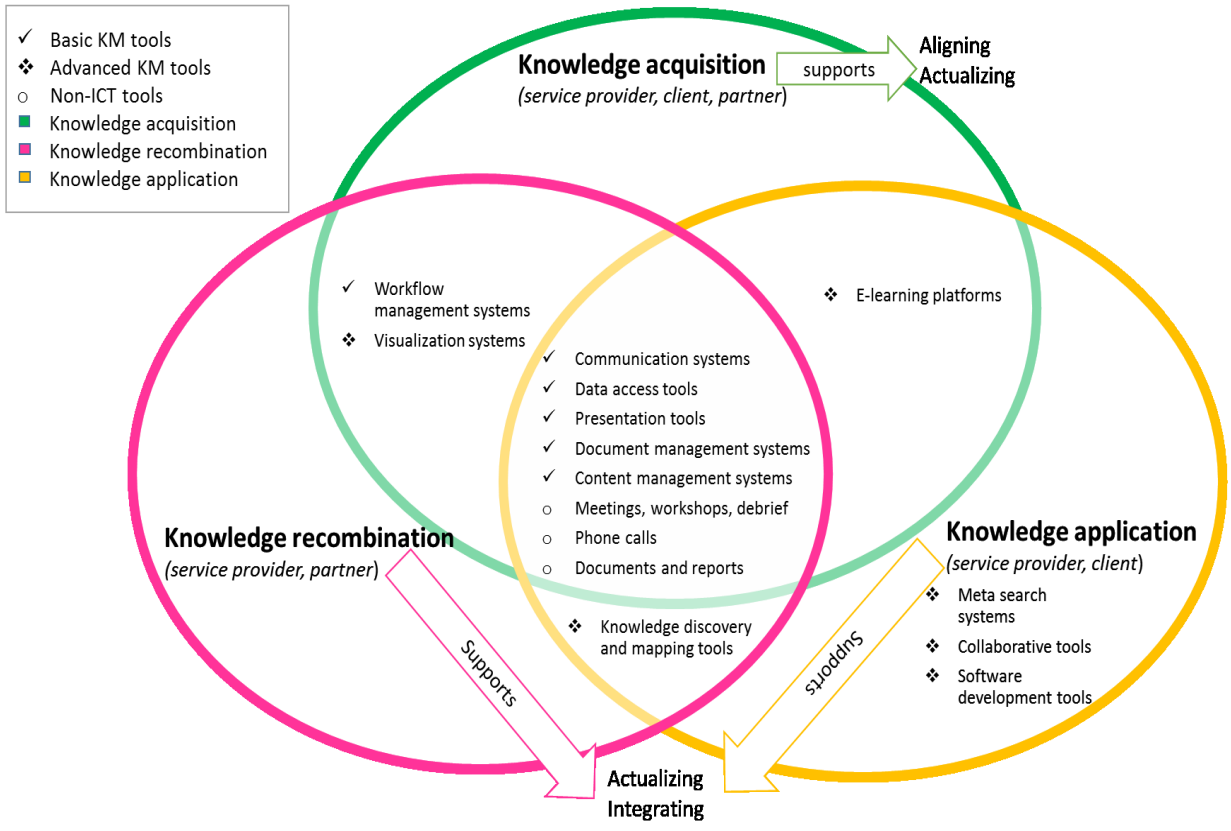

Figure 4: Revised framework of KM tools support for value co-creation in KIBS engagement

KM tools providing support for knowledge acquisition are within the green circle, KM tools providing support for knowledge recombination are within the pink circle, and KM tools providing support to knowledge application are within the yellow circle. Contrary to the initial framework, only KM tools present within our data sets were included in the revised framework. This represents a reduction in the number of KM tools present in the framework, especially in regards to advanced KM tools. Particularly, basic KM tools and non-ICT means were more predominant in our data set while advanced tools were minimally used. The arrows in the framework point to the value co-creation process supported by a knowledge process. Contrary to the initial framework where knowledge acquisition supported just the aligning process, knowledge acquisition is shown to support the aligning and actualizing process. Knowledge recombination and knowledge application are both shown to support the actualizing and integrating processes, whereas, in the initial framework knowledge recombination supported just the actualizing process, and knowledge application supported just the integrating process. Actors that used KM tools during each knowledge process are shown within the brackets in each of the circle; this information was not part of our initial framework.

The relationship between knowledge processes and value co-creation process: The linkages between knowledge processes and corresponding value co-creation processes in the initial framework were confirmed. In addition, we also identified that knowledge acquisition supports the actualizing process, that knowledge recombination supports the integrating process, and that knowledge application supports the actualizing process (see Sections 4.1.2, Chapter 4).

The relationship between KM tools and knowledge processes: The linkages between KM tools and knowledge processes proposed in the initial framework were confirmed for KM tools

present within our data sets. In addition, our results also identified other processes supported by each KM tool (see Section 4.1.3, Chapter 4). For example, all basic KM tools except workflow management systems present within our data sets supported all three knowledge processes. However, it is important to note that the absence of a KM tool within the framework does not generally mean that it may not be used in KIBS engagements, but merely that was not present in our data set.

Actor's use of tools (New dimension): Our results identified actor's use of tools as a new dimension that refines our initial framework. This new dimension adds to the framework by identifying actors who most actively used tools during each knowledge process (see Section 4.1.4, Chapter 4). For example, as illustrated in figure 5.1, service providers and partners used KM tools during the knowledge recombination process. From our data sets, clients did not use KM tools during this process but used the tools during knowledge acquisition and knowledge application. It is also important to note that "partners" were only present in two cases, hence, their limited use of KM tools for knowledge application might also be due to their bias in the data set. In addition, although not visually represented in figure 5.1, certain factors may affect the use of tools by actors (see Section 4.1.4.4)

Chapter summary

This chapter presents the findings of this study: knowledge processes present in KIBS engagement, the relationship between knowledge processes and value co-creation processes, KM tools used to support knowledge processes, and finally, the use of KM tools by actors during knowledge processes. We conclude the chapter with the revised framework based on our results. The next chapter will present a discussion of our results and a brief application of the revised framework.

5. Discussion

The previous chapter presented our study's findings. In this chapter, we focus on linking our results with respect to literature to discuss our theoretical contributions. The remainder of this chapter is structured as follows. First, we discuss on the linkages between the concepts of knowledge management systems (i.e. using KM tools), knowledge processes, and value co-creation processes in knowledge-intensive business services (KIBS) engagements. Next, we discuss our results on knowledge processes and value co-creation processes in KIBS engagements. Following, we discuss our findings on KM tools used in KIBS engagements. Finally, we present a brief evaluation on how our revised framework (see Section 4.3) can be applied practically.

5.1. Linking knowledge management tools, knowledge processes and value co-creation processes

At the beginning of this study, our major goal was to better understand how knowledge management systems (KMS) could better provide support to value co-creation. We thus began an investigation that resulted in an initial conceptual framework linking the concepts of KM tools, knowledge processes, and value co-creation processes. Prior to now, literature has only identified partial relationships but had not looked at the possibility of the linkages between these three concepts. For example, some studies discuss the importance of knowledge processes for the co-creation of value in KIBS engagements (Ordanini & Pasini, 2008; Sarker et al., 2012). These studies explain that knowledge shared by the client enabled the collaborative creation of new solutions. However, it is not clear how exactly knowledge processes provided that support, nor is it mentioned if ICT support was also provided for knowledge processes. On the other hand, some discuss the importance of information and communication technology (ICT`s) for value co-

creation in KIBS engagements (Breidbach, Kolb, & Srinivasan, 2013). Here, these studies explain that technology can enable collaborative value creation. However, they do not present how that can be accomplished. In this study, we conceptualize the linkages between these three concepts, and show supporting evidence from empirical data. Therefore, in summary, this study have been able to show that ICTs such as KM tools can support the process of collaborative value creation in KIBS engagements by directly supporting knowledge processes. In the remaining sections of this chapter, we will situate our findings within literature.

5.2. Knowledge processes and value co-creation processes

One of the major objectives of this study was to improve our understanding of how knowledge processes enable collaborative value creation in KIBS engagements. To meet this objective, we carried out an empirical study to investigate if knowledge processes identified in literature were actually present in KIBS engagements. Moreover, we investigated the relationship between these knowledge processes and value co-creation processes. The result confirmed that there are three knowledge processes in KIBS engagements – knowledge acquisition, knowledge recombination, and knowledge application (Hakanen, 2014; Muller & Zenker, 2001; Strambach, 2001). Also, we confirmed that there were relationships between these knowledge processes and the value co-creation processes of aligning, actualizing and integrating (Hakanen, 2014; Sarker et al., 2012). In the remaining part of this section, we will discuss the meaning of these results for literature. In section 5.2.1, we present a discussion on the relationship of knowledge processes to the collaboratively level in KIBS engagements. We then discuss the importance of knowledge acquisition for KIBS engagements in section 5.2.2. Section 5.2.3 presents a discussion on the multiple relationships between knowledge processes and value co-creation processes in KIBS engagements.

5.2.1. Knowledge process relationship to collaborative level in KIBS engagement

Our, findings show that there are variations in the presence of knowledge processes; indeed, knowledge processes are more present in highly collaborative KIBS engagements (see Section 4.2.1). Current literature has shown that the more involved actors are towards the co-production and co-creation of solutions tailored to the client's problem, the more the tendency of knowledge activities (Miles & Miles, 2012). Knowledge processes do facilitate the co-creation of ideas and solutions during KIBS engagements (Bettencourt et al., 2002), and maintaining a highly collaborative level between actors contributes towards the success of value co-creation process (Sarker et al., 2012). In fact, innovation surfaces from an intense service relationship which involves a high degree of interaction between service providers and client (Gallouj, 2002). Therefore, our findings support previous bodies of literature on knowledge processes in KIBS literature and suggests that higher collaborative engagements may need to focus more on the management of knowledge processes between the client, service provider, and partners.

5.2.2. Importance of knowledge acquisition

The findings of this study show the prevalence of knowledge acquisition during KIBS engagements. Prior studies explain that knowledge acquisition involves activities that could result in meeting the clients requirements (Hakanen, 2014; Muller & Zenker, 2001; Strambach, 2001). During knowledge acquisition, both the service provider and client better understand the solutions that are appropriate for the particular client problem (Miles & Miles, 2012). Consequently, understanding the client's requirements increases the possibility of developing a deliverable that fulfills the client's expectations, thus of the client perceiving value from the engagement (Lessard, 2014), knowledge acquisition could facilitate the creation of value in KIBS engagements. This research, therefore, adds to the existing body of knowledge on value

co-creation by showing the importance of knowledge acquisition to perceived value in the value co-creation process.

5.2.3. Multiple relationships between knowledge processes and value co-creation processes

Current literature provided a foundation for defining the relationship between knowledge processes and value co-creation processes (Hakanen, 2014; Lessard, 2014; Muller & Zenker, 2001; Sarker et al., 2012). We posited that supporting relationships exist between knowledge acquisition and aligning, knowledge recombination and actualizing, and knowledge application and integrating (see Section 2.6.1). While our analysis confirms these relationships, it also offers evidence of additional ones . Indeed, as in current literature, knowledge acquisition happens at the beginning of the engagement and involves initial negotiations between the client and service providers, that aims at obtaining a clearer understanding of the clients requirements (Hakanen, 2014). Clients requirements which can be seen as their expected benefits from the engagement needs to be aligned with the provider's value propositions (Aarikka-Stenroos & Jaakkola, 2012; Lessard, 2014). Additionally, our findings show that these requirements also influence decisions made during the co-production and implementation of the new solution for the client. Specifically, service providers become flexible and attempt to adapt and incorporate the clients requirement within the new solution. Since the co-production and implementation activities are within the actualizing process (Aarikka-Stenroos & Jaakkola, 2012), this research, therefore, adds to the existing body of knowledge on knowledge processes and value co-creation by showing the support of knowledge acquisition to the actualizing process.

Current literature also states that knowledge recombination involves the combination of newly acquired knowledge with previous knowledge, expertise and skills of the provider and partner to

develop a new solution for the client (Muller & Zenker, 2001, Strambach, 2001). Developing a new solution for the client is encompassed within the co-production of deliverables (Aarikka-Stenroos & Jaakkola, 2012; Ordanini & Pasini, 2008) in the actualizing process (Stucky et al., 2011). Also, develeoping a new solution involves learning from working together with the client (Hakanen, 2014). Going further, our findings show that such learnings were later integrated into stakeholders organizations (service provider, client, and partner). Since the integration of the collaborative process such as learning is a mechanism within the integrating process (Lessard, 2014), the results of this research add to the existing body of knowledge on knowledge processes and value co-creation by showing the support of knowledge recombination to the integrating process.

Finally, current literature shows that knowledge application involves knowledge regarding the use and transfer of new deliverables to the client (Hakanen, 2014, Muller & Zenker, 2001). Applying the new solution leads to learning and the provision of feedbacks to the provider (Sarker et al., 2012). These feedbacks and new knowledge can help stakeholders to value the deliverables gotten from the process of collaboration (Lessard, 2014), as well as to perceive value from the engagement based on initial perceived benefits (Aarikka-Stenroos & Jaakkola, 2012, Smals & Smits, 2012). Going further, our findings showed that in some KIBS engagements, the service provider developed the new deliverable while the implementation was carried out by the client. During the process of implementing the solution, clients obtained new knowledge regarding the use and application of the solution. Since the implementation of a solution (Aarikka-Stenroos & Jaakkola, 2012; Ordanini & Pasini, 2008) is an activity within the value co-creation actualizing process(Stucky et al., 2011), this research adds to the existing body

of knowledge on knowledge processes and value co-creation by showing the relationship between knowledge application and the value co-creation integrating process.

5.3. Knowledge management systems for KIBS

In this section, we discuss the implications of the results of this research on literature related to KM tools. We present discussions on the refinements of the relationships between KM tools and knowledge processes, the limited use of sophisticated KM tools during KIBS engagements, and the varying use of tools by actor types during each knowledge process. Finally, we discuss KIBS' need for KM tools during their engagements or if it is not required.

5.3.1. Refining the relationship between KM tools and knowledge processes

The findings of this study refine our conceptual framework and add to literature by validating the relationships between KM tools and knowledge processes. In Table 5.3, we present the relationship of KM tools to knowledge processes for value co-creation both from literature and the empirical data in this study. KA stands for knowledge acquisition; KR stands for knowledge recombination, and KAP stands for knowledge application. We discuss the refinements to our initial framework for each tool in the rest of this section.

Table 5-1: Comparison of tools supports for knowledge processes from literature and empirically

	KM Tools (Maier, 2007; Maier et al., 2009)	Knowledge processes supported conceptually from literature	Knowledge processes supported empirically
	ICT TOOLS		
Basic ICT tools	Communication systems	KA	KA, KR, KAP
	Data access tools	KA	KA, KR, KAP
	Presentation tools	KA	KA, KR, KAP
	Document management tools	KA, KR	KA, KR, KAP
	Content management systems	KA	KA, KR, KAP
	workflow management systems	KR	KA, KR
	search tools	KA, KR, KAP	No data
Advanced ICT tools	Knowledge discovery and mapping tools	KR	KR, KAP
	Meta-search systems	KA, KR, KAP	KAP
	Collaboration tools	KA, KAP	KAP
	Visualization systems	KA	KA, KR
	Community Builder	KA	No data
	Push oriented systems	KAP	No data
	Enterprise knowledge portals	KA	No data
	E-learning platform	KAP	KA, KAP
	Knowledge repositories	KA, KR	No data
	Software development tools		KAP
	NON-ICT MEANS		
Non-ICT means	Meetings, workshops, debrief	KA, KAP	KA, KR, KAP
	Phone calls	KA	KA, KAP
	Documents and reports	KA, KR, KAP	KA, KR, KAP

As illustrated in Table 5.1, the findings of this study confirm most of the relationships between KM tools and knowledge processes identified in literature (Jarrahi & Sawyer, 2013; Maier, 2007; Maier et al., 2009). Some authors contend that the use of information communication technologies (ICTs) as enabling technologies for knowledge processes is constantly growing (Rao, 2005). However, our results show the contrary. In as much as these tools were identified to support knowledge processes during KIBS engagements, there is still a minimal use of these KM tools. Indeed, the management of knowledge involves much more than the use of technology (Davenport & Prusak, 1998). The major role of technology is to enable and facilitate interaction and sharing of knowledge among individuals (Handzic, 2004). However, technology alone is not sufficient to facilitate the processing of knowledge in organizations (Davenport & Prusak, 1998).

Knowledge-intensive workers typically prefer real live face – face interactions, rather than the use of some technologies (Handzic, 2004). Such a preference might contribute to the limited use of KM tools in organizations such as KIBS.

5.3.2. Limited use of sophisticated KM tools

Our findings show that there was a limited use of advanced KM tools during KIBS engagements. One reason could be that advanced KM tools provided support to only certain knowledge processes compared to basic KM tools and non-ICT means, which provided support to almost all knowledge processes (see Table 5-1). Generally, the choice of ICTs depends on the particular knowledge activity as well as the operators involved (Bolisani & Scarso, 1999). Non-user friendly KM tools, unable to support users knowledge activities and their business expectations become unappealing (Tseng, 2008). Thus, while basic KM tools and non-ICT means are less sophisticated, they may be sufficient for the needs of KIBS engagements since they have the ability to provide support to a wider range of knowledge processes than advanced KM tools.

In addition, another possible reason for the use of limited sophisticated tools could be the nature of knowledge during KIBS engagements. Knowledge in KIBS could take either the tacit or explicit forms and can also be converted from one form to another during the engagements (Gallouj, 2002). However, compared to explicit knowledge, KIBS engagements have a higher level of taciticity (Muller & Doloreux, 2009). Since tacit knowledge is the major form of knowledge in KIBS engagements, a tacit to a tacit form of conversion (socialization) will be often required. Tacit to tacit knowledge conversion is often supported by tools that facilitate

meetings, presentations, discussions and sharing of documents (Marwick, 2001). Such tools are either found within the basic ICT tools or non-ICT means.

Another possible reason for the limited use of advanced KM tools is based on the availability of the KM tool during the engagement. Service providers often adapt the ICT infrastructure that was provided and made available to them by their client (Breidbach, Kolb, & Srinivasan, 2013). The findings of this study showed instances where tools were used based on their availability. Actors might, therefore, use tools not necessarily because it is most suitable but because it is made available. This reason should be considered in future KIBS engagements. Actors need to find a balance between using KM tools that were available to them and tools that were suitable for meeting their needs.

Finally, another possible reason for the limited use of advanced KM tools could be due to the scope of the engagements represented in the multiple cases in this study. It is likely that smaller engagements might require the use of basic KM tools. Generally, the need for more sophisticated KM tools rises as organizations expand and grow (Rao, 2005). Thus, there is a tendency for larger organizations to make use of more sophisticated KM tools as opposed to basic KM tools. Consequently, our data sets showed that cases with KIBS engagements involving larger organizations recorded more use of advanced KM tools. However, this might need to be confirmed in future studies.

5.3.3. Use of KM tools in inter-organizational relationships

The findings of this study refine the initial conceptual framework and extends literature on knowledge management systems by introducing a new dimension i.e. actors dimension to the framework. Insofar as literature provided us with a list of certain KM tools that could be used for

knowledge-intensive processes, information was not provided about particular actors. Prior studies reviewed either did not clarify the users of KM tools (Carlsson, 2003; Jarrahi & Sawyer, 2013), or discussed on the use of KM tools internally without focusing on the inter-organizational perspectives (Maier, 2007; Maier et al., 2009). Going further, this research shows that in KIBS engagements, thus in inter-organizational relationships, KM tools are used not only by the service providers, but also by their clients and partners. It is, therefore, important to account for clients and partners access and use of these KM tools during KIBS engagements, taking into consideration the different technical skills set of each actor.

5.4. Application of the framework

In this section, we present the application of our framework for guiding knowledge management system solution providers and designers, and service providers, clients, and partners in KIBS engagements. Using the features of these KMS solutions, we briefly evaluate the framework and show how the framework can be practically used. Two KMS solutions from leading vendors offering listed on the Knowledge management (KM) world buyers guide website (KM world, 2015b) were selected for this purpose. In the rest of this section, we briefly describe these solutions, present their functionalities, apply it against our framework and explain how the results of the framework can be used.

5.4.1 Knowledge management commercial solution

In this section, we present two (2) commercial knowledge management solutions: Transversal enterprise knowledge solution and KANA knowledge solution. We provide a brief description of the features of this solution and with the aid of a table, we briefly compare their differences in features.

Transversal is one of the leading providers of knowledge solutions for the cloud. Their solutions aim at improving the performance of organizations through their employees and business partners using modern technologies (KM world, 2015c). To accomplish this, they have developed a series of products. One of such product is the Transversal enterprise knowledge solution. According to their website, (Transversal, 2015), this solution provides accurate, accessible and easy to maintain systems to knowledge workers. They aim at supporting knowledge workers by providing a platform for them to share and obtain information promptly. Table 5.2 presents the features of the solution and also the corresponding tool in our framework.

Table 5-2: Features of Transversal enterprise knowledge solution and corresponding tool related to in framework

Features of Transversal	**Corresponding KM tool in framework**
Powerful search accuracy	Search tool
Self-improving search	Search tool, meta-search systems
Guided contextual help	Data access tools, push oriented systems
Multimedia content authoring	Content management systems
Flexible content publishing	Workflow management systems
Content organization	Knowledge discovery and mapping tools
Flexible security and user roles	
Knowledge monitoring	Knowledge discovery and mapping tools
Cross-device availability	
Reporting and analytical tools	Document management tool, visualization and navigation tools

Kana is another leading provider of cloud solutions and on-premises customer service solutions. Kana claims to help reduce operational costs and increase resolution rate (KM world, 2015a). To achieve these objectives, they have also developed a series of products including the KANA Enterprise knowledge management. According to their (KANA A Verint company, 2015), this solution gives the right knowledge to the user based on the context of the query by enabling users to perform searches using different parameters and to access contents of various sources

such as knowledge bases and community forums. Table 5.3 presents the features of the solution with the corresponding tool in the framework of this study.

Table 5-3: Features of KANA Enterprise knowledge management solution and corresponding tool related to in framework

Features of KANA	**Corresponding tool in framework**
Multiple access methods beyond simple search	Search tool, meta-search systems
Apply context to personalize results	Meta-search systems
Spider external sources, such as websites and file systems	Data access tools
Entitle content for the appropriate user audience	Content management systems
Collect feedback and ratings on content	Content management systems
WYSIWYG authoring interface	Presentation tool
Robust content approval workflow and version control	Workflow management systems
Step by step troubleshooting flows with visual designer	Knowledge discovery and mapping tools
Integrated to KANA Enterprise agent desktop	
Multilingual knowledge management for global customer service	

5.4.1.1 Application of the framework to the solution

Table 5.4 below shows a comparison of both solutions. It illustrates how different knowledge management solutions can consist of different the KM tools in the framework.

Table 5-4: Application of the framework to two commercial solutions

	KM tools	**Transversal enterprise knowledge solution**	**KANA enterprise knowledge management**
Basic ICT tools	Communication systems		
	Data access tools	✓	✓
	Presentation tools		✓
	Document management tools	✓	
	Content management systems	✓	✓
	workflow management systems	✓	✓
Advanced ICT tools	Knowledge discovery and mapping tools	✓	✓
	Meta-search systems	✓	✓
	Collaboration tools		
	Visualization systems	✓	
	E-learning platform		
	Software development tools		
Non-ICT	Meetings, workshops, debrief		
	Phone calls		
	Documents and reports		

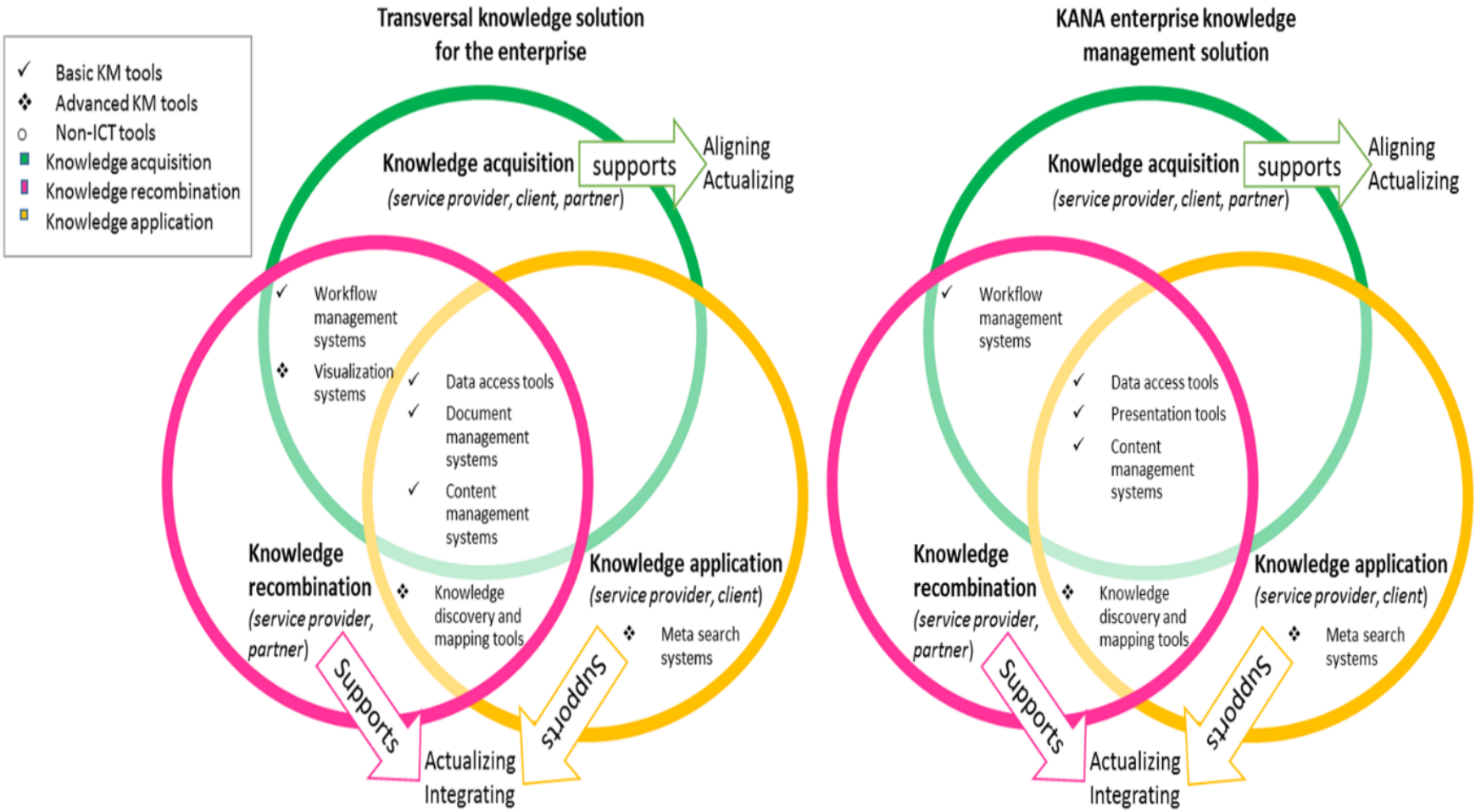

Figure 5-1: Application of revised framework to Transversal knowledge solution for the enterprise and KANA enterprise knowledge management solution

The information presented in Table 5.2, 5.3, 5.4, and Figure 5.2 shows how our framework can be applied practically. The functions of each of the solution were related to a corresponding KM tool within the framework. Using our framework to categorize these functions shows that both solutions provided support to all three knowledge processes (see Figure 5.2). The application indicates that both KANA's and Transversal's solutions consist mainly of functions corresponding to basic KM tools, with a limited number of functions corresponding to advanced KM tools.

This evaluation could be used differently by various stakeholders (knowledge management solution providers and designers, KIBS providers, clients and other partners). First, Transversal and KANA knowledge solution providers could identify functions that could be added to their solution in order to better support knowledge processes in KIBS engagements. For example, none of these solutions includes communication systems. Since, from our data set, communication systems were one of the tools that most actors used during the engagement, these solution providers could decide to add functionality for that corresponding KM tool. Also, service providers, clients and partners in KIBS engagement could use the framework as a guide when selecting an appropriate commercial solution for their knowledge activities. For example, service providers, clients, and partners who require functions like visualization systems could choose to go for Transversal over KANA since it provides functionalities to support this KM tool. On the other hand, service providers, clients, and partners who require knowledge management solutions with functionalities for presentation tools could choose KANA enterprise knowledge solution. In addition, service providers, clients, and partners can use the framework to identify additional functionalities that need to be supported by their current knowledge

solution. In conclusion, this framework provides practical guidance to choose or develop KM tools for the specific needs of KIBS engagements.

In summary, this chapter presented a discussion on the findings of this research in terms of their contribution to literature and their practical applicability. Findings contribute to literature by providing empirical support to previous research on the way in which KM tools can support knowledge processes, and in turn on the way in which knowledge processes can support value co-creation processes in KIBS engagements.These understandings are captured by a revised framework whose applicability has also been shown. In the next chapter, we will present the conclusions of this study, its limitations, and directions for future work.

6. Conclusion

In the previous chapter, we discussed the findings of this study with respect to its implication for literature. We described the ways our study confirms and contributes to the existing body of knowledge. In this chapter, we highlight the summary of the achievements of this study, its limitations and finally, we conclude with directions for future work.

6.1. Summary of research achievements

This study had the initial objectives of improving our understanding of how knowledge processes enable collaborative value creation, and how knowledge activities in KIBS engagements are supported by KM tools. We achieved this goal by conducting a multiple case study with an analysis of each KIBS engagements. Based on eight cases across KIBS contexts, we attempted to validate the initial conceptual framework that showed a linkage between KM tools, knowledge processes in KIBS engagement and value co-creation processes in KIBS engagements.

Results confirmed that: 1) three knowledge processes – knowledge acquisition, knowledge recombination, and knowledge application were present in KIBS engagements; 2) the process of knowledge acquisition supports the value co-creation aligning process, the process of knowledge recombination supports the actualizing process, and the process of knowledge application supports the integrating process, and 3) specific types of KM tools supported given knowledge processes. Going further, results extends the initial framework by: 1) Indicating varying degrees of presence of knowledge processes, with knowledge acquisition being most prevalent; 2) indicating further relationships between knowledge processes and value co-creation processes – knowledge acquisition and actualizing process, knowledge recombination and integrating

process, knowledge application and actualizing process; 3) indicating additional knowledge processes supported by KM tools (see Table 5-1); 4) indicating classes of KM tools mostly used during knowledge processes; and 5) identifying actors who most actively used tools during each knowledge process.

6.1.1 Conceptual contributions

Our study provides two major contributions to literature. First, this study contributes to the body of literature on value co-creation by focusing on the under-researched topic of knowledge management systems (KMS) support to value co-creation in KIBS engagements. Specifically, this study developed a framework that linked the three concepts of KM tools, knowledge processes and value co-creation processes, which has not been identified in existing literature (see Section 5.1). This study, thus, explains that knowledge management systems can support value co-creation through the support of knowledge processes.

Secondly, this study provides empirical support for the linkages between a) Knowledge processes and value co-creation in KIBS engagements, b) KM tools and knowledge processes in KIBS engagements c) KMS and value co-creation in KIBS engagements. By doing that, this study brings together three bodies of literature – literature on knowledge management system (KMS), literature on knowledge processes in KIBS engagements, and literature on value co-creation in KIBS engagements. Thus, this research shows the importance of providing better support to knowledge processes in KIBS engagements, as it can result in value co-creation outcomes.

6.1.2 Practical implications

Practically, this research contributes to KIBS providers, clients, and partners. By clearly identifying KM tools that support knowledge processes in KIBS engagements, KIBS professionals and other actors in an engagement can now have a better understanding of what KM tools will be best suited for their knowledge processes. Therefore, this study can be used as a guide in helping these actors select the most appropriate KM tool for their knowledge activities. In addition, actors can also use this study as a guide in conducting a gap analysis on their current KM tools.

Secondly, this study contributes practically to knowledge management system (KMS) developers and solution providers. KMS developers can use this study as a guide when aiming to develop a solution for the specific needs of KIBS engagements. On the other hand, KMS solution providers can use this study as a guide to help estimate how well their current solutions support the needs of KIBS providers and their clients. Such understanding will enable these KMS solution providers in identifying improvements to made to their solutions, in order to better support actors requirements.

6.2. Limitations of the research

Several limitations constrain the findings of this study. One of the limitations of this study was the challenge in addressing the extent of generalizability and external validity since our case research involved a limited number of cases. This limitation has been an enduring challenge in case study research (Hillebrand, Kok, & Biemans, 2001; Yin, 2002). However, to increase the generalizability, this study included cases across various KIBS context. Knowing that the way KIBS innovate vary across different contexts, we can account more for theoretical

generalizability as against statistical generalization, which is more focused on the sample size (Hillebrand et al., 2001).

Another limitation in case study research with qualitative methods is the extent of rigor used when analyzing the data. To address this limitation, the study made use of systematic ways of collecting and analyzing the data. First, the same standard interview protocol was used for all interviews. Also, we ensured that we followed a structured process in analyzing the data, and we carried out an inter-coder reliability test to ensure correctness in the coding of the data. In addition, our coding process, which included paper coding, coding with Transana software and coding with excel was meticulous and helped to ensure that our codes were accurate.

Another limitation concerns the participants of the study. Even though KIBS engagements involve multiple stakeholders, interview sessions were held solely with participants from KIBS providers. Hence, engagements were recalled based on the participants' perspectives. However, despite this constraint, the limitation was mitigated by asking participants to reflect on other stakeholder's perspective.

Finally, another limitation of this study concerns the challenge of collecting feedback from the participants of this study. Conducting feedback after the final analysis strengthens confirmability and internal validity in studies with qualitative methods; however this is not always accomplished (Miles & Huberman, 1994). To address this limitation, we provided comprehensive and meaningful descriptions of how we collected and analyzed the data with example quotes to support our analysis. Moreover, most of our initial predictions made on the linkages between concepts in this study were confirmed to be accurate after the analysis.

6.3. Directions for future works

This research provides a foundation for future studies that aim at further understanding how knowledge managements systems can better support value co-creation processes. The support of KM tools for knowledge processes in KIBS engagements is a relatively new and unexplored area. Thus, this thesis contributes more towards the "development of a framework". The framework proposed in this research is only a first step towards achieving a stronger theoretical model. In other to work towards theory development, there will be a need to verify if KM tools actually improve outcomes such as value co-creation and innovation in KIBS engagements. Therefore, future research could carry out a validation of the framework with respect to the outcomes of value co-creation and innovation in varied type of KIBS contexts.

Secondly, future studies could look at identifying if particular patterns exist between differences such as; 1) The use of KM tools in T-KIBS over P-KIBS contexts, 2) The use of KM tools in KIBS engagements involving stakeholders in large organizations over smaller and mid-sized organizations. In addition, future studies could identify how much KM tools are currently relied on in these organizations.

Thirdly, Future studies could also look into extending the framework by validating the framework against data obtained from other stakeholders (clients and partner's) asides from KIBS provider. Such data would provide a multi-dimensional view that could be integrated into the framework.

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Appendixes

Appendix 1: Descriptions and definitions of KM tools

A1.1 Basic KM tools

A1.1.1 Communication systems

Communication systems are ICT systems that help support individuals and organization to exchange information, knowledge, and ideas. They provide both synchronous and asynchronous communication between actors. KM tools with these functions include emails, chat systems, audio and video systems, instant messaging, text and video conferencing systems, newsgroups, list servers, discussion lists, electronic whiteboards, etc. (Maier, 2007). Communication systems help bring different experts together irrespective of location. Thus, making it possible for different actors to share knowledge among themselves. For example, online forums and discussion boards serve as a platform where actors can create knowledge networks (Alavi & Leidner, 2001). They also can be used as a source of discovering an answer to a knowledge problem (Jarrahi & Sawyer, 2013).

A1.1.2 Data access tools

Data access tools help provide access to various sources of data. Examples include relational database management systems, web servers, file servers, storage systems, online database, etc. (Maier, 2007). Data access tools are used to store structured and semi-structured data as well as enable easy access to the data (Maier et al., 2009). Data access tools help actors to get answers to questions they might have. For example, FAQ's helps clients to access answers to commonly asked questions (Maier, 2007).

A1.1.3 Presentation tool

Presentation tools are used to display, visualize and present knowledge content. The files that can be presented using this tool can either be multimedia's such as videos, or usual text document (Maier, 2007). Examples include PowerPoint presentations, video presentations. Presentation tools help in converting tacit knowledge into explicit knowledge (Marwick, 2001).

A1.1.4 Document management tool

Document management systems are used to handle the management of documents (Maier, 2007). This activity is carried out electronically, and it takes care of the capturing, retrieving, storing, accessing, editing, and archiving of documents throughout their lifecycle (Maier et al., 2009). They manage electronic documents and can convert paper-based documents to electronic documents. Examples include spreadsheets, word files, briefing notes, meeting notes, memorandums. Document management systems support the externalization of knowledge, the documentation of tacit knowledge and identifying and integrating external knowledge (Maier, 2007; Maier et al., 2009).

A1.1.5 Content management system

Content management system is used to organize and publish contents on the web (Maier, 2007; Maier et al., 2009). Contents can include audio and video files, text files, and can be published on the web or electronically. The difference between content and document management is in their primary objectives. While document management systems handle documents primarily, content management system focusses on handling the activities that pertain towards publishing contents majorly on the web (Maier et al., 2009). An example includes Wikis and weblogs. Content management systems such as wikis help knowledge workers to discover important

information. They also serve as a place for acquiring a wider knowledge perspective on a specific area (Jarrahi & Sawyer, 2013).

A1.1.6 Workflow management system

Workflow management systems are used to automate and manage the execution of business process activities (Maier, 2007; Maier et al., 2009). They are built to support structured and semi-structured work processes (Maier et al., 2009). Workflow management systems are built to support the coordination of group activities such as the assignment of tasks (Maier, 2007). Traditional workflow management system cannot directly support processes in knowledge-intensive organization because of their unstructured nature. However, the incorporation of knowledge stances (a class of repeating knowledge work outlined based on context, occasion, and mode) into tools will result in flexible workflow management system that will support the generation, translation and application of knowledge (Maier et al., 2009). Examples of workflow management systems include process automation tools, scheduling tools.

A1.1.7 Search tool

Search tools are used to search for messages, documents, and experts when required (Maier, 2007; Maier et al., 2009). Search tools can be used to find experts as well as locate documents that consists of knowledge in a specific field (Maier et al., 2009). Examples of search tools include yellow pages. Search tools such as yellow pages help actors to share knowledge about their skills and competencies as well as acquire knowledge about the skills and competencies of others (Maier, 2007).

A1.2 Advanced KM tools

A1.2.1 Knowledge discovery and mapping tools

Knowledge discovery refers to the process of finding out new patterns of knowledge from existing data (Fayyad, Piatetsky-Shapiro, & Smyth, 1996). Knowledge discovery and mapping tools consist of techniques that help one to discover patterns from volumes of data and also make sense of those patterns, thus discovering knowledge (Fayyad, Piatetsky-Shapiro, & Smyth, 1996). Techniques for knowledge discovery include text mining and data mining, and they help organizations discover relationships in a large collection of data (Maier, 2007). Thus, they support the acquisition of new knowledge.

A1.2.2 Meta search systems

Meta-search systems are used to provide advanced search functions and collect knowledge from different knowledge sources (Maier, 2007). Thus, Meta-search systems queries varieties of databases to produce rich content results (Maier et al., 2009). Meta-search systems can be configured to carry out either just organizational-wide searches or also search external sources. Sources of the knowledge gotten from meta-search systems can come from online databases, file servers, document management systems, search engine databases (Maier, 2007). Examples of meta-search systems include MetaCrawler. Meta-search systems support the process of searching and presenting knowledge (Maier, 2007). Thereby, we can say that they support the process of acquiring of knowledge.

A1.2.3 Collaboration tools

Collaboration tools are used to enable knowledge workers to share knowledge as well as collaboratively work together (Maier, 2007). Examples of collaboration tools include

blackboards, lotus notes, groupware systems, project management tools. Collaboration tools support communities of practice among knowledge workers, and also interactions among groups. It enables groups to exchange ideas and work together. Collaboration tools enable knowledge workers to create, share and apply and develop knowledge together (Maier et al., 2009). Thus, facilitating interactions and teamwork among individuals (Alavi & Leidner, 2001). Social media such as Twitter, LinkedIn also support collaboration because they foster interactions among individuals with different expertise and skills (Jarrahi & Sawyer, 2013).

A1.2.4 Visualization and navigation systems

Visualization and navigation systems are used to illustrate the relationships between knowledge, the carrier of knowledge, and processes (Maier, 2007). Visualization tools make it possible for one to represent complexity in knowledge easily. Thus, assisting the cognitive part of individuals (Keller & Tergan, 2005). An example of a technique used in visualization and navigation systems are knowledge maps. Knowledge maps make it possible for knowledge to be displayed, easily accessed and organized (Shiffrin & Börner, 2004). Visualization and navigation tools can either generate results using texts or graphics or can use a combination of both (Maier et al., 2009). Visualization tools support access to client, product and process knowledge (Maier, 2007). Thereby, helping in the process of acquiring knowledge.

A1.2.5 Community builder

Community-building tools are used to support the establishment of virtual communities where the team member can provide knowledge and ideas irrespective of geographical location (Maier, 2007). They can also be referred to as community home spaces, and they provide a platform for individuals to share knowledge and contribute to topics when necessary (Maier et al., 2009).

Community-building tools fosters trust and shared understanding among team members which is important for collaboration (Sherif, Hoffman, & Thomas, 2006). Thus, this KM tool supports helps to support the knowledge acquisition process. Discussion boards are an example of such tools.

A1.2.6 Push oriented systems

Push oriented systems consists of tools that are used to send knowledge elements to individuals in an organization (Maier, 2007). Examples include intelligent agents and information subscriptions. They provide knowledge in real time so as to bring up to date the knowledge of the team members. Push oriented systems enable the transfer, spread and communication of knowledge to other individuals in the organization. They support the publication and distribution of knowledge to knowledge seekers (Maier, 2007). Push tools such as email-push technology do not require individuals to request knowledge; they automatically send the knowledge themselves (Maier et al., 2009).

A1.2.7 Enterprise knowledge portals

Enterprise knowledge portals are used as a platform for the integration of different ICT systems for knowledge management in an enterprise (Maier et al., 2009). We can view these tools as an umbrella for different knowledge sources as well as a way of gaining access to the different sources (Maier, 2007). Examples include different portals solutions. In as much as we have EKP's many organizations, KM tools are not integrated, and they exist separately (Maier, 2007). Enterprise knowledge portals enable individuals to navigate easily to the particular module that they need to access without having different entrance points (Priebe & Pernul, 2003). They also help users in creating and managing knowledge repositories (Bowman, 2002).

A1.2.8 E-learning platform

E-learning platforms are tools used to provide technology-supported learning environments to individuals in an organization. On e-learning platforms, contents could either be displayed asynchronously (e.g. from stored databases) or synchronously (e.g. broadcasting live)(Maier, 2007). They make it possible to discover and obtain the best expertise there is in an organization. E-learning makes it possible for users to have easy access to knowledge irrespective of the location and time. Also, users can have a better understanding of complex issues by listening to the media over and over again. However, e-learning could also hinder collaboration because individuals interactions are done mostly with technology (Maier et al., 2009). An example is telelearning. E-learning fosters the exchange of knowledge through online media. E-learning contributes towards the knowledge repositories of an organization and supports the development of tacit and explicit knowledge. E-learning makes it possible for individuals to acquire, adapt, store, distribute and acquire knowledge (Wild, Griggs, & Downing, 2002).

A1.2.9 Knowledge repositories

Knowledge repositories are tools that are used to store and organize knowledge in such a way that it can be easily retrieved when required (Maier, 2007). We could see them as document management systems with much more advanced functionalities like sophisticated filtering. The source of knowledge repositories can either be from external knowledge (e.g. competitive intelligence), structured internal knowledge (e.g. project reports), or informal internal knowledge (e.g. lessons learned) (Davenport, De Long, & Beers, 1998; Maier, 2007). Knowledge repositories contain links to projects, experts, and skills (Maier, 2007). While knowledge repositories do not promote social interactions, they serve as an important tool for locating expertise i.e. codified knowledge (Davenport et al., 1998; Jarrahi & Sawyer, 2013), thereby

being more suitable for the storage of explicit knowledge (Maier et al., 2009). Knowledge repositories are mostly useful for knowledge that is easily generalizable (Alavi & Leidner, 2001). Knowledge repositories facilitate the acquisition of knowledge from experts, the transfer of knowledge to individuals and the combination of different expertise that are stored within it (Davenport et al., 1998).

A1.3 Non-ICT means

KM tools are designed to help create, gather, organize and disseminate knowledge in an organization specifically for managerial and professional activities. Organizations can achieve KM tools support using different technologies depending on their size and technical infrastructure (Alavi, 1999). However, not all KM tools are technologically based (Maier, 2007; Maier et al., 2009). Thus, from our literature review, we still found some non-ICT tools that were used to support knowledge processes.

A1.3.1 Meetings, workshops, and debriefs

KM tools such as meetings, workshops and debriefs are tools that allow individuals to share and acquire knowledge (Alavi & Leidner, 2001). Through these tools, actors can share, understand and precisely articulate explicit and tacit knowledge (Maier et al., 2009). Thus, they support knowledge processes. For example, face to face meetings supports the development of team culture among individuals. It provides an avenue for them to compare notes and directly communicate with each other (Maier et al., 2009). Tools such as workshops create an avenue for clients to provide feedbacks (Maier et al., 2009). These feedbacks could serve as sources of knowledge for the provider. Non-ICT tools remove the technology barrier between team members. Tools such as face-to-face meetings create and improves trust between team members

and organizations (Maier, 2007). However, KM ICT tools such as social media tools (e.g. LinkedIn) can lead to the use of non-ICT means such as face-face meetings (Jarrahi & Sawyer, 2013).

A1.3.2 Phone calls

Although phones are technology based, they are non-ICT tools, and they are used to support knowledge processes. Phone calls enables actors to reach out to other individuals or team members for quick answers to questions (Jarrahi & Sawyer, 2013). They also make it possible for actors to express ideas and improve interactions between individuals (Maier, 2007). Through the use of phones, experts can be identified, contacted irrespective of location (Maier, 2007). Phone calls encourage individuals to transfer tacit knowledge (Gottschalk, 2006). Phone calls aids the acquiring of knowledge from organizations as well as identifying the right contact person in an organization (Maier, 2007), thus, supporting the knowledge acquisition process.

A1.3.3 Documents and reports

Knowledge management systems (KMS) ought to provide support to knowledge elements such as documents and reports with ICT tools. However, this is not always the case because some organizations often use the knowledge elements such as documents and reports as tools themselves. Documents and reports are tools used to record knowledge about happenings or/and findings (Maier, 2007). Examples include project report, news report, etc. Documents are reports that consist of articulated explicit knowledge (Alavi & Leidner, 2001). KM tools such as knowledge repository can be used to support the documents and reports (Bowman, 2002). Documents and reports support the identification of knowledge, its acquisition, its storage and its

transfer (Maier, 2007). Thus, we can say that documents and reports support knowledge acquisition and knowledge recombination.

Appendix 2: Explanation of the linkages between KM tools and knowledge processes from Literature

A2.1 Basic KM tools

Communication systems are used to support knowledge acquisition process. The linkage is justified by the ability of communication systems to enable actors to exchange and share knowledge and ideas with one another (Alavi & Leidner, 2001). Through sharing, actors acquire knowledge from other actors that can help them to provide a solution (Jarrahi & Sawyer, 2013). This tool can thus be deemed to support the knowledge acquisition process.

Data access tools are used to support knowledge acquisition process. The linkage is justified by the ability of data access tools in helping to access and identify knowledge that has been stored in data and document bases (Maier, 2007; Maier et al., 2009). The stored knowledge enables actors in acquiring initial knowledge about the organization. Thus, supporting the knowledge acquisition process.

Presentation tools are used to support knowledge acquisition process. The linkage is justified by the ability of presentation tools in enabling actors to present knowledge contents to other actors (Maier, 2007). Other actors can then acquire knowledge and have a better understanding of the solution and deliverables that can be provided to them from the engagement and see if it is in conformity with their requirements. Thus, it shows support for knowledge acquisition process.

Document management tools are used to support knowledge acquisition and knowledge recombination processes. The linkage is justified by the ability of document management tools in providing support to the externalization of knowledge (Maier, 2007; Maier et al., 2009). Thus, it enables actors to acquire explicit knowledge about the organization that was once tacit. Also,

these tools aid actors to document their tacit knowledge that can later be integrated with external knowledge, thus combining the knowledge to produce a solution.

Content management systems are used to support knowledge acquisition process. The linkage is justified by the ability of content management systems to provide support for the publication of knowledge which is a form of externalization. Thus, they aid the formalization of knowledge by actors so that the knowledge can be stored and retained for use (Jarrahi & Sawyer, 2013; Maier et al., 2009). We, therefore, conceptualize that they assist actors in acquiring important knowledge about other actors as well as sharing knowledge contents that give other actors a wider knowledge perspective about a certain area.

Workflow management systems are used to support the knowledge acquisition process. The linkage is justified by the ability of these systems to provide support for the creation of new improved processes and competencies for organizations (Maier, 2007; Maier et al., 2009). Through the support of interactions among actors, they enable them to acquire knowledge.

Search tool supports the knowledge acquisition, knowledge recombination, and knowledge application processes. The linkage is justified by the ability of search tools to provide support through links between different knowledge elements and makes it possible for knowledge about a specific field to be discovered by actors (Maier et al., 2009). Thus, we infer that this tool helps actors acquire knowledge that they require in solving a problem. Also, actors combine that knowledge with previous knowledge e.g. the provider's tacit knowledge, in order to produce a solution. Also, during the application of knowledge, search tools assists actors in finding answers to their questions by consulting knowledge that has been previously stored, thus, supporting the knowledge application process.

A2.2 Advanced KM tools

Knowledge discovery and mapping tools support the knowledge recombination process. The linkage The linkage is justified by the ability of this tool to provide support for the visualization of knowledge structures as (knowledge elements linked to each other) as well as the creation of links with other knowledge elements (Fayyad et al., 1996; Fayyad et al., 1996). Thus, we infer that the knowledge stored and organized in the structures can be consulted by actors in an engagement and further combined with other knowledge to provide a solution for the client, thus, supporting the knowledge recombination process.

Meta-search systems support the knowledge acquisition, knowledge recombination, and knowledge application processes. The explanation of the linkage is just as that of search tools above. Although they have more advanced functions such as collecting information from multiple sources (Maier, 2007), they support the same set of knowledge processes.

Collaboration tools support the knowledge acquisition and knowledge application processes. The linkage is justified by the ability of collaboration tools to enable actors in an engagement to create, exchange, develop and apply knowledge together (Maier et al., 2009) (see Section 1.2.3). Thus, supporting the knowledge acquisition and knowledge application processes.

Visualization and navigation systems support the knowledge acquisition and knowledge application processes. This linkage is justified by the ability of this tool to assist actors in learning about the relationship between different knowledge elements (smallest unit of knowledge e.g. knowledge about a process) (Maier, 2007). They also enable access to the client product and process knowledge(Maier, 2007), thus, supporting the knowledge acquisition process.

Community builder supports the knowledge acquisition and knowledge application processes. The linkage is justified by the ability of community builders to enable the generation and exchange of knowledge between actors within the community (Maier et al., 2009; Sherif et al., 2006). Thus, we infer that just as collaboration tools, this tool can help actors to acquire the knowledge that they need to provide a solution. This supports the knowledge acquisition process.

Push oriented systems support the knowledge application process. The linkage is justified by the ability of push-oriented systems to enable actors in providing knowledge to other actors who need it (Maier et al., 2009). They support the internalization process (Maier, 2007). Hence, they enable the conversion of explicit knowledge to tacit knowledge. Thereby, we infer that actors e.g. client can use the knowledge when applying the solution provided by other actors e.g. provider, thus, supporting the knowledge application process.

Enterprise knowledge portals support the knowledge acquisition process. The linkage is justified by the ability of enterprise knowledge portals to enable actors to have access to knowledge about other actors organizations from a central point (Maier, 2007; Priebe & Pernul, 2003). Therefore, we infer that EKP's enable actors in acquiring knowledge about the organizations that they might need to for providing a solution. Hence, it supports the knowledge acquisition process.

E-learning platform supports the knowledge application process. The linkage is justified by the ability of E-learning platforms to enable actors to learn about knowledge that they to apply the solution or deliverable that has been given to them (Wild et al., 2002). It also supports the internalization of knowledge (the conversion of explicit knowledge to tacit) (Maier, 2007).

Actors can use this as a medium for transferring the skills that other actors need to make use of the solution provide to them. Hence, this tool supports the knowledge application process.

Knowledge repositories support the knowledge acquisition and knowledge recombination processes. The linkage is justified by the ability of this tool to enable actors in providing knowledge of their organization to other actors. Therefore, other actors can acquire knowledge about other organizations by accessing the knowledge base of their KMS (Davenport et al., 1998; Maier, 2007). Also, because they contain knowledge from previous projects, they support actors in combining the new knowledge they have with previous knowledge so that they can provide a solution (Davenport et al., 1998). Thus, knowledge repositories support the knowledge acquisition and knowledge recombination processes.

A2.3 Non-ICT means

Meetings, workshops, and debriefs supports the knowledge acquisition and application processes. Although, not an ICT tool as explained (see Section 1.3.1), face-to-face meetings, workshops and debriefs enables actors too in sharing explicit and tacit knowledge with other actors (Alavi & Leidner, 2001; Maier et al., 2009). Through these mediums, other actors can acquire knowledge that will help them in providing a solution to their problem. Also, actors can obtain feedback about the deliverables provided and the engagement itself, therefore, helping actors to value the process results and deliverables. Thus, we infer, that meetings support the knowledge acquisition and application processes.

Phone calls support the knowledge acquisition process. Actors can use this tool to obtain knowledge about other actors (Jarrahi & Sawyer, 2013). Irrespective of physical presence, actors

can still exchange ideas and tacit knowledge among themselves (P. Gottschalk, 2006). Thus, we infer that this tool supports the knowledge acquisition process.

Documents and reports support the knowledge acquisition, recombination and application processes. Through documents and reports, actors can obtain knowledge that was stored from previous projects and they can then combine this knowledge with other skills and competencies to provide a solution (Maier, 2007). Also, actors can apply the knowledge in the contents of this medium to their organization processes. Thus, we infer that they support the knowledge application, recombination and application processes.

Appendix 3: Ethics Approval letter

File Number: 01-14-24B **Date (mm/dd/yyyy):** 04/01/2015

Université d'Ottawa University of Ottawa
Bureau d'éthique et d'intégrité de la recherche Office of Research Ethics and Integrity

Ethics Approval Notice

Social Sciences and Humanities REB

Principal Investigator / Supervisor / Co-investigator(s) / Student(s)

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File Number: 01-14-24B

Type of Project: Professor

Title: Refining and validating modeling requirements for improved value creation in KIBS engagements

Renewal Date (mm/dd/yyyy)	Expiry Date (mm/dd/yyyy)	Approval Type
05/12/2015	05/11/2016	Ia

(Ia: Approval, Ib: Approval for initial stage only)

Special Conditions / Comments:
N/A

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Appendix 4: Interview protocol

Title of study: "Refining and validating modeling requirements for improved value creation in KIBS engagements."

Reminder on the use of the interview protocol: The main goal of the interview session is to collect rich data on participants' perception and opinion on the usefulness of the requirements for establishing and monitoring future KIBS engagements. The questions written below should thus be considered as a general guide to be used to stimulate the conversation with the participants, but not to direct the conversation. If the participant wishes to orient the discussion on other topics than those covered by these questions, he or she should be free to do so. However, the person conducting the simulation session should ensure that answers to the questions written below have been answered in one form or another.

Part 1: Description of a recent KIBS engagement

- "Please describe a recent service engagement in which you have participated."
- (Follow-up questions can concern elements of the engagement's context, processes, and outcomes if the participant does not spontaneously provide that information).

Part 2: Application of the requirements to the recalled engagement *(Use information and questions for interview protocol document)*

- (Provide a written list of the proposed requirements in the form of information to be gathered and questions to be asked about a KIBS engagement).
- (Ask the participant to run through each item, asking the following questions):
- "Did you or your colleagues gather each type of information? Was the information gathered explicitly (for example, recorded), or implicitly – thus known but not expressed?"

- "Was each type of question asked at some point in the engagement? When? Was that done explicitly, or implicitly?"

- Did you use any ICT tools to help you gather this information or answer these questions? Which ones? Were they effective? Would you have liked to have ICT support if you didn't?

Part 3: Discussion on the relevance and comprehensives of the requirements

- "Did going through the requirements provide any new insights on the outcomes of that engagement? Do you think they could provide insights for future engagements?"

"Are there processes, or factors, that were or should have been taken into account in the engagement you recalled, and that weren't addressed by the requirements? Are there processes or factors that you think should be taken into account in future engagements that are not addressed by the requirements?"

Appendix 5: Coding scheme for knowledge management system support for value co-creation

A5.1 Knowledge acquisition

Knowledge acquisition refers to the process of acquiring external knowledge that is necessary for the problem-solving activities in KIBS engagements (Hakanen, 2014). During this process, a series of activities and interactions takes place with the client. These activities include the acquiring of knowledge concerning client requirements and the proposed solution (Hakanen, 2014). It also includes the willingness and decision of an actor to share and transfer knowledge to another actor (Maier, 2007). Knowledge acquisition will be coded for when knowledge is transferred, shared and acquired at the beginning of the engagement for the purpose of obtaining knowledge about the clients' problem and a possible suitable solution for the client.

Table A5-1: Knowledge acquisition coding scheme

S/N	***CODE***	***CODE NAME***	***BRIEF DESCRIPTION***
1.1	KA: Who	Knowledge acquisition: Who	This sub-category concerns either the person acquiring the knowledge or the person transferring and sharing the knowledge for acquisition purposes. It could be the KIBS firm, clients or partners (Hakanen, 2014; Muller & Zenker, 2001).
	KA: What	Knowledge acquisition: What	This sub-category refers to the type of knowledge that was acquired and the way in which it is acquired. It could be field / technical knowledge, organizational knowledge, domain knowledge, etc. (Strambach, 2001).
1.2	KA: How	Knowledge acquisition: How	This category relates to the avenue through which knowledge is acquired, shared and transferred for acquisition purposes. It could be through KM tools such as communication

			systems or non-ICT means such as face to face meetings and workshops (Gottschalk, 2006; Maier, 2007).
1.3	KA: When	Knowledge acquisition: When	This category concerns the moment when knowledge is acquired, shared or transferred for acquisition purposes with respect to the value co-creation processes i.e. aligning, actualizing and integrating (Lessard, 2014; Stucky et al., 2011).
1.4	KA: Impact	Knowledge acquisition: Impact	This category concerns the consequence of having acquired, shared or transferred knowledge for acquisition purpose with regards to the value co-creation processes.

A5.2 Knowledge recombination

Knowledge recombination also referred to as knowledge assimilation, can be defined as a process that involves analyzing, understanding, interpreting, and integrating knowledge acquired from external sources and different knowledge fields in order to create new innovative knowledge for the client (Strambach, 2001). Beyond combining knowledge that was previously acquired, knowledge recombination also involves converting tacit knowledge into explicit knowledge (Muller & Zenker, 2001). Knowledge recombination will thus be coded for when knowledge is combined in other to produce a solution for the client.

Table A5-2: Knowledge recombination coding scheme

S/N	***CODE***	***CODE NAME***	***BRIEF DESCRIPTION***
2.1	KR: Who	Knowledge recombination: who	This sub-category concerns the person in the engagement that combines the knowledge. It could be within the KIBS firm as well as between other parties (Hakanen, 2014; Muller & Zenker, 2001).

2.2	KR: What	Knowledge recombination: what	This category relates to the type of knowledge that is combined and the way in which it is combined. e.g. domain knowledge, core skills and competencies (Hakanen, 2014; Strambach, 2001; Muller & Zenker, 2001).
2.3	KR: How	Knowledge recombination: How	This category relates to the avenue through which knowledge is combined. It could be through KM tools such as knowledge repositories or non-ICT means such as documents and reports (Gottschalk, 2006; Maier, 2007).
2.4	KR: When	Knowledge recombination: When	This category concerns the moment when knowledge recombination takes place with respect to the value co-creation processes i.e. aligning, actualizing and integrating (Lessard, 2014; Stucky et al., 2011).
2.5	KR: Impact	Knowledge recombination: Impact	This category concerns the consequence of having to recombine knowledge with regards to the value co-creation processes.

A5.3 Knowledge application

Knowledge application, also referred to as knowledge diffusion in literature, refers to the process of applying new or improved service to the client firm (Muller & Zenker, 2001). Clients are provided with solid deliverables that are jointly created by actors and can be utilized for the creation of value in their organization (Hakanen, 2014). Also, it handles the use and integration of new knowledge by actors (Hakanen, 2014; Muller & Zenker, 2001). Therefore, knowledge application will be coded for when knowledge is generated, transferred from the problem-solving process and then used to integrate the solution for the client.

Table A5-3: Knowledge application coding scheme

S/N	*CODE*	*CODE NAME*	*BRIEF DESCRIPTION*
3.1	KAP: Who	Knowledge application: who	This sub-category concerns the person in the engagement that is applying the knowledge. It could be the KIBS firm, clients or partners (Hakanen, 2014; Muller & Zenker, 2001).
3.2	KAP: What	Knowledge application: what	This sub-category refers to the type of knowledge that is applied in the client organization and the way in which it is applied e.g. knowledge on how to use a new solution.
3.3	KAP: How	Knowledge application: How	This category relates to the avenue through which knowledge is applied. It could be through KM tools such as e-learning systems or non-ICT means such as documents and reports (Gottschalk, 2006; Maier, 2007).
3.4	KAP: When	Knowledge application: When	This category concerns the moment when knowledge is applied with respect to the value co-creation processes i.e. aligning, actualizing and integrating (Lessard, 2014; Stucky et al., 2011).
3.5	KAP: Impact	Knowledge application: Impact	This category concerns the consequence of applying the knowledge with regards to the value co-creation processes. e.g. the possibilities of new/prolonged relationships (Muller & Zenker, 2001).

Appendix 6: Results of inter-coder reliability test

This section describes how the inter-coder reliability test was calculated. First, each section coded (eventual quick clips in Transana software) were classified as **locations**. An inter-coder reliability test was then performed first at a higher level using the knowledge processes (Knowledge acquisition, recombination, and application) as shown in Table A6-1.

Table A6-1: Higher-level knowledge processes inter-coder reliability test. KA: knowledge acquisition, KR: Knowledge recombination, KAP: Knowledge application

	Coder 1	**Coder 2**
Location 1	KR	KR
Location 2	KAP	KR
Location 3	KAP	KAP
Location 4	KAP	KAP
Location 5	KR	KR
Location 6	KA	KA
Location 7	KR	KR
Location 8	KR	KR
Location 10	KA	KA

For the above Table A6.1 each green represents agreement (1), each red represents disagreement (0), each grey represents not applicable (no point is allocated, and it is not part of the calculation). Therefore, we have 1+0+1+1+1+1+1+1+1 = 8/9 *100 = **88.9%** agreement and **11.1%** disagreement. Next, an inter-coder reliability test was carried out at a lower level involving the sub-categories. The results are illustrated in the table A6-2.

Table A6-2: Lower level knowledge processes sub-category inter-coder reliability test result.

	WHO		WHAT		WHEN		HOW		IMPACT	
	Coder 1	Coder 2	Coder 1	Coder 2	Coder 1	Coder 2	Coder 1	Coder 2	Coder 1	Coder 2
LOCATION 1	1	1	0 - 1	0 - 1	1	1	X	X	1	1
LOCATION 2	1	1	1	1	X	X	0	0	1	1
LOCATION 3	1	1	1	1	X	X	1	1	1	1
LOCATION 4	1	1	1 - 1	1 - 1	X	X	X	X	1 - 1	1 - 1
LOCATION 5	1	1	1 - 1	1 - 1	X	X	X	X	X	X
LOCATION 6	1 - 1	1 - 1	1 - 1 - 1	1 - 1 - 1	1 - 1	1 - 1	X	1	1 - X - X	1 - 1 -1
LOCATION 7	1	1	1	1	X	X	X	X	0	0
LOCATION 8	1	1	1	1	X	X	X	X	X	X
LOCATION 9	X	X	X	X	X	X	X	X	X	X
LOCATION 10	X	X	1	1	1 - 1	1 - 1	1 - 1 - 1 - X - 1 - 1 - - 1 - 1 - 1 - 0	1 - 1 - 1 - 1 - 1 - 1 - 1 - X - 1 - 1 - 0	X	X
Total	9/9		13/14		5/5		9/12		7/9	

For Table A6.2, each green represents agreement (1), each red represents disagreement (0), each grey represents not applicable (no point is allocated, and it is not part of the calculation) and each yellow represents an oversight by one of the coders (0.5). To calculate the total percentage agreement and disagreement, we apply the inter-coder reliability test formulae for each sub-category (column)

$$reliabilty = \frac{number\ of\ agreements}{Total\ number\ of\ agreements + disagreements} \times 100$$

- Who = 1+1+1+1+1+1+1+1+1+1 =9/9 * 100 = **100%**
- What = 0+1+1+1+1+1+1+1+1+1+1+1+1+1+1 = 13/14 * 100 = **92.9%**
- When = 1+1+1+1+1 = 5/5 * 100 = **100%**
- How = 0+1+1+1+1+1+0.5+1+1+0.5+1+1+0 = 9/12 * 100 = **75%**
- Impact = 1+1+1+1+1+1+1+0.5+0.5+0 = 7/9 * 100 = **77.8%**
- Total = who + what + when + how + impact / 5 = 100+92.9+100+75+77.8/5 = 445.7/5 = **89.14%**
- Therefore there was **89.14%** agreement and **10.86%** disagreement

Appendix 7: Relationship of knowledge processes to value co-creation processes

Table A7-1 illustrates more details of the relationship between knowledge processes and value co-creation processes.

- When: represents the moment at which knowledge is acquired, recombined or with respect to the value co-creation processes.
- Impact: refers to the consequence of having acquired, recombined or applied knowledge with regards to the value co-creation processes.
- Relationship to VCC (value co-creation): refers to how what particular value co-creation process, a certain knowledge process affected.
- Why it is related to VCC: refers to the reason for the relationship between knowledge processes and value co-creation processes. Here acronyms mean:

AL- aligning, AC-Actualizing, IN-integrating, RES: resources, COP: co-producing deliverables, VAL: valuing of deliverables, DEL: deliverables, VP: value propositions, PB: perceived benefits, HLI- High-level interest, IMP- implementing deliverables, PV: perceived value and FUT: future. So, for example, AL-RES means aligning resources

Table A7-1: Relationship of knowledge processes to value co-creation processes

Knowledge processes	When	Impact	Relationship to VCC	why is it related to VCC
Knowledge Acquisition P1	Initially, at the start of the project	1. Service provider started discovering the incompetence of the client's IT team 2. Knowledge was gotten, but it was filtered through the client's IT team	It affects the aligning process	AL-RES
Knowledge Acquisition P2	At the beginning and during the project	**1.** The service provider would know what directions to follow and would not get stuck. **2.** Service provider didn't need to start from the scratch **3.** The service provider profited from the acquisition process because it led to the development of a framework that led to other collaborations with colleagues	It affects the aligning, actualizing, and integrating process	AL-RES, AC-COP, IN-VAL
Knowledge Acquisition P3	In the beginning, during the first part of the project	**1.** Service provider understood client process **2.** Service provider understood client's expectations/requirements **3.** Service provider got client's approval to proceed with the proposed solution **4.** The client was informed of the on the best practice for the solution **5.** Service provider made decisions to affect the production of a more effective solution 6. service provider acquired domain-specific knowledge	it affects the aligning process, and it also affects the actualizing process	AL-COM, AL-DEL, AL-RES, AC-COP
Knowledge Acquisition P4		**1.** So client's executive could be the governance for the project **2.** The external body could understand new proposed solution and give consent **3.**Too much knowledge confused clients and clients were	It affects the aligning stage	AL-VP, AL-PB, AL-HLI

		not interested in knowledge that doesn't pertain to their job **4.** Young organization staffs saw opportunities for learning and how they could use the knowledge.		
Knowledge Acquisition P5	Throughout the project	**1.** Detailed learning by the service provider and also by client **2.** Service provider identified areas/specifications and things that were more important to the client and planned to accommodate those within the solution	It affects the aligning and actualizing process	AL-RES, AL-DEL, AC-COP, AC-IMP
Knowledge Acquisition P6	each stage along the way	**1.**service provider identified gaps in the client process, and the gaps were rolled forward into an actionable improvement plan so it can be put in place **2.**service provider divided work among clients in the organization so they can be engaged in the process **3.**service provider have examples from work done for previous clients **4.** The service provider can draw on the knowledge acquired and bring themselves to speed. **5.** The service provider and client learn from each other. **6.** The service provider can make sure that the client assignment is done well so that value can be added at the end of the day.	It affects the actualizing and aligning processes	AC-COP, AL-RES, AL-VP,
Knowledge Acquisition P7	Initially, when service provider and clients meet, every day of the week	**1.** service provider identified how client will make use of technology	It affects the aligning process	AL-HLI
Knowledge Acquisition P8	At the start of the contract, All the way through the project	**1.** The service provider will find the right client individuals to communicate with and provide answers to their questions. **2.** Service provider finds the right knowledge expert to discuss with **3.** The service provider was brought in based on the knowledge he had and the relationship with the client was built. **4.** The clients were engaged in the process and aware of the requirements. **5.** The engagement process was explicit **6.** The clients knew how to provide answers to the service provider **7.** Service provider could provide the right solution	It affects the aligning and actualizing processes	AL-RES, AC-COP
Knowledge Recombination P1		**1)** client was able to reuse parts of the software **2)** There were problems when the client`s junior developer wiped out a database **3)** The process wasn't that fluid because it was structured around pieces of work to be doing	It affects the actualizing process	AC-COP, AC-RES
Knowledge Recombination P2		**1.** The service provider is likely to find a solution **2.** They could find an alternative solution **3.** Service provider and CoPI could	It affects the actualizing process	AC-COP, AC-RES, AC-IMP

		handle the client on different expertise areas **4.**Service provider, and CoPI offered a much more quality service together		
Knowledge Recombination P3	before implementation	**1.** Service provider didn't have a reference guide/manual and had to figure things out by trying things out on the [client technology]	It affects the actualizing process	AC-COP
Knowledge Recombination P4		**1.** Service provider acquired new project management skill and was promoted. **2.** Service provider benefitted from the knowledge of the team **3.** The ICT tool available didn't work because client system as too secured **4.** Client system had technology restrictions	It affects the actualizing and integrating processes	IN-VALO, IN-PV, AC-IMP, AC-COP
Knowledge Recombination P5	Every time	**1.** To allow service provider develop the required technology needed for the client. **2.** A long-term collaboration with a service provider with partner **3.** Commercialization partner can produce the solution. **4.** The client also has to use the service provider commercialization partner technique. **5.** Transfer of knowledge from commercialization partner to service provider. **6.** Partner acknowledges that service provider solution is better and learns from service provider	It affects the actualizing, integrating processes	AC-COP, N-FUT, AC-IMP, IN-RES
Knowledge Recombination P6		**1.** The service provider and client work together collaboratively as a team to bring value and learn about what each other is doing **2.** Service provider learns about client culture and mode of operation **3.** Service provider processes become more efficient, faster and less costly to clients **4.** The technology will impact service provider work; clients can generate data and analytics to see what is going on in other industry sectors.	It affects the actualizing and integrating processes	AC-COP, IN-RES,
Knowledge Recombination P7	At the beginning	**1.** Service provider knew who was okay with the previous product and who wasn't. **2.** The fact that it was a different product benefited certain clients in the project. **3.** Service provider used the knowledge to adapt their explanations of the product features. **4.** Service provider researched on how to add client's requirement to its core product functionality.	It affects the aligning and actualizing processes	IN-VALD, INVALP, AC-COP, AL-VP
Knowledge Recombination P8	An evolution throughout the project	**1.** Service provider way of doing things evolves based on previous projects	It affects the actualizing process	AC-COP

Knowledge Application P1		**1)** Service provider got executive level buy-in but not the lower managers buy-in **2)** Client lower managers changed the agenda **3)** Service provider didn't get required support because of the poor follow through from the client executive to the work team. **4**) Client's technology had missing features because it wasn't upgraded **5)** Service provider could not work effectively because the technology provided to them by the client such as lotus note wasn't working properly **6)** Service provider brought in a new free technology for managing the project because the clients did not have tools for that purpose. However, it forced the client to provide more data than they would have. **7)** The lack of knowledge sharing between the clients hinders innovation within the client, and it also hinders innovation with the service providers.	It affects the actualizing process	AC-IMP, AC-COP, AC-RES
Knowledge Application P2		**1**. Service provider solution would lower client's delivery time to their own clients **2**. Clients product was improved	It affects the integrating process	IN-VALD
Knowledge Application P3	Throughout, as the project progressed	**1**. Service provider learned about the technical limitation of the solution **2**. Service successfully transferred new technology and locked down the old one **3.** The Client IT team wasn't on board **4.**people couldn't find something's because they didn't look at the guide **5.** The experienced helped service provider to identify inadequacies **6.** Service provider learned lessons **7.** The service provider was able to develop more formal solutions **8.** Experienced clients didn't want to learn new knowledge so as to be able to apply the new solution	It affects the actualizing and integrating process	AC-IMP, AC-COP, IN-RES
Knowledge Application P4	it built up as the project progressed and was very good by the time it was over	**1**. The old experienced client was not happy on service provider recommendation for his process and didn't want to accept the change **2**. The old experienced client wasn't willing to make adjustments and buy into provider's concept of things **3.** Service provider used the deliverables from the project as a reference in future activity **4.**service provider delivered what was expected of him, and the good quality output was kept for future posterity **5.** Service provider saw the project as an opportunity to do things properly and deliver positive results for client financial inputs **6.** experienced clients were not willing to work with the service provider who was a contrary	It affects the actualizing and integrating processes	AC-COP, IN-DEL, IN-VALO, IN-RES

		opinion to service providers mindset **7.**service provider realized inefficiencies in the process and, learned it and improved it **8.** clients developed the skill of continuous improvement from the service provider		
Knowledge Application P5	Monthly	**1.** Service provider transferred the technology **2.** Service provider identified what directions to take based on the failure of the solution. **3.** Service provider gained lots of fundamental knowledge that can be applied in future projects	It affects the actualizing and integrating processes	AC-IMP, AC-FEED, IN-PRO
Knowledge Application P6	it built up as the project progressed and was very good by the time it was over	**1.** Service provider transfers knowledge so that client can operate on their own after they are gone 2.clients can take advantage of lessons learned by the service provider from other organizations **3.** Clients gain a lot of knowledge about how to do their job better **4.** Service provider continually improves the resources used **5.** service provider makes adjustments because they strive for ultimate satisfaction	It affects the actualizing process	AC-IMP AC-RES, IN-RES
Knowledge Application P7		**1.** An understanding of added functions required in the product for the next project phase. **2.** Service provider gets feedbacks from the solution use **3.** Problems are reported **4.** Service provider collected information from the ticketing systems on problems that kept reoccurring. **5.** knowledge of more resources that are required based on the problem faced	It affects the aligning and integrating processes	IN-RES, IN-VALD, IN-PVN
Knowledge Application P8		**1.** Service provider solution was implemented practically 2**.** Client used their resource to automate service provider deliverable	It affects the actualizing and integrating processes	AC-IMP, IN-RES