Research Paper

A Process Oriented Knowledge Audit for a Small Software Development Company in New Zealand

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1 Acknowledgements

I would like to thank my supervisor, Professor Pak Yoong, who has spent valuable time in guiding me through this study. I would also like to thank the five participants who have kindly offered their time to share their experience.

2 Abstract

This study is a knowledge audit that focuses on one of New Zealand's leading small software development companies, and examines one of the company's most important processes in great detail to uncover and categorise the knowledge requirements in the selected process. Because the majority of knowledge items examined are implicit and must be studied in light of the surrounding context, the knowledge audit used qualitative research methods that analyse tasks and knowledge items in conjunction with the process these items are part of.

3 Introduction

Before an organisation decides to implement any knowledge management initiatives, some of the questions it needs to find answers to are "what knowledge do we need to manage?", "what sort of knowledge do we need to create?", or "what are the business values of having such knowledge managed?" To answer these questions, the organisation will need to go through an exercise to find out what knowledge it already has, how well it is used, and what other knowledge is yet to be created. It needs to perform such an exercise in a limited scope to have a clear view of the business values in answering these questions and the potential knowledge management initiatives that follow.

This study attempts to answer these questions for the participating company by conducting a Process Oriented Knowledge Audit. The knowledge audit focuses on one of the company's existing business processes, so that the results of the audit can be related to the business values of the process itself. The pre-project process was selected for the audit. The process starts when the company discovers a new opportunity, a potential new piece of work, and covers the activities that happen from there onwards, to work through the opportunity with the client, forming a project, until the point where the company secures the project by signing a contract with the client to formally start working on the project. This study attempts to identify the following key items in this process:

- knowledge needs at the various stages of the process
- how the company obtains and stores the required knowledge
- how knowledge is being used throughout the selected process

Once the knowledge items have been identified, they are then categorised to determine the flow and density of knowledge throughout the different stages of the process.

The report is organised in three sections. The first section details the background work of the knowledge audit, including the literature reviews, the conceptual framework and justification of the methodology chosen. The second section presents the findings of the knowledge audit, describing the knowledge intensive tasks identified and the knowledge items required, and how they relate to the process as a whole. The third section details the discussions generated from discovering the knowledge items and poses further questions to be considered.

4 Literature review

4.1 Knowledge audit

Serrat (2008) defines a knowledge audit as "an investigation of the strengths and weakness of an organisation's knowledge, and of the opportunities and threats that face it". A number of knowledge management studies argue and treat knowledge audits as a necessity for successful knowledge management initiative, suggesting that without an understanding of these knowledge requirements, the organisation is in no position to implement any knowledge management initiative. Serrat (2008) argues that a knowledge audit exercise is required to clearly understand the current state of the organisation's knowledge, what knowledge the organisation has, how knowledge flows or is being used throughout the organisation, and to identify what knowledge the organisation will need. Henczel's (2000) article suggested a more elaborate approach to preparing for knowledge management initiatives: to carry out an information audit before a knowledge audit. The information audit focuses on determining what information the organisation generates or consumes and then subsequently examines how this information is being used through the knowledge audit exercise. Choy, Lee & Cheung (2003) are very much of this view and have introduced a systematic knowledge audit process to ensure that the necessary auditing activity is carried out before the organisation implements any knowledge management initiative.

Similar to any other information system development process, to implement any knowledge management activities, one must first understand the underlying business problem, in this case, a problem related to how knowledge is created and used to fulfil the business goal. Many of the common pitfalls of IT projects – poorly defined scope and objectives, lack of commitment towards change, lack of measurement in business benefits, or the project being excessively technology focused – are shared by knowledge management implementations (Hylton, 2002b). Some studies suggest that these common pitfalls of knowledge management implementations can be mitigated or even completely avoided by carrying out

a knowledge audit exercise prior to the implementation (Hylton, 2002a, 2000b; Pere-Soltero et al., 2007).

A knowledge audit should not just concentrate on the technology that stores organisational knowledge; it covers the life-cycle of knowledge, how it is created, how it is used and how it flows across the organisation (Perez-Soltero et al., 2006). In order to sufficiently prepare for knowledge management implementations, a knowledge audit (or k-audit) should encompass both explicit and tacit knowledge (Hylton, 2002a). To effectively identify tacit knowledge, the auditing exercise needs to take an exploratory approach, recognising that the majority of the organisation's knowledge resides with its people, and a k-audit should focus more on the people instead of being technology-centric (Dora & Lee, 2005; Hylton, 2002a).

A knowledge audit, when viewed on its own without the subsequent knowledge management initiatives, has its limitations which have been identified by scholars who have conducted knowledge audits in a wide range of industries (Dora & Lee, 2005; Snowden, 2000a, as cited in Dora & Lee, 2005). Because organisational knowledge is not static, when knowledge audits have not been planned as an on-going exercise or when results of knowledge audits have been presented without any follow-up plan to implement any knowledge management initiatives, the knowledge audit exercise does not add significant value to the organisation on its own (Dora & Lee, 2005).

The most common knowledge audit activities attempt to resolve the following areas (Serrat, 2008; Perez-Soltero et al., 2006; Maier & Remus, 2003):

- Identify the organisation's knowledge needs
- Identify what knowledge the organisation currently has, both tacit and explicit
- Identify the life-cycle of the knowledge, how it is created, stored, shared and used

Some other activities are also mentioned in many studies (Henczel, 2000; Maier & Remus, 2003):

- Examine how technology and business processes support or hamper knowledge transfers
- Identify knowledge gaps and duplication

Several studies have also pointed out that the result of a knowledge audit may be challenging to maintain, as knowledge is not a static entity; it constantly evolves in the organisation as processes change, and people join and leave the organisation (Chong & Lee, 2005; Perez-Soltero et al., 2006).

Identify the organisation's knowledge requirements

The knowledge audit exercise usually identifies the knowledge intensive tasks in the pre-defined scope; this could be the business process audited, or a department within the organisation, and in this case the pre-project process. It identifies both explicit and tacit knowledge required to complete the tasks. This includes knowledge required by the individual or the group. This process also attempts to discover the knowledge staff may need in order to enhance their skills or competencies, and opportunities for staff to learn and develop in areas that may benefit the knowledge intensive tasks (Serrat, 2008).

Identify the knowledge that is currently available to the organisation

This activity is often referred to as creating a knowledge inventory. During this exercise, the knowledge audit analyses the knowledge intensive tasks to identify, locate and document existing knowledge possessed by the participants of the task. It categorises and indexes the explicit knowledge, and where it is stored, and for tacit knowledge, the knowledge audit will attempt to identify, highlight and locate the individual or group who possesses the tacit knowledge (Serrat, 2008).

At this stage, a knowledge audit should be able to identify and compare the knowledge inventory with the organisation's knowledge needs, and derive an overview of the major knowledge gaps in the scoped knowledge audit areas.

Identify the life-cycle of the knowledge

The knowledge audit also examines the flow of knowledge within the pre-project process. Focusing on the knowledge items identified in the inventory, this exercise paints a network map showing the flow of these knowledge items. In addition, a knowledge audit may also extract a social network map showing how individuals or groups within the pre-project process communicate with each other (Chong & Lee, 2005). Between these two network maps, one can identify knowledge gaps or knowledge overload accumulated in the business process.

4.2 Process-centric approach taken in this study

It is difficult to obtain a holistic view of the organisation's knowledge and its knowledge needs, because of the scale and dynamic nature of organisational knowledge (Chong & Lee, 2005). Organisations and knowledge management studies have introduced methodologies to divide the overarching knowledge management initiative into smaller iterations, by carrying out department based, function based or process based knowledge management activities. However, process-based knowledge management initiatives seem to be the most effective method (Woitsch & Karagiannis, 2005).

Another major challenge faced in many knowledge management initiatives is the missing link between knowledge management and the organisation's business strategy. By taking a process-oriented approach, it becomes much easier for management to visualise how knowledge management initiatives contribute to the business strategy (Maier & Remus, 2003). By focusing on the business processes, knowledge management initiatives can be

divided into manageable chunks, providing visibility for the value added by the initiatives from measuring and monitoring the business process (Maier & Remus, 2003), and in supporting the knowledge focused tasks in the business process, knowledge management systems add value to the process, and in turn, contribute to the organisation's strategic goals (Woitsch & Karagiannis, 2005). Perez-Soltero et al. (2006) also argue that k-audits should be based on business processes, focusing on the people and systems involved in the process. Their article also provides ways to effectively break down the k-audit exercise into smaller and more manageable parts. This can also help the organisation determine what to do with the result of the k-audit, and where to focus the organisation's effort in the subsequent knowledge management initiatives, by considering the importance of the business processes audited.

Frameworks integrating knowledge management initiatives into business processes tend to take the approach of first identifying Knowledge Intensive Tasks (KIT) within the business processes and expanding knowledge management related analysis from and around the KITs. Woitsch and Karagiannis 2005 treat business processes and their KITs as both the content of the organisation's knowledge as well as the entry point for further knowledge management activities. Palkovits, Woitsch and Karagiannis (2003) suggested the approach of using Process-Oriented Knowledge Management (POKM) as an extension of business modelling, to produce models that are based on the KITs of the business process.

Other works have also defined POKM as a more formal and detailed framework. Fachbereich et al. (2003) created a model to capture an organisation's knowledge in relation to its processes by adapting and expanding Nissen's (1999) knowledge management life cycle model, which distinguishes the six phases of knowledge evolution (Nissen, 1999):

1. Capture: Valuable knowledge is elicited and externalised
2. Organise: Captured knowledge is systematically stored for later access
3. Formalise: Whenever necessary, captured knowledge is formalised, e.g. for clarity and automation
4. Distribute: Captured knowledge is made available to employees
5. Apply: Employees make use of the distributed knowledge during their work
6. Evolve: During knowledge application, new knowledge is created that might be valuable to the organisation

Fachbereich et al. (2003) expand on this life cycle model by identifying and formally defining the knowledge components which can be used to form the basis of process orientated knowledge management studies: knowledge item, information item, and information source. The framework links knowledge and information items with the activities and process participants by introducing the formal concept of the useful knowledge item: "A knowledge item *k* is called useful for an agent *agt* during an activity act, if reading, understanding and applying the contents of *k* during act increases the probability that the agent *agt* sucessfully performs *act*." (Fachbereich et al., 2003). "An activity *act* has been enacted successfully by an agent *agt*, if the enactment *eact*, *agt* is of sufficient quality" (Fachbereich et al., 2003). The framework also introduces the concept of meta-knowledge for the knowledge organisation phase, to link knowledge items with activities that require them (deemed useful to the activity).

4.3 Tacit knowledge

Tsoukas (2002) argued against the popular understanding of tacit knowledge at the time in management studies, such as Nonaka and Takeuchi's (1995) view that tacit knowledge is knowledge waiting to be translated or converted into explicit knowledge, that tacit knowledge is knowledge not yet articulated. Tsoukas (2002) proposes the view that tacit knowledge should be studied without the intention to convert it, that tacit knowledge requires a different mechanism to be transferred between individuals than explicit knowledge, and suggests that tacit knowledge may be acquired through forms of socialised actions.

Stenmark (2001) re-iterated that the main issues with identifying, storing and disseminating tacit knowledge are:
(1) Individuals are not aware of their tacit knowledge
Often the way people approach or complete an activity is informed by their own tacit knowledge, without thinking about it, or even recognising it as knowledge. The knowledge resides within individuals and cannot be documented or explained to others in words.

(2) Individuals do not have personal interest in expressing tacit knowledge in a systematic way in order to use it
There is often no need or driver for the knowledge holder to document tacit knowledge, since individuals embody the tacit knowledge and use it without thinking: it is not simply a laborious task, it also has no direct benefit for the knowledge holder. Studies have suggested that forcing work upon people which they have no direct benefit from it often results in failure (Grudin, 1987, as cited in Stenmark, 2001).

(3) Individuals view having tacit knowledge as competitive advantage.

In some cases, the evasiveness of disseminating or systematically documenting tacit knowledge could also be caused by the social competitiveness within the organisation, individuals fearing they may "automate away" their existence in the organisation (Leonard & Sensiper, 1998).

To resolve these issues, the article suggests approaches that do not intend to catalogue an organisation's tacit knowledge but merely provide a platform and incentive for individuals to advertise their tacit knowledge. Knowledge seekers are then able to use the platform to gain access to tacit knowledge holders in the organisation.

Feher and Gabor (2006) examined a large number of knowledge management initiatives in software development companies and summarised that successful knowledge management activities tend to involve a combination of tacit knowledge transfer strategies and explicit knowledge transfer strategies, with the majority of the knowledge transferred through codification. The strategies for tacit knowledge are mainly based on personalisation activities: sharing knowledge through personal interactions, meetings, and conversations. Explicit knowledge is transferred through codifying, documenting and systematically categorising it.

The review by Nonaka et al. (2006) on organisational knowledge creation theory has outlined the progressions in the organisational knowledge creation area, where studies have approached the topic from different epistemologies, attempting to both disseminate knowledge to individuals as well as centralising individual knowledge into an organisational knowledge system. The review highlighted that the variation of knowledge has become a continuous scale with tacit and explicit knowledge on opposite ends, and different conversion methods such as internalisation or externalisation to move knowledge items to different positions on the scale. Internalisation is the process of embodying knowledge within individuals, shifting such knowledge items from being explicit to tacit. Externalisation aims to articulate tacit knowledge, or parts that can be articulated, into

explicit concepts to enable sharing of such knowledge items among members of the organisation.

4.4 Knowledge management in small software development companies

Studies have suggested that companies of various sizes tend to leverage knowledge for different business purposes. Sparrow (2001) suggested that small firms tend to focus their knowledge management projects on expediting efficiency benefits for the firm or enhancing the performance of the business, while larger firms tend to carry out knowledge management projects to exploit new opportunities and innovations.

Sparrow also summarises the main components of small firms' knowledge management projects: the appreciation of individual and shared understanding, where small companies frequently implement knowledge management projects to capture and distribute people's understanding of information, the meaning and interpretation of information or events (Cole-Gomolski, 1997, as cited in Sparrow, 2001); and creating an effective knowledge base and systems – unlike larger enterprises, smaller firms tend to focus more on establishing their knowledge base.

Later studies of knowledge management in the software sector echo these components. Feher and Gabor's (2006) study suggested that the most common knowledge management activities in the software development sector are focused on sharing and reusing existing knowledge, while creating and developing new knowledge is less likely to be attempted through formal knowledge management activities. Other studies have also suggested that when software development firms implement knowledge management systems, there is a common belief that the knowledge sharing initiatives add the most value (Aurum et al., 2007; Kukko et al., 2008). Because knowledge management initiatives usually focus on distributing or transferring existing knowledge, some studies argue that part of the knowledge creation process in software development companies is transformation of tacit

knowledge to explicit knowledge, so that it can be distributed or easily transferred (Pourkomeylian, 2001).

In terms of facilitating the transfer of tacit knowledge in the context of software engineering processes, the findings from this study re-iterated the results of Aurum et al. (2007). In that people who are leading and owning software engineering processes play an important role in enabling the transfer and effective use of tacit knowledge, this leadership and an established organisation-wide knowledge sharing culture are the key combination of accessible knowledge sharing mechanisms. The focus on people and their willingness to share knowledge rather than knowledge management systems is also evident in Desouza's (2004) article: "The biggest obstacle to effective knowledge management is not implementing a cutting-edge IT solution, but getting people to talk and share their knowledge."

5 Methodology

5.1 Choosing a qualitative research design

Knowledge management is widely accepted as a field of practice, and solutions such as knowledge management systems have been widely adapted by many organisations. However, many studies argue that knowledge is contextual and its existence depends on how people use the information made available to them while they perform a specific task, and knowledge management systems merely manage the information (Wilson, 2002; McDermott, 1999).

The same could be said for process centric knowledge audits: although there are a number of knowledge management studies conducted using the process orientated approach (Woitsch & Karagiannis, 2005; Palkovits, Woitsch & Karagiannis, 2003; Fachbereich et al., 2003), there are still very few studies (Maier & Remus, 2003) that are focused on conducting knowledge audits using a process centric approach.

Because of these mixed views, and the lack of studies on process orientated knowledge audits, this research will undertake a post-positivism view and hence be conducted in an exploratory manner, as qualitative research based on semi-structured interviews. The research will acknowledge the possibility that organisations may not require a formal knowledge management system, and the result of the knowledge audit may prove beneficial to the organisation in ways other than being used to implement such systems.

5.2 Choosing a case research approach

This study chooses a case research approach because the knowledge audit is an exploratory exercise. The pre-project process selected for this study is fairly complex and is deeply integrated with the rest of the organisation, and would be hard to study in separation from

its natural setting. Furthermore, because the company has not undertaken any work to look into the knowledge management aspects of the pre-project process and the lack of knowledge management systems in the company, there is no existing framework or structure in place to base any form of questionnaires or models upon. Hence it is best to conduct a single case research as an exploratory study (Bebensat et al., 1984). The study can then shift its focus according to the complexities discovered as the research progresses.

Bebensat et al. (1984) summarised case research as a study examining a phenomenon in its natural setting and meaningfulness, allowing the questions of why, what, and how to be answered with full understanding of the nature and complexity of the complete phenomenon.

Some of the common characteristics of case research, as pointed out by Voss et al. (2002) are:

- The phenomenon is examined in its context
- One or few entities are examined in detail
- The complexity of the phenomenon is studied intensively
- No experimental controls or manipulations are involved
- Changes in data collection methods could take place as the investigation progresses

5.3 Background of the participating company

The company participating in this study is a software development company with 300+ employees. The company has offices in Auckland, Wellington, as well as Sydney. Its portfolio covers online business, information management, enterprise support, agile consultancy services. It offers services to clients in the government, education, and financial, banking sectors.

5.4 Role of the researcher

The researcher is an employee within the participating company, but is reasonably new to the company and has not previously been exposed to the pre-project process. The researcher has performed the business analyst role in previous projects, but has only been involved in projects after they have been established and approved as a result of the pre-project process.

The researcher designed and conducted all five interviews; the interview results were also analysed by the researcher in relation to the literature review. Since the interviews were semi-structured, the researcher made slight changes to the interview questions after each interview, as more information and questions were discovered.

5.5 Data collection

5.5.1 Selection of the process

The study chose the company's pre-project process to conduct a knowledge audit on. This process was selected because of the following attributes:

- It is of significant value to the company's core business
- It is well used; the company discovers and works through new opportunities very often
- It is a dense point of knowledge generation and consumption, and the feedback from the first two interviews confirmed this

The pre-project process spans the period from a new opportunity being discovered by the company, until the company is selected and contracted to carry out a piece of work for the client, forming a project. The process covers activities such as assessing and planning how to engage the opportunity, drafting and presenting proposals, and negotiating the contract that governs the subsequent project.

A new opportunity can be presented to the company either through a formal Request For Proposal process, which the client company may publish on a Request for Proposal platform about its interest in hiring a vendor or a group of vendors to do some specific work, or informally through existing relationships. The person who first becomes aware of the opportunity usually determines whether the opportunity is of a reasonable size to be brought up in the sales meeting to be discussed and assessed. Sometimes if the opportunity has very minimal risk associated with it, and requires only a small resource commitment from the company, it may be responded to without going through the pre-project process. Once a new opportunity is assessed by the sales team, a response team will be formed to create a proposal and present it to the client. Should the client accept the proposed solution, the response team will then enter into a negotiation phase to finalise the contract for a project.

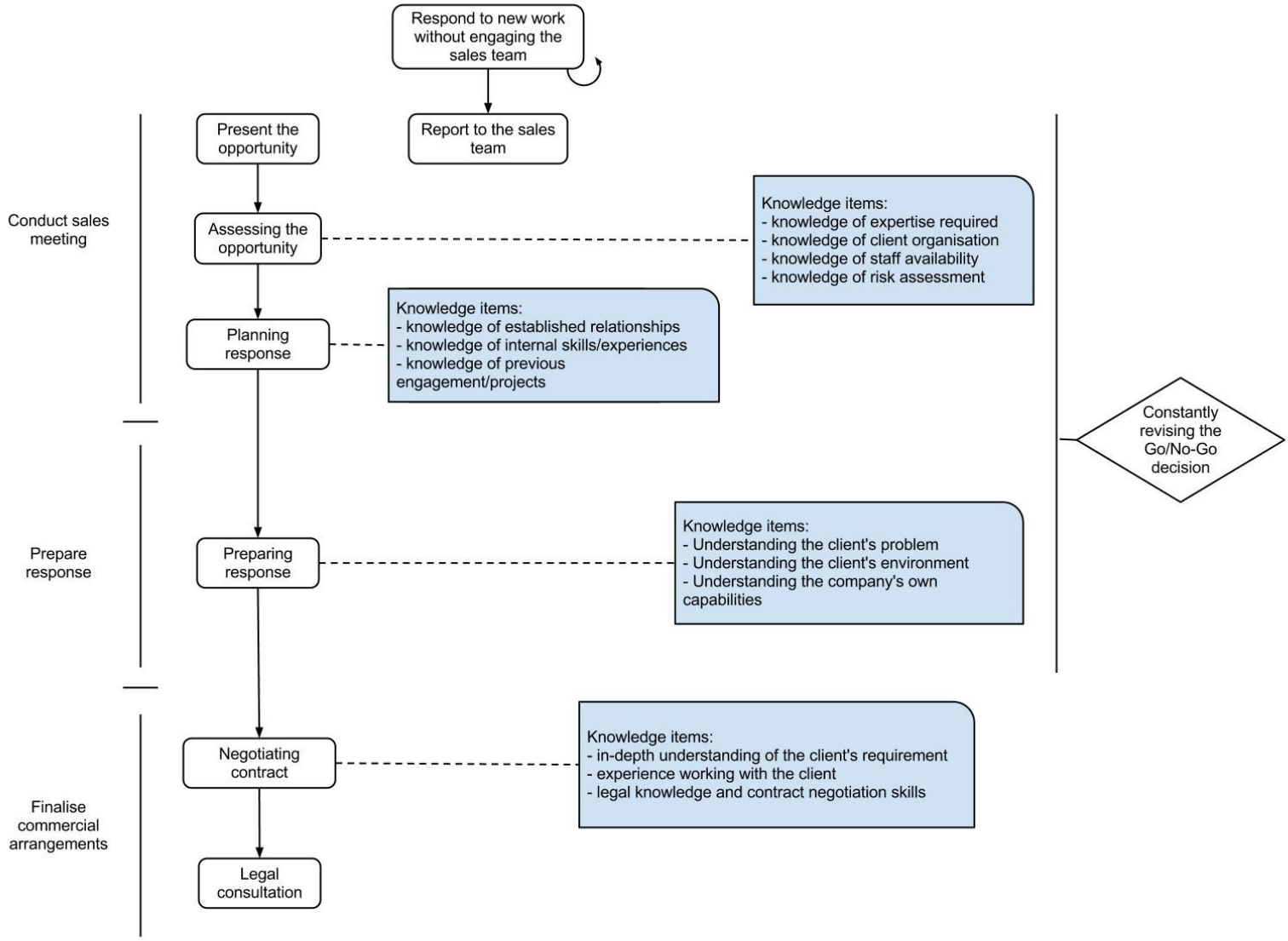

Figure 1 - Overview of the pre-project process

5.5.2 Selection of participants

The study identified five frequent participants in the pre-project process and conducted semi-structured interviews to identify and analyse the following:

- The Knowledge Intensive Tasks (KIT), as described in Woitsch and Karagiannis's (2005) article
- The content of the interviews used the KITs as starting points to identify how knowledge is generated and consumed in these KITs, how they are captured, organised, and formalised, conforming to the first three stages of knowledge evolution defined by Nissen (1999)
- Apart from focusing on the KITs, the interviews also contained questions that prompted discussion of the process as a whole, and how the process moves product or information from one stage to the next; these discussions identified how knowledge associated with the KITs is being distributed, applied or evolved

5.5.3 Interview transcription and validation

To ensure the accuracy of the information recorded, the interviews were transcribed by the researcher in conjunction with the interview notes. The transcriptions were then sent back to the interviewees to verify, providing an opportunity for the participants to identify any inaccuracies.

After the researcher had completed all five interviews and transcribed them, the researcher summarised the information gathered, and carried out the initial analysis. The results of the initial analysis were then organised by the researcher into a formal presentation, and delivered back to the interviewees as a group, giving the interviewees another opportunity to verify the emergent findings.

5.6 Data analysis

The study draws on the common knowledge audit life cycle identified in the literature reviews: the analysis first identified the knowledge needs, how they are being fulfilled, the life cycle of the acquired knowledge, and how technology and processes support knowledge transfer (Serrat, 2008; Perez-Soltero et al., 2006; Maier & Remus, 2003).

The analysis took the interview transcriptions and categorised the comments into:

- what are the knowledge items that are being used by the Knowledge Intensive Tasks identified
- how the company stores these knowledge items in the context of the selected process
- how the company accesses these knowledge items in the pre-project process

The study then examined each of these categories in detail to find common patterns within each category, and documented the findings in the form of Knowledge Intensive Tasks and their knowledge requirements, and how these knowledge requirements are being fulfilled.

The study then discussed the common patterns that emerged from the findings, particularly around how knowledge is being shared within the pre-project process and how the knowledge items can be further categorised.

6 Analysis and interpretation

6.1 Assessing a new opportunity

When a new opportunity is discovered by a member of the sales team, the company will go through a qualifying process to make the go/no go decision. The company makes this decision based on the size of the opportunity and the amount of risk it carries. Usually an opportunity carries high risk if it:

- requires the company to provide a service
- requires the company to invest significant resources to pursue it
- has a number of unknown factors attached, involves unknown technology or client

This assessment generally happens at the sales level: either during or outside the sales meeting, members of the sales team will decide whether enough information is available to make the go/no go decision. If there is not enough information at the time, the sales meeting will usually assemble a team to follow up and acquire the necessary information, and present the findings back to the sales meeting.

Throughout the first two phases of the pre-project process, the company may be constantly revisiting the go/no go decision, as an iterative process, because as the opportunity progresses, new information may become available that reveals the opportunity as unsuitable for the company to pursue, e.g. it may expose the company to greater risks than initially anticipated, or the chance of the company benefiting from the opportunity is very low.

"In general it's a iterative process, there is going to be … especially for larger project, there will be a number of meetings with the client, there is going to be a number of sales meetings that happened in the meantime, each time you advanced your knowledge, so at any point you could say are we keep going with this or not" (Interview 2, 10 November, 2011).

The qualifying task requires a number of knowledge items from different perspectives, but most of these knowledge items are around high level understandings of the opportunity, the context it is presented in, and how it aligns with the company's capabilities.

Knowledge of the client organisation

Required knowledge

This knowledge item is around knowing what the client's organisation does, how it is structured, and what their decision making process is. This also includes knowing the client's budgeting situation. This knowledge item is required throughout the tasks performed in the pre-project process, but the level of understanding required varies. At this stage of the process, only a very high level understanding of the client is required. Members of the sales team will need to understand the goals that the client would like to achieve through the engagement, what their underlying business problems are. This understanding helps the company gauge the amount of work required to understand the client's requirements and provide a suitable solution. Clarity around this area can often help the company make an accurate assessment of the risks involved in the subsequent requirements elicitation process.

It is also important to understand how the client organisation is structured. Members of the sales team usually have experience working with clients from various sectors; with the client's structural information and experience, the company can make a reasonable assessment of the nature of the engagement. This helps answer questions on whether the engagement is politically driven, value based, is the organisation moving to a strategic direction, or are they looking for a tactical cost-saving exercise. This in turn helps the company assess the risk/value of the opportunity accordingly.

Availability of the required knowledge

This knowledge item is retained by senior members of the sales team. It is one of the many tacit knowledge items that have not been externalised. The senior sales team members acquire this knowledge either through their experience of working with particular clients, or by talking to other staff in the organisation that have the experience.

Knowledge of the expertise required

Required knowledge

This knowledge item is about knowing who has the skills and experience to carry out the work required for the client. The company needs to understand the skills and experience of its staff in order to assess how it is placed to engage the opportunity: will the company need to acquire new resources externally, or does it have the staff with sufficient experience to engage the opportunity.

To acquire new resources, the company usually taps into the expertise of its partners, existing relationships, and contractors, or simply recruits new staff. Members of the sales team will need to assess the information available at the time, with knowledge of the various kinds of expertise required in the field to make these decisions, and then assess how they will affect the risk/value of the opportunity.

Should the expertise reside internally within the company, then members of the sales team will need to understand who these experts are, what they are currently working on, and how confident they are with their skills and experience. Members of the sales team will need to use this information to assess whether the company is well placed to engage the opportunity presented.

Availability of the required knowledge

Internal expertise is documented as a set of staff portfolios, and the company encourages staff to update their portfolio as they acquire new skills/experience or certifications. To some degree this knowledge item has been externalised. However the participants pointed out that this is not very well used at the moment, and people tend to just talk to each other in person to find out who has what skills/experience.

Knowledge on internal staff availability

Required knowledge

This knowledge item is about knowing what internal resources are available and for how long. Staff availability is one of the first types of internal resource that the company considers before deciding on engaging in an opportunity. The company needs to have knowledge of not just its internal staff and how busy they are, but also what kind of work they are doing, and what the value of this work is to the company. It requires understanding of the company's current pipeline of work: whose projects are in there, i.e. who the clients are, their value to the company strategically, who is doing them at the moment, and whether there are any potential replacements. From this information, and together with the experience to put it into context, the company can then make decisions on how it is placed from a resourcing perspective, particularly if it is a service orientated opportunity.

It is mostly the responsibility of the delivery manager, who has that knowledge and the experience to extract the required information and provide sound advice to members of the sales team. Most of the experience required to make these judgements resides with the delivery manager as part of his/her tacit knowledge; only a very small portion of the information is externalised or in a state that is ready to be externalised.

Availability of the required knowledge

Staff availability can be determined in two ways. The delivery manager maintains a staff matrix that displays the systematic version of staff members' availability through information extracted from individuals' time sheets which most of the staff update weekly. Outside of that, the delivery manager usually approaches the staff in person to discuss their availability and how they are getting on with their current work.

Experience and knowledge to assess the risk of the opportunity

Required knowledge

This knowledge item is focused on having the ability to assess the opportunity based on the information available. Members of the sales team will need to take the knowledge items mentioned above and apply their own experience to make decisions around the risk/value of the opportunity. These experiences may be from working with the client previously, which helps the company assess the risks of working with the potential client.
"Now that's of course knowledge and familiarity with the people at (client a), we actually build a knowledge of what project managers are like, some project managers are effective, direct in their communication, they only hold a limited number of meetings, they know who's doing what, and keep close eye on things. Other project managers on the other hand can be highly demanding, highly confrontational etc, so you have to in those scenarios put more time in the project to actually deal with that, either counter it or pre-empt it, whatever, so that's more experience feeding into that process." (Interview 5, 14 December, 2011).
The company can also tap into knowledge from other channels, by leveraging existing relationships and talking to other vendors in the industry, and/or partners who have done similar work or have worked with the same client in the past.

Availability of the required knowledge

Most of the participants expressed that in order to assess information from various sources, they need to use their own knowledge to put information into the correct context, and this knowledge comes from experience working with the relevant sector, client, or individual. *"So my decision making is not purely based on hard facts, a lot of it is combination of hard facts and existing knowledge base, understanding and perceptions."* (Interview 3, 25 November, 2011). The knowledge required to make such assessments could be considered at the tacit end of the continuous explicit/tacit knowledge scale (Nonaka et al., 2006), and most participants' comments suggests that it may be impossible to document this explicitly.

6.2 Planning how to respond to a opportunity

After the company assesses an opportunity and has made the decision to pursue it based on understanding of the risk and potential value involved, the next knowledge intensive task is to form a plan on how to pursue the opportunity.

This task mainly revolves around two decisions:

How should we approach the opportunity?
Is the opportunity more suitable for a formal engagement, e.g. through a formal proposal, followed by a formal presentation? Otherwise would it be more efficient to approach this in a more informal manner, e.g. through conversations with the key decision makers, presenting the proposal verbally.

Who should be involved in preparing the response?
This applies to finding out who the company should involve both internally and externally. Internally, the company needs to determine who has the skill/experience required to prepare the response. Externally, the company needs to identify who the key decision makers are in

the client's organisation. Other than leveraging existing relationships in the client's organisation, other people in the industry may also provide valuable information in preparing the response: these may be from partners, or other vendors that the company has worked with previously.

Knowledge of established relationships

Required knowledge

This is about knowing what existing relationships the company has that are relevant to the opportunity – this includes relationships with partners, people in the client's organisation, or other people in the industry. Often one of the questions that the response planning group asks is "who do we know here?" and the company finds this out mostly from community forums in the industry, through partners, distributors and competitors. At this stage of the process, members of the sales team do not usually have all the necessary information to draft an effective response to the client, so one of the most important tasks at this stage is to find out more about the opportunity: including information around who the competitors are, who the key decision makers are in the client's organisation, the nature of the client's previous projects, how they normally operate, and what kind of challenges they have faced.

Availability of the required knowledge

The participants expressed that this information mostly comes from relationships, from talking to the key people in other organisations, from the client, partner, and other vendors. Once the planning group has identified the relevant relationships to leverage, the group will then need to discuss and come up with approaches on how to utilise these established relationships.

"… It's really about relationships, relationships with your client, your partner, your vendor, your stake holders, your competitors, and with internally people in this company, who knows who, who gets to say what." (Interview 3, 25 November, 2011)

Knowledge of internal skills/experiences

Required knowledge

This knowledge item is about knowing who knows what internally, who has previously worked with the client, or understands a particular type of technology. In order to better understand the client's problem or lower level requirements, either through prediction or elicitation, the planning group needs to identify who the best person is internally to help gain this understanding. The company most likely has people who have worked with the client before, who will have some degree of understanding on how the client operates, their needs, and their environment. There may also be people internally who better understand the competition in the business domain, or in the particular technology area, e.g. Content Management, Self-serviced web services etc.

Availability of the required knowledge

The participants mentioned that although this information should be documented in the staff portfolios, and in theory, that should be the place where this information is extracted, often in practice, members of the sales team work in a much more collaborative manner, where the sales team will ask the delivery managers directly to find out who has worked with the client, and what type of work they were doing. Members of the sales team may also approach the staff directly to find out more detailed information regarding their previous involvement with the client.

Knowledge of previous engagement/projects

Required knowledge

To build a stronger case, and to make the response more appealing to the client, the company needs to show its ability to deliver the service, and the most effective way to do this is to showcase successful projects the company has completed previously. This requires not only detailed information about the projects but also how they progressed and were delivered. Members of the planning group need to use their knowledge of previous projects to extract key successful factors from the projects and relate them to the opportunity.

Availability of the required knowledge

The only place to extract this information currently is from previous proposals and relevant project documentation. In most cases, the planning group will need to identify people that have worked in the relevant projects and discuss the details with them directly, to elicit the information required. Again this requires the ability to assess and make judgements on the feedback/information received, to work out how to put that in the context of the opportunity, and present it to the client.

6.3 Preparing a response to an opportunity

Once the company has identified who should be involved in preparing the response, and have put together an ad-hoc team to do so, the team will start preparing the proposal for the client. This may be the most knowledge intensive task in the pre-project process, and it often requires several engagements with the client to tweak the proposal based on feedback from meetings and presentations.

Understanding the client's problem

Required knowledge

This knowledge item is about understanding the client's business point of view, what their problem is and how they would like to address it. The exercise to acquire this understanding is very much a high level requirement gathering task. Often there is a business analyst in the response team, who will be responsible for finding out and documenting the client's problem from a business point of view, without focusing too much on the technology. Information gathered in this exercise will help the team understand the client's intention, i.e. it will help answer questions such as: is the client simply trying to cut down costs in a certain process, is the client trying to re-engineer a process to make it more effective, or is the client wanting to build a new platform to reach new customers?

After the response team has established a firm understanding of the client's problem, they will also need to understand how the client intends to address the problem, in order to draft a proposal that is more aligned with the client's thinking. This is arguably part of the requirement gathering exercise, but it requires domain expertise and experience working with similar business problems.

Availability of the required knowledge

Usually the company will involve a business analyst at the planning stage to start gathering business requirements. Requirements will be documented at a very high level at the start of the process and then refined and documented into detailed requirements as the pre-project process progresses. At the planning stage, knowledge of high level requirements is most likely not documented anywhere; as the opportunity progresses into a proposal, and later

into contracts at the negotiation stage, requirements will be specified and documented in more detail.

Understanding of the client's environment

Required knowledge

From the technology perspective, the response team will need to understand the technology involved, and this is not limited to the technology of the system to be constructed, but may also extend to other existing systems or technologies deployed in the client's environment. This is mainly to help identify risks in working with particular technology, and therefore to help with accuracy of the estimates put into the proposal. Many of the participants mentioned difficulties in having to work with clients that have different systems in place, and the potential integration issues they needed to point out or be aware of when preparing responses.

"One of the biggest challenge with working with (client a) is dealing with the structural and organisational elements, the way they choose to break up operational support, and change delivery there, their business units, their IT, their service desks, the ownership of the application there, are very very fragmented." (Interview 5, 14 December, 2011)

Apart from mitigating risks, sometimes knowledge of other vendors and their products can also be leveraged to build a stronger proposal to the client: the response team can maximise the message that the company understands the client's existing systems, and have established relationships with the client's other vendors, and therefore will be able to deliver better results working with them.

"When we were responding to question in the RFP about how we are going to deliver services, and who's going to own it, who is going to drive it, it's about relating that institutional knowledge about (client a) and how they function and maximising the message that we understand how they work, and we can deliver results based on our history." (Interview 5, 14 December, 2011).

Experiences with a particular type of technology involved or the sector the client is in can also be valuable; this will allow the response team to provide advice to the client at a very early stage of the project, to point out or address the common pitfalls of a particular type of technology or the common anti-patterns the sector or company of a particular culture exhibits when implementing a particular type of technology.

From an organisational culture perspective, the response team will also need to understand, as much as possible, the potential impact of the organisation's culture or history. For instance, some of the participants pointed out that some client organisations may have gaps between their end users' expectations and what the actual implementation allows.
"It's not to say that the people at the end of the process at (client a) don't know what they are talking about, but they often talking about the application as they use it, perceive it, rather than close in-align with how it actually function under the hood, so you have to bridge the gap between what they users think they want, and what the developers actually have to do." (Interview 5, 14 December, 2011)

Availability of the required knowledge

Again, knowledge of the client's environment comes from experience working with the client; the participants' comments suggest that this mainly resides with senior members of the sales team who have worked with the company's clients at the management level and have been exposed to the client's governance structure, political landscape, and how the different systems/technology are integrated.
"… But it tends to be more senior people who has higher level of understanding and much broader understanding, many domains, main different clients, technology so on …"
(Interview 1, 25 October, 2011)
Understanding the company' capabilities includes understanding the company's differentiators in pursuing the opportunity, what the company is good at, the track records that can be used to build a stronger message, and who the company can reference.

Required knowledge

In order to build a stronger case, the response team will need to identify and leverage the company's differentiators through its capabilities. This requires the response team to understand what the company is good at, not just from a technology perspective, but also from a business domain perspective: what type of organisations the company has worked with, what challenges it has encountered, and how they were overcome.

At this stage of the process, previous projects that can be used for reference would have already been identified, and the response team will revise details of these projects to find information that can be used in the proposal: these include details on stakeholders of the project, technology involved, challenges faced, and success factors. The response team will then need to put this information in the context of the opportunity presented.

Availability of the required knowledge

Apart from the information recorded in the previous engagements, the participants expressed that a lot of the knowledge regarding the company's capabilities results from discussions between senior members of the sales team, and is mostly not documented or recorded in any systems.

"…If we have the capability we have done this before. So that type of information in-line with capabilities just take form of case study and people knowing what projects are been done and reference it appropriately, because I am involved with lots of projects and proposals like that, that's how my knowledge to these things falls in. Because I am involved with capabilities, I am involved with managers, I have a lot of that knowledge base …"
(Interview 3, 25 November, 2011)

6.4 Contract negotiation

After the client has accepted the proposal, the company goes through a negotiation process with the client to work through the financial details of the contract. The contract negotiation task involves fine tuning estimates, discussing and agreeing on project costing (time and material or fixed cost), or whether to implement the project in stages rather than in just one deliverable.

In-depth understanding of the client's requirements

Required knowledge

In order to be able to negotiate the detailed costing for the project to fit the client's budget, members of the sales team need to have more detailed understanding of the client's requirements, and judging the quality or precision of the requirements gathered at this stage of the process, members of the sales team can then forecast challenges in the project to come, and put in necessary caveats accordingly.

In addition to the detailed requirements gathered, members of the sales team also need to make use of their project management experience to assess the nature of the project, to come up with reasonable contingencies and communicate them to the client.

Availability of the required knowledge

At this stage of the process, in most cases, the requirements are already well documented, and widely communicated among the group involved in working on the opportunity and the upcoming project.

Experience working with the clients

Required knowledge

The negotiation process usually goes much more smoothly if the company already has relationships established with the client through previous engagements. In these cases, both parties can build upon their trust in each other, taking risks they otherwise would not, reducing unnecessary processes from both sides, and focusing their efforts on project delivery.

Availability of the required knowledge

Often these relationships reside with a very few senior members of the sales team, who will most likely be actively involved in the negotiation process. This is also why knowledge around client relations and the client environment are rarely externalised, because they are generated and used by the same people over a long period of time.

Supporting knowledge

Apart from the domain specific knowledge, it is also obvious that contract negotiation requires some degree of legal and contractual negotiation knowledge/skills. The company has an on-going working relationship with a legal consultant company to review its contracts in order to mitigate unwanted legal risks. As for contractual negotiation skills, the participants suggested that senior members of the sales team are very well equipped in this regard.

7 Discussion

7.1 Knowledge sharing mechanism

People involved in the pre-project process tend to work very collaboratively internally. Most of the knowledge required is gathered by the proposal or sales team members talking to people internally in person. The sales person or person responsible for the opportunity then takes the various feedback they received and use his/her own experience to triangulate and form their own view, and make decisions based on the triangulation. Hence staff managing the opportunity are often required to have a certain level of technical and domain knowledge to make the correct judgements regarding how best to use the advice they received from others.

"I mean people are very good at the company, very honest, but a lot people are very good thing, but they have perception about what they do. So if you coming in and telling them don't do this but do that, they may tell you that they don't want to do this. So on one hand they may tell me they don't want to do it, or on the other hand they may tell me we don't do it. So I will have to make a decision, and generally I don't make that in isolation. If I think this is strange I go and ask" (Interview 3, 25 November, 2011).

The participants' comments also suggest that this approach currently works very well, and this is mainly due to the knowledge sharing culture within the company.

"(The company) is generally very communicative, so I may go off to (person r) and say 'hey have you ever run into this issue before' and he will tell me 'yeah, and this is how you resolve it'" (Interview 3, 25 November, 2011).

This conforms to what Tsoukas (2002) pointed out in his study: that tacit knowledge is best distributed and transferred through social interactions. It is also important to note the uniqueness of the company's knowledge sharing culture, particularly staff's willingness to share tacit knowledge. This is contrary to Stenmark's (2001) observation that individuals are usually very reluctant to share or even become aware of their tacit knowledge without some form of incentive and platform to help them discover their tacit knowledge.

7.2 Categorisation of the knowledge required

Because there is a considerable amount of cross overs between the knowledge items identified in the four knowledge intensive tasks, to help visualise and understand the most important knowledge areas and how the importance shifts throughout the pre-project process, the knowledge items for each of the tasks are categorised as follows:

Assessing a new opportunity

Knowledge of the client: knowledge of the client organisation at a very high level

Knowledge of internal resources: knowledge of the expertise required, knowledge on internal staff availability

Knowledge of the company's capability: very minimal at this stage, enough to identify opportunities that do not fit the company's portfolio

Knowledge of the context of the opportunity and the technology involved: very minimal, there is not much technology or domain knowledge required to assess a new opportunity

Planning how to respond to an opportunity

Knowledge of the client: knowledge of established relationships with the client

Knowledge of internal resources: knowing the right people to involve in drafting the proposal

Knowledge of the company's capability: knowledge of previous engagements/projects, to help identify how it should be involved

Knowledge of the context of the opportunity and the technology involved: again very minimal at this stage

Preparing a response to an opportunity

Knowledge of the client: need more detailed understanding of the client's problem, and the client's environment, how they aim to solve the problem, knowledge to relate information such as business requirements to the right context

Knowledge of internal resources: minimal at this stage, since the required resources would have already been locked in to work on the opportunity
Knowledge of the company's capability: need detailed understanding of the company's capabilities, to relate them to the opportunity, and articulate to the client in the proposal
Knowledge of the context of the opportunity and the technology involved: requires rich domain knowledge and experience with the relevant technology to make sure that the proposal is focused

Contract negotiation
Knowledge of the client: in-depth understanding of the client's requirements to provide accurate estimates
Knowledge of internal resources: has fair understanding of the resource forecast to provide accurate estimates that cover possible down time, or allow discounts for strategic opportunities
Knowledge of the company's capability: very minimal at this stage, as the project has already been secured
Knowledge of the context of the opportunity and the technology involved: some understanding of the sector and technology is required, to ensure that estimates provided allow for uncertainty/certainty associated with the sector or technology

As the categorisations suggest, most of the knowledge used throughout the pre-project process seem to be centred around the client; throughout all four knowledge intensive tasks, consumption of client related knowledge items increases as the process progresses, unlike the other knowledge items that are only required by one or two tasks throughout the whole process.

The second most useful knowledge is the understanding of the company's own capabilities and the ability to relate them to each unique opportunity, and articulate that to the client through proposals. The less used knowledge items are around the context of the opportunity and technology involved, and understanding of the company's own resources.

This coincides with the participants' comments around how the company is very client focused, and because a lot of the company's business is service oriented, each project has to be so tailored to suit the client's needs.

7.3 Further questions

What does the company learn from successful or unsuccessful proposals?

Throughout the study, none of the participants mentioned what happens when the company did not secure an opportunity; the company does not seem to officially review unsuccessful attempts. This is again confirmed in the feedback presentations, when one of the participants expressed the lack of activities in this area in the pre-project process. This is not limited to unsuccessful proposals: even for successful proposals, there is no formal process or planned series of tasks put in place to reflect on and document the lessons learnt in the pre-project process. The consequence is less apparent in this case, because when the opportunity is turned into a project, and a successful one, it becomes a potential reference for the company and is reviewed and may be documented as such.

How does the company maintain its knowledge sharing mechanism after significant expansion?

The majority of the company's knowledge items used and created in the pre-project process are not formally documented in any systems, apart from some of the knowledge around staff availability and their skills/experience, which are documented in the availability forecast system and the staff profiles. This conforms to the result of Sparrow's (2001) study that small companies tend to have externalised knowledge to increase efficiency and performance, but rarely use knowledge to discover new opportunities and innovations. The knowledge items that are required to discover new opportunities or spark innovations are mostly tacit, experience based knowledge culminated over a long period of time, e.g. the

knowledge of the client's environment required to prepare the response. At the moment, to transfer and distribute this type of tacit knowledge, at least in the pre-project process, the company relies heavily on its knowledge sharing mechanism, which is based on its open collaborative working culture. In other word, the company relies on people's willingness to talk about the challenges they are facing and share the lessons learnt in their own experiences in person and each individual's ability to assess and use the feedback they received for triangulation.

As the company continues to grow and expand into overseas markets, this knowledge sharing mechanism that is heavily based on face to face communication and individuals' ability and judgement to put the information into context may no longer function as effectively, simply due to the geographical distances (Tillema et al., 2010). Whether this will cause a significant problem in how the organisation transfers and distributes tacit knowledge, and in turn, how it continues to use this tacit knowledge to explore new opportunities, are still to be discussed.

7.4 Implications

7.4.1 Implications for practitioners

Results of the knowledge audit contribute to the company's understanding on the current state of knowledge within the pre-project process, on what knowledge is required, how it is created, transferred and used. Based on this understanding, the company can then decide on how it may implement any knowledge management initiatives. Because the knowledge audit is focused on one particular business process, it also helps the company to map the potential value of the knowledge management initiatives to the business value of the process.

7.4.2 Implications for further research

From an academic perspective, this study contributes to the body of knowledge on knowledge audits, process based knowledge management. This study can also be viewed as a case research on knowledge management in small software development companies. The knowledge needs identified in this study re-enforces the view that knowledge sharing initiatives adds the most value for small software companies (Aurum et al., 2007; Kukko et al., 2008).

The knowledge sharing mechanism identified in this study could be further studied to gain insights on how tacit knowledge can be shared in a small company, as the mechanism contradicts with the popular view that tacit knowledge is hard to disseminate without first establish personal incentives to do so (Stenmark, 2001).

8 Conclusion

This report details the outcome of a process oriented knowledge audit carried out on a New Zealand medium sized software development company's pre-project process, the process that covers how the firm works through an opportunity to secure a project. The knowledge audit was conducted to identify the key knowledge items required at each stage of the process, and how these knowledge items are stored and retrieved.

Analysis of the findings also categorised the knowledge items into knowledge of the client, knowledge of internal resources, knowledge of the company's own capability, and knowledge of the context and technology. Through this categorisation, the study was also able to determine the density of knowledge required in different stages of the process, and concludes that the most important knowledge area throughout the pre-project process is around understandings of the client.

The report also poses further questions around the absence of feedback mechanisms to formally gather knowledge generated during the pre-project process, and the potential challenges faced by the company in maintaining its current knowledge sharing mechanism during and after the company's expansion.

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