Management of Knowledge & Experiences in Project Management Companies

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- A way of using knowledge within the construction industry

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PREFACE

This research could not have been conducted without the support of a number of people, to whom we wish to express our sincere thanks.

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ABSTRACT

Being able to create, maintain and disseminate knowledge and experiences is becoming increasingly important for project management companies in order to achieve a competitive advantage. Most knowledge exists only in the minds of individual participants and an organisation can not create knowledge or learn by itself. Instead it supports creative individuals or provides contexts in which they can create and transfer knowledge. The idea with knowledge management (KM) is that knowledge can be reused and shared among engineers and experts in an organisation in order to improve the construction process and reduce the time and cost of solving problems. The aim of the thesis is to suggest key issues for a technical consultant organisation in regard to KM and its work procedures. Furthermore, this study addresses KM issues concerning organisational as well as technological aspects in project management companies. Four project management companies in Gothenburg were selected and at each company three semi-structured interviews were conducted. Results were obtained through an analysis and evaluation of responses and then compared to the frame of reference. Six key issues were established; mentoring, meetings for knowledge dissemination, organisational aspects, IT, creating the right climate and age gap. Mentoring is the most efficient, rapid and natural way of introducing a junior engineer into the company and projects. Interaction between individuals is the best way of sharing knowledge therefore having meetings for knowledge dissemination is essential. A flat organisation is advocated, as it will improve communication between individuals in the organisation. IT is a crucial part in managing knowledge and experiences. Without the right work climate, sharing of knowledge will not occur and becomes therefore an important issue for employers. Age gap is considered a problem in the trade, employing junior engineers and educate them in the profession is the only remedy.

Keywords: knowledge management, knowledge sharing, project manager, construction

SAMMANFATTNING

Ett stort antal projektledningsföretag arbetar med knowledge management (KM) för att ta tillvara på kunskap både inom den egna organisationen samt hos externa aktörer för att gynna såväl kunder som aktieägare. Iden med ett väl implementerat KM system är att minimera tid och kostnader för att lösa problem, förbättra kvaliteten på tjänster och lösningar samt att inte göra om gamla misstag. För att kunna konkurrera i kunskapsintensiva branscher, så som denna, måste företagen effektivt kunna skapa, använda och sprida kunskap. I det dynamiska klimat som projektledningsföretag arbetar i är de företag som kan hantera sin kunskap bäst, mest konkurrenskraftiga.

Detta examensarbete är en studie av hur projektledningsföretag i Göteborg kan förbättra sin hantering av interna och externa kunskaper och erfarenheter, detta för att förstärka sin position på arbetsmarknaden. Syftet med examensarbetet är att identifiera nuvarande problem hos projektledningsföretag med avseende på hur de skapar, behåller och sprider kunskap inom organisationen. Vidare syftar examensarbetet på att identifiera hur kunskaps sprids mellan äldre erfarna medarbetare och yngre medarbetare, detta för att så fort som möjligt få in dem i organisationen och arbetet. Målet med examensarbetet blir då att lämna förslag på nyckel områden gällande KM som arbetssätt vilka har framkommit under arbetets gång.

Problemen med projektledningsföretag är att de anställda projektledarna uteslutande arbetar i temporära projekt samt att de ofta är lokaliserade på projektkontoren och är därmed sällan på företagskontoret. Vidare bygger projektledning mycket på erfarenheter och personligt nätverk av projektörer, kunder, andra projektanställda med flera. Detta är svårt att dela med sig av och det tar lång tid att etablera vilket gör det svårt för nyanställda att fort göra nytta för företaget. Ytterligare ett problem med projektledningsföretag är att anställda slutar av olika anledningar. Detta minskar inte bara mängden kunskap i företaget utan även antalet kunder, eftersom många uppdrag fås genom personliga kundkontakter. Konjunktursvängningar har också bidragit till en sned åldersfördelning inom branschen, med en övervikt av äldre medarbetare. Om inte detta problem lyfts fram och företagen rekryterar nya medarbetare som kan lära sig av de äldre, innan de går i pension, kommer många års erfarenheter och mycket kunskap att gå förlorad.

För att belysa de ovanstående problemen och svara på syfte och mål har en studie utförts med litteraturstudier, intervjuer och en analys av detta. Den empiriska studien bygger på de anställdas upplevelser av hur företagen arbetar med KM frågor och det är dessa upplevelser som har utvärderats. Den skall därmed inte betraktas som en expertutvärdering. Intervjuer har genomförts med medarbetare på fyra projektledningsföretag i Göteborg där tre personer på varje företag intervjuades. Som komplement till detta intervjuades tre kunder till dessa företag för att få deras syn på problemen.

KM kan ses som en process att få rätt kunskap till de rätta personerna i rätt tid för att ge de största fördelarna till organisationen (Sverlinger 2000). Wiig (1993) föreslår följand fyra viktiga punkter när det gäller hantering av kunskaper och erfarenheter: (1) för att

behålla en ledande position måste företag lägga vikt på att skapa, förvärva och utveckla konkurrenskraftig kunskap, (2) organisationen måst skötas smart och effektivt det vill säga tillhandahålla kvalitetstjänster med minst möjliga ansträngning och med största möjliga kundnöjdhet, (3) öka förmågan att hitta nya affärsmöjligheter genom att skapa kunskap och belöna innovationer inom företaget, (4) företagen måste göra en tydlig granskning av företagets kunskapstillgångar.

När det gäller KM aktiviteter är det viktigt att förklara för medarbetarna att detta inte leder till mera arbete utan istället skall detta leda till mindre arbete, snabbare analys, beslut och verkställande. Vidare är det viktigt att förstå att KM inte är en tilläggsfunktion i organisationen utan det skall vara en pågående process utan att göra arbetet mer tidskrävande eller svårare.

Abell och Oxbrow (1999) säger att man inte kan sköta eller styra kunskapen i sig. Det man kan göra är att skapa en miljö eller ett klimat som optimerar kunskap, skapar kunskap, uppmuntrar medarbetare att dela med sig av sin kunskap och förespråkar att arbeta i team. För att skapa denna miljö och detta klimat är det framförallt tre områden som måste komma i fokus: förbereda organisationen, styra kunskaps tillgångar och sprida kunskapen inom organisationen. Dessa tre områden måste kontrolleras samtidigt vilket i sin tur kräver ledarskap, förmåga att arbeta i team och förmåga att förstå informations- och kommunikationsteknologier.

Människor är ovilliga att gratis dela med sig av det de har lärt sig till andra och en lösning på detta är att introducera belöningssystem för att få medarbetare att dela med sig av sina erfarenheter (Coleman, 1999). En viktig del i att få medarbetare att dela med sig av sin kunskap är att man måste få dem att förstå att de inte förlorar något på detta och att de inte komprometterar sin ställning i företaget. En förusättning för detta är att förtroende mellan medarbetare och ledning är en del av företagets kultur, utan förtroende kommer ingen kunskapsspridning att ske. Quinn, Baruch och Zien (1997) säger vidare att hemligheten till belöning av lärande och kunskapsspridning är:

> ➢ Ta bort hinder för lärande inklusive de rutiner som belönar oförändrat läge och befordran baserat på hur länge man varit i företaget.
> ➢ Ge möjlighet till lärande med hjälp av delad kunskap eller rotation inom arbetsplatsen.
> ➢ Ge möjlighet till att kunna påvisa lärande, metoder och utförande.
> ➢ Erkänna lärande.

Belöning kan utrycka sig i både i finansiella och icke finansiella former, så som pengar, erkännande, ledighet, befordran och utveckling.

IT blir mer och mer viktigt för KM inom byggbranschen, dock har branschen inte riktigt ännu förstått den fulla nyttan med IT. Eftersom byggande är uteslutande projektbaserat är risken stor att teknisk- och specialistkunskap går förlorad från det ena projektet till det andra. Detta i sin tur försämrar en organisations möjlighet att utveckla ny kunskap och nya idéer. Egbu och Botterill (2002) är av åsikten att IT kan vara av stor hjälp, men

företagen bör införa IT-verktyg för ett specifikt syfte och inte införa IT som ett generellt verktyg.

Under studien framkom att viktiga områdena när det gäller att skapa, behålla och sprida kunskap och erfarenhet inom projektledningsföretagen är: *mentorskap, möten för kunskapsspridning, organisatoriska aspekter, IT, arbetsklimat och åldersglapp.*

Mentorskap är det mest effektiva, snabba och naturliga sätt för att introducera yngre medarbetare i företagets rutiner, projekt och för kunder och bör därför införas av varje företag. Det är författarnas åsikt att yngre medarbetare bör arbeta med sin mentor under sitt första projekt för att utveckla en bra relation och förtroende. Det är dock viktigt att låta den yngre medarbetaren arbeta med flera projektledare för att se olika synsätt på arbetet. Vidare måste mentorn förstå att mentorskapet kommer med vissa förpliktelser så som att vara tillgänglig och fungera som stöd. Mycket av lärandet inom projektledning får man genom att jobba i projekt, detta gör det viktigt att motivera för kunden varför man ska ta med en biträdande eller assisterande projektledare d.v.s. kundnyttan måste visas.

Det mesta av informations- och kunskapsutbytet sker genom interaktion mellan människor, problemet är att projektledning är ett mycket individuellt yrke där man arbetar på olika projekt och ofta lokaliserade på olika projektkontor. En konsekvens av detta blir då att ledningen måste skapa organiserade *möten för kunskapsspridning* mellan kolleger. Dessa möten får dock inte vara för frekventa då de kan uppfattas som en belastning utan de måste betraktas som viktiga, vara väl förankrade i organisationen samt vara välplanerade. Under dessa möten kan t.ex. en projektledare berätta om sina projekt, dess medgångar och motgångar, förväntade problem, lösningar etc. vilket i sin tur skapar frågor och då även en diskussion.

För att stödja kunskapsutvecklingen i ett företag finns det vissa *organisatoriska aspekter* att beakta. Organisationens struktur bör vara så platt som möjlig för att underlätta kommunikationen både mellan medarbetare/medarbetare och mellan medarbetare/ledning. En platt organisation lämnar dock inget utrymme för befordran, som belöning för att dela med sig av kunskap, utan detta uttrycker sig i att få leda större projekt. Dock bör hantering av större projekt baseras på den anställdes kompetens och inte på hur mycket kunskap som sprids. Övriga belöningar för främjande av kunskapsspridning är ett alternativ men det blir då nödvändigt att kunna mäta detta rättvist. Arbetsplatsen bör även utformas och planeras så att den möjliggör en hög grad av informationsutbyte och erbjuder de anställda många möjligheter till både formell och social interaktion. Ytterligare en organisatorisk aspekt är att dela in arbetet i projekt, vilket görs idag, men de bör bemannas med team istället för med individer. Detta för att kunskap sprids bäst mellan de personer som har ett gemensamt mål.

Som nämndes tidigare får *IT* en mer och mer betydande roll inom byggbranschen. Ett företags intranät är ett effektivt forum för att lagra och sprida kunskap inom företaget. Några förutsättningar för att få nytta med det och ett effektivt användande är att det skall vara driftssäkert, uppdateras regelbundet, tydligt, tillgängligt oavsett var man befinner sig

samt enkelt att använda. Intranätet bör vara uppbyggt på ett sådant sätt som gör det möjligt att söka på specifika referensprojekt eller anställda med specifik kompetens. Referensprojekten bör inte vara skrivna som en berättelse, det som kan misstolkas måste minimeras samt de måste vara objektiva. När intranätet designas måste utgångspunkten vara de som skall använda det och inte systemet i sig.

Arbetsklimatet och vi-känslan inom företaget är av största vikt för kunskapsspridning och lärande och det är upp till ledningen att åstadkomma detta. Ett projektledningsföretag är speciellt utsatt för detta eftersom medarbetarna oftast skapar vi-känslan med projektorganisationen och inte med företaget där de är anställda. Det finns flera sätt för ledningen att förbättra vi-känslan så som ge bra lön, skapa en tillfredställande arbetsmiljö, ge förmåner, möjliggöra personlig utveckling, visa uppskattning, ge anställda möjlighet att påverka sin arbetssituation och anordna sociala aktiviteter.

Åldersglappet inom branschen pratas det mycket om men om det kommet att bli ett problem för teknikkonsulter i framtiden eller inte går ej att förutsäga. Denna studie visar på att det inte kommer att bli ett problem för teknikkonsultföretagen om man planerar för det och nyanställer kontinuerligt. Det finns fortfarande tid till att lära upp yngre medarbetare innan de äldre medarbetarna går i pension, det blir dock viktigt att de äldre tilldelas tid till detta. Studien visa även att vissa kunder känner ett visst ansvar för återväxten inom branschen, samtidigt som det ligger i deras intresse att teknikkonsultföretagen har kompetent personal.

TABLE OF CONTENTS

1 INTRODUCTION

This master thesis was initiated by Ramböll Project Management, a subsidiary within the Ramböll group. During the last years the company has come to realise the benefits of being able to maintain, create and disseminate knowledge throughout the organisation thus becoming more competitive. This is not only an issue relevant for Ramböll thus focus has not been on any particular organisation but the entire branch of trade.

1.1 Background

Knowledge is a primary asset of customer-oriented organisations and emphasis should be placed on its integration within the organisation. A vast number of organisations are engaged in knowledge management (KM) efforts to leverage knowledge both within their own organisation as well as externally to benefit their stakeholders and clients. The idea is that a well implemented knowledge management system will hopefully reduce the need to refer explicitly to past projects, diminish time and costs of remedying problems and improve the quality of solutions. If experience and knowledge are shared instead of retained, same or similar problems do not need to be repeatedly solved. Shin (2004) argues that a vast number of organisations still face serious problems in managing knowledge such as; difficulties in capturing tacit knowledge, lack of KM policies, lack of methods for mapping knowledge and knowledge overload.

In order to compete in knowledge-intensive industries, such as technical consultant organisations, an organisation must continuously create, utilise and disseminate new knowledge. In the dynamic environment in which most firms operate, those capable of producing a continuous stream of new knowledge are best positioned to achieve competitive advantage (Fong, 2003). Knowledge-creating skills are of paramount importance as they are required to create new processes or products or improving already existing ones. Learning must also be integrated with current tasks to develop and preserve knowledge for future organisational needs (Jacobsen and Thorsvik 2002).

1.2 The problem

As it is today, the main problem for a project management organisation is to create, disseminate and maintain knowledge within the organisation. To ensure a high level of knowledge is imperative in order to remain competitive in the industry. A well established manufacturing company will not experience the same problem since they are not equally dependent upon well educated and experienced employees instead they are dependent on the product and the brand. However, this is not entirely applicable for knowledge based companies as the knowledge of the employees constitutes the company and therefore the brand i.e. a project management company sell a service which is very individual while a manufacturing company sell mass produced products. A diminished amount of knowledge i.e. employees quit, will seriously compromise their competitiveness. Project management companies are especially prone to these problems since their kind of work distinguishes according to the following items:

> ➤ A project manager is usually working in temporary projects located on site and is therefore seldom at the office. This makes it difficult to disseminate knowledge and experience within the company. The problem is further escalated as project managers usually base their work on past experiences, which takes time to amass, thus using tacit knowledge which is more difficult to disseminate.

> ➤ A contemporary problem is that project managers quit their job at the larger consulting companies of various reasons. This will put the company in quite a predicament as it will not only lessen the amount of knowledge within the organisation but also diminish the number of clients available to the organisation. People quitting from organisations is nothing uncommon and is a process which every organisation is subjected to. The reasons for quitting varies but most common are retirement, that project managers prefer to work alone because it offers more options at the same time as it is considered a challenge, the project manager changes branch of trade or higher salary.

> ➤ The business cycles contribute to two major issues. Firstly, the recent recession has contributed to a large age difference and has created an organisation which consists of more or less exclusively senior engineers. Consequently, the senior engineers will not be able to share their knowledge to the newly employed. This issue have to be dealt with and planned for as early as possible since it is a time consuming process to educate and train junior engineers at the same time as one has to be able to motivate for the client why a junior engineer should participate in projects. Secondly, it is not economically viable to maintain the same amount of employees within the organisations in times of recession. Hence, the problem for the management is to find the right balance between employees and sub-consultants. The problem is further escalated since the balance is not constant but changing in the same pace as the business cycles.

1.3 Aim and objective

The aim of the thesis is to *suggest key issues for a technical consultant organisation in regard to knowledge management and its work procedures*. The issues are based on the problems and considerations of organisational as well as technological aspects.

The first objective of this thesis is to identify current problems within project management organisations regarding their management of knowledge i.e. how the companies create, disseminate and maintain knowledge and experiences. Secondly, the thesis tries to identify how the companies transfer and ensure transference of knowledge from senior engineers to junior engineers as well as the organisation and thereby bridge the gap of the age distribution that is so apparent in today's construction industry.

1.4 Structure of the thesis

Chapter one, this chapter gives an introduction to the study by providing background, goals and limitations. Chapter two bring up the frame of reference for this thesis. In the

beginning of this chapter we explain the concept of knowledge management. After that we explain why knowledge management should be integrated into the daily work and why it should be anchored to the strategy of the company and at the end issues like how knowledge management should be implemented and what types of challenges can be expected. Finally, organisational aspects are discussed. Chapter three describes our work procedure and the methods used in this thesis. Chapter four presents the result from the empirical study. In chapter five we discuss the outcome of the empirical study and compare it to the frame of reference at the same time as we add our opinions. Finally in chapter six conclusions are drawn and recommendations are suggested.

2 FRAME OF REFERENCE

This chapter introduces the concept knowledge management and its definition. Furthermore, by the aid of existing literature it presents a theoretical background to the main issues of knowledge management. This chapter also introduces the professional service organisation and how it is affected by knowledge management.

2.1 Knowledge and Knowledge Management

There are many types of knowledge available in an organisation, and many different ways to think about knowledge. All organisations require a specific type of knowledge and this will determine the profile of the employees, the systems they use and the training they receive. The risk in professional service organisations is that employees with valuable knowledge leave the organisation. Because of this it is important for the management in the organisation to have a deep understanding of these issues and that they work with knowledge management processes (Brooking, 1999). However, knowledge management is not the only way to managing knowledge, it is only one alternative among many relevant perspectives and approaches. Instead it should be considered, when used in practise, to provide a possible and valuable way to deal with knowledge in an organisation and it is necessary to be both flexible and alert in this area (Wiig, 1993). This section aims at presenting an interpretation on knowledge and knowledge management.

2.1.1 Knowledge

Brooking (1999) states that many people incorrectly use the words data, information and knowledge interchangeably thus it is easy to be confused about the meaning. Data is for example facts, images or sounds while information is organised data. Furthermore, Brooking (1999) defines knowledge as information in context, together with an understanding of how to use it. Unlike traditional factors of manufacturing, knowledge is intangible and embedded within individuals and may therefore be difficult to locate, make use of and easily lost (Fong, 2003). However, when reading knowledge management literature the writers use many different definitions on knowledge, see Table 1. The definition given by Nonaka and Takeuchi (1995) is the most common in today's knowledge management litterateur and consistent with the working definition of knowledge used in this thesis.

Table 1. Various definitions of knowledge

Author	Definition of knowledge
Davenport and Prusak, (1998), p. 5	*A fluid mix of framed experience, values, contextual information, and expert insight that provides a framework for evaluating and incorporating new experiences and information.*
Nonaka and Takeuchi, (1995), p. 58	*A dynamic human process of justifying personal belief toward the truth. Knowledge is created by the very flow of information, anchored in the beliefs and commitment of its holder. Knowledge is essentially related to human action.*
Sanchez and Heene, (1997), p. 4	*Knowledge is the set of beliefs held by individuals about casual relationship among phenomenon.*
Wiig, (1995), p. XVIII	*Knowledge consists of facts, truths and beliefs, perspectives and concepts, judgments and expectations, methodologies and know-how. Knowledge is accumulated and integrated and held over a longer periods to be available to be applied to handle specific situations and problems.*

To improve, organisations must continually acquire and create new knowledge and put it into use. They constantly need to learn, exploit what they have learned and make sure the new knowledge is made available to all relevant employees as swiftly as possible and with ease (Fong, 2003).

2.1.1.1 Tacit and explicit knowledge

In Nonaka and Takeuchi (1995), knowledge is classified according to its accessibility and categorised into the two type's tacit respectively explicit knowledge. Tacit knowledge is knowledge of experience (body skills), simultaneous knowledge (here and now) and analogue knowledge (practice) and difficult to express and can not be documented in formal language. Explicit knowledge is knowledge of rationality (mind), sequential knowledge (there and then) and digital knowledge (theory) and can be expressed in formal language and therefore stored, shared and effectively applied. To distinguish between these two is imperative because each must be managed differently. Beckman (1999) states that instead of two there may be three stages of knowledge accessibility: tacit, implicit and explicit. Implicit knowledge is accessible through querying and discussion, this kind of informal knowledge must first be located before it can be communicated.

2.1.1.2 Conceptual levels of knowledge

Usage of knowledge depends on how it is organised and perceived. Wiig (1993) states that knowledge is arranged and applied in four conceptual levels and they are essential when trying to understand what happens when people use knowledge, how much they

know and which kind of knowledge is required for different tasks. The four conceptual levels are:

1. *Idealistic knowledge:* Some of this knowledge is well known and explicit since people work with it consciously. But most of it is visions, goals and beliefs, which is not well known. This knowledge is tacit and only accessible subconsciously.
2. *Systematic knowledge:* This is theoretical knowledge of underlying systems, general principles, and related problem-solving strategies it is largely explicit and well known.
3. *Pragmatic knowledge:* Decision-Making knowledge is practical and mostly explicit since it is often based on scripts that are well known.
4. *Automatic knowledge:* Knowledge so well known that it is automated and most of it has become tacit.

2.1.2 Knowledge Management

Knowledge Management is a relative new concept and it was according to Beckman (1999) introduced by Karl Wiig at a Swiss conference in 1986. Over the years knowledge management has appeared under different names but recently has the term knowledge management become widely used. However, when it comes to concepts like this it is hard to find a clear, well-established definition. But many writers in the subject see it as a process of getting the right knowledge to the right people at the right time in order to bring the greatest benefit to the organisation (Sverlinger 2000). In Table 2 a number of definitions of knowledge management are stated. The definition in this master thesis is consistent with the one stated by Sverlinger (2000).

Table 2. Definitions of knowledge management

Author	Definition of knowledge management
Wiig (1997)	KM is the systematic, explicit, and deliberate building, renewal, and application of knowledge to maximise an enterprise's knowledge-related effectiveness and return from its knowledge assets.
Hibbard (1997)	KM is the process of capturing a company's collective expertise wherever it resides – in databases, on paper, or in peoples head – and distributing it to wherever it can help produce the biggest payoff.
O'Dell and Grayson (1998)	KM applies systematic approaches to find, understand, and use knowledge to create value.
Van der Speek and Spijkervet (1997)	KM is the explicit control and management of knowledge within an organisation aimed at achieving the company's objectives.
Sverlinger (2000)	KM consists of all initiatives an organisation undertakes to create and transfer knowledge.

According to Wiig (1993) there are four items that are particularly important when managing knowledge: (1) in order to stay in leading position, efforts to create, acquire, and develop competitively important knowledge is essential; (2) the organisation must be operated smart and effective by managing the knowledge on a daily basis e.g. deliver high quality services to the highest customer satisfaction with least effort required; (3) increase experience and the ability to find new business opportunities by creating knowledge and promote innovation within the organisation; (4) the organisation have to get an explicit survey of knowledge assets within the organisation.

2.2 Why using KM?

According to Wiig (1999), the reasons for accepting KM are practical and basic. KM will enable and motivate employees as well as the organization itself and provide an opportunity to act intelligently and thereby ensure success through proficient performance. Wiig (1999) advocates KM to be the systematic and explicit management of knowledge-related activities, practices, programs and policies within an organisation. What the management has to understand is that KM is not only a technology, it is not only a set of explicit and systematic activities and it is not only a patent method to increase economic value to the organisation. Instead, KM is an effort to make the organisation aware of the benefits of knowledge. Wiig (1999) further states that two aspects of KM can not be emphasised enough. The first is that KM activities normally do not lead to more work. Instead, improved knowledge and improved usage of knowledge is likely to contribute to less rework, quicker analysis, decision and execution. The second aspect is that KM activities are not an additional function to the organisation but a part of ongoing efforts without making them more time consuming or difficult.

Knowledge management needs a stronger link to the fundamental strategy of companies. Strategy-oriented knowledge may involve a vast number of domains such as: customers, competitors, suppliers, regulators and regulations, technologies, and service substitutes. The management can view an existing strategy to determine what knowledge will make it successful or view its existing knowledge and determine what strategy is most appropriate. Davenport, (1999) advocates that considering knowledge in the context of strategy formulation would be of benefit to all types of firms and if knowledge management will lead to a strategic advantage depends partly on:

> ➢ Knowledge management can enable an innovative strategy that would otherwise be impossible. For example, reusing both methods and software and thus achieve higher productivity compared to the competitors.
> ➢ Knowledge management could contribute to a better execution of a strategy throughout a company. Davenport (1999) states an example regarding a drug development in a pharmaceutical company. The study concludes that firms with more aggressive and innovative knowledge-creation approaches are more profitable compared with more mundane knowledge strategies.
> ➢ Companies can also increase their advantage by adding knowledge to the services they offer for sale.

> ➢ By using knowledge and knowledge management, companies could also achieve competitive advantage by performing nonstrategic processes very well. If a firm can use suppliers knowledge to improve procurement, share financial knowledge and circulate knowledge about human resource or information system processes it might gain an advantage over its competitors.

2.3 KM and strategies

In order to achieve competitive advantage, Davenport (1999) suggests that a firm has to understand what aspects of the business can lead to advantage and be clear about what kind of advantage they are seeking (revenue, profit, growth or market share, etc.). The most critical prerequisite is that those who determine and set the strategy are conversant with knowledge management and the possible strategic opportunities it provides. The knowledge would generally be held by senior management of a firm although it is possible to disseminate the knowledge of strategy more widely. The particular types of knowledge of a consulting firm include mission and purpose knowledge, competitor knowledge, knowledge about the client and industry knowledge. To have a well defined knowledge strategy requires sufficient understanding in KM. According to Davenport, (1999), a knowledge management strategy is very important because it forces an organisation to make choices about key aspects of their knowledge environment such as:

> ➢ Is tacit or explicit knowledge more important to manage?
> ➢ What knowledge domain is most important to the firm (customer-, competitor-, product- or supplier knowledge)?
> ➢ Is the firm good at creating knowledge but weak in applying it? What department is in most need of improvement?
> ➢ Should the organisation make or buy knowledge?
> ➢ Which aspects of our knowledge environment should be measured?
> ➢ How will the organisation make money on the knowledge?

No organisation is capable of managing all kind of knowledge domains equally well. It is therefore incumbent upon the management to make choices about what kind of knowledge that should be focused upon. How to make the necessary choices regarding KM depends on the business strategy adapted by the organisation. The kind of strategy to which the knowledge management can be connected to is generally not financial goals but rather high-level operational strategies.

2.4 Measuring KM impact

Measuring success can be one of the largest challenges of KM. But being able to demonstrate and promote success is essential, not only for top management but for everyone within the organisation. Identification of benefits and creating appropriate measures to monitor benefits are essential to KM success and the ultimate test of KM is to see whether it leads to measurable improvements in business performance. As it is today, few organisations have been able to establish a link between their knowledge management activities and their business performance. One way, advocated by

Davenport (1999), of establishing a relationship between KM and improved financial performance is to employ "intermediate measures". These measures involve the most basic set of measures regarding KM activities. These might include the number of users of a knowledge management system, the number of "hits" to a knowledge repository or the satisfaction levels of employees with a knowledge management initiative. Improvements in these measures do not mean a better organisational performance but it will indicate that levels of knowledge activity are improving. Companies should then try to link KM activity measures with intermediate measures of business performance. These could be process measures, indicators of knowledge workers capability or ideas and decisions. If both KM activities and intermediate measures are rising at the same time, there is a great possibility that knowledge management helped to cause the improvement in process performance.

Improvements in intermediate measures are sufficient for some organisations to show value from knowledge management. Others feel the need to link intermediate measures to financial measures. If KM activities and intermediate measures rise together with financial performance, there is a chance that KM contributed to the better financial result. But in order to establish a possible link, it would be necessary to remove other factors which could have a positive impact on the improved result. Consequently, the management need to determine how to apply methods to evaluate the expected benefits regardless of whether they are direct, indirect or pertain to noneconomic objectives (Davenport, 1999). It is quite easy to put values on direct and first-order benefits such as; staff reduction, lessen office area and thereby reducing the cost of lease. Assessing benefits of second-order and higher is more difficult though immensely important thus it is necessary to develop and apply methods for evaluating these benefits and impacts. One way, advocated by Wiig (1995), is to facilitate identification of factors which may result in wanted benefits and costs, by using graphical representations of event chains. This chain begins with management's decision to develop and install Knowledge Based Systems and ends with (hopefully) improved profitability. In many situations, this simple representation is enough. However, in most cases it is necessary to consider many parallel event chains where these parallel events may contribute negatively as well as positively. It should be apparent that developing a reliable link between KM and business performances requires a significant amount of time and effort. Because of the complexity of measuring KM activities, organisations knowledge managers should be certain that the measurement activities are necessary and sufficient to achieve credibility with senior management (Davenport 1999).

2.5 Implementation of KM

Knowledge management should not be imposed on the organisation from above. The success of the introduction of knowledge management depends on gaining the support from the whole organisation throughout the process. KM is not a quick fix. KM is more of a change program and the changes impact on the way the organisation works, this will be further discussed later on in this master thesis. There has to be a compelling enthusiast at the top of the organisation to convince the peers to support a strategy that will have a considerable impact on investment but with the potential for a substantial return on

invested capital. Once this is accomplished, the next step is to create a knowledge team, preferably externally, representing all the major functions of the organisation. These are normally; human resource, organisational development, information systems and all other functions which are considered to be core business to the organisation (Abell and Oxbrow 1999). The main task of the team is to plan the development and implementation of the KM program. Albeit KM is not something that will contribute to improved company revenue over a day, the approaches need to show result swiftly enough for the benefits to become apparent to people who have been forced to change their way of working. If the implementation of KM is not monitored by a KM enthusiast, there is a chance that some of the aspects of the program will be neglected. If everything is going according to plan, the enthusiast is likely to have a core role for a period of three to five years (Abell and Oxbrow, 1999).

Abell and Oxbrow (1999) further argue that you can not manage knowledge. What you can do is to create an environment that optimizes knowledge, encourages information sharing, knowledge creation and team working. An environment facilitating creative and supportive interaction between employees to ensure that they store and make information available in a manner beneficial to the organisation. To create this knowledge environment, special attention should be placed on three particular areas, depicted in Figure 1 (Abell and Oxbrow 1999).

Figure 1. Three areas of knowledge focus

Preparing the organisation is where the initial focus will lie. This stage is primarily about changing the culture, changing the way people work and building a trusting and sharing environment. *Managing the knowledge assets* requires an understanding of workflows and business processes within the organisation. One has to connect people to people, people to information and create a way to develop the tacit knowledge necessary to utilize information. *Leveraging knowledge* is more or less the core of knowledge management. The three areas of focus need to be governed simultaneously. This calls for leadership and team working skills and an understanding of information and communication technology.

In order to obtain appropriate behaviour from organisation once the KM activities are implemented, they need to be governed by a creative and effective knowledge worker. The purpose of having a knowledge worker is to identify potential benefits, understand

the dynamics of the organisation which will lead to benefits being realized. Wiig (1993) argues that a prudent knowledge worker ought to possess qualities such as: well educated and trained within their profession, have extensive knowledge on all knowledge levels (idealistic, systematic, pragmatic and automatic), be creative and innovative, have broad interpersonal skills and be willing to share the organisation's values and goals. Abell and Oxbrow (1999) suggest that people and social skills as well as business and profit generation is something which should be considered a criteria when appointing the knowledge worker. To integrate these qualities within the organisation should be of primary concern of the management and is the first step to create an intelligent and proficient organisation.

According to Wiig (1993) there are five major strategies used by leading organisations to gain value from implementing KM; KM has to be used as a business strategy, there have to be sufficient transfer of knowledge, the knowledge has to be client-focused, the employees have to have a personal responsibility for knowledge and finally innovation and knowledge creation must take place within the organisation.

2.5.1 Challenges of implementing KM

Beckman (1999) advocates several challenges in implementing KM within organisations. Knowledge is often amassed rather then shared. Valuable knowledge developed by others is often ignored rather than applied in the daily routine. Knowledge is often not valued by the corporate culture and the people who shares knowledge can therefore be considered as naive rather then being awarded for their contribution.

Before KM can be implemented within an organisation it is incumbent upon the management to identify which type of KM they will be focusing upon. The definition of KM is broad and comprises approaches and activities throughout the organisation. To ensure a successful implementation and to alleviate the challenges of applying KM, Wiig (1999) has, based on past experience from several companies, created a list of items with things to do. The major KM items that have to be considered before introduction of a new KM practice are listed below.

> ➢ *Develop a broad vision of KM practices and obtain management commitment.* People involved with the implementation must have a deep and flexible understanding of how KM will be conducted and organized to support the organisations directions, goals and objectives. This understanding will work as a foundation and guide for creating KM capabilities, infrastructure support and for setting priorities. Obtaining senior management commitment has proven essential for the implementation of KM strategies. Senior management must identify opportunities for improvement such as revenue progress, development of new products and services and removal of knowledge-bottlenecks.

> ➢ *Realize the targeted KM focus established from knowledge landscape mapping that align with organisation objectives.* Companies have to identify the nature, strengths and weaknesses of the organisations knowledge assets from a market

pressure and opportunity point of view. Furthermore, the organisation must undertake targeted KM initiatives with clear benefit expectations since it would facilitate the implementation of KM.

➢ *Allow team members to focus full time on KM and build professional teams.* Appoint competent KM team members and do not assign them additional responsibilities. The team members must have a profound understanding of knowledge (in contrast to information), its role in conducting knowledge-intensive work, method for eliciting, acquiring, transferring and organising knowledge. A common problem with several KM introductions is that the KM team have not had the opportunity to prepare themselves with adequate understanding of KM theory and practical approaches.

➢ *Install KM benefit and impact evaluation methods.* Benefits of KM are not direct and can therefore happen over a certain period of time. Management must determine priorities for activities based on KM strategy and expectation for net benefits, needs and available capabilities. It is imperative that feedback on the performance of KM practices is provided.

➢ *Implement incentives to manage knowledge on a personal level, to act intelligent - innovative and to facilitate capturing, building, sharing and usage of knowledge.* Incentives should be implemented directly after obtaining management buy-in. Its purpose is to spur employees to be innovative, share knowledge, expend effort to capture knowledge. The organisation must express their support for KM and employees must understand the benefits of KM and disincentives must be removed.

➢ *Make sure that implemented KM activities provide opportunities, capabilities, motivations and permissions for individuals to act intelligently.* Capture knowledge from departing personnel and knowledge required for critical knowledge functions.

➢ *Create supporting infrastructure.* Build upon all existing competence and gradually add new ones if it is required to facilitate effective KM.

Most of these issues must be dealt with by the practicing knowledge professionals. Senior management can not be expected to anticipate on every step. Furthermore, it is helpful to the senior management when knowledge professionals can provide practical framework within which issues can be remedied, consequences can be illustrated and evaluations can be determined and explained (Wiig, 1995). The recommendations above emphasises the need to work with top management to build understanding and to obtain their agreements. But all these items are useless if the management is not capable of working with the employees and to get them to understand that KM is in their interest.

2.6 Incentives, rewards and motivational systems

In larger organizations, employees and managers are discouraged from sharing knowledge and experiences (Beckman, 1999). Knowledge is in fact considered a source of power and amassing it is not only expected but also rewarded. Past experience suggests there is a problem of getting employees to adopt knowledge and expertise developed by someone else. In dysfunctional organisations, expertise poses a threat to the powerbase of those managers who need it. Beckman (1999) argues that in extremely dysfunctional organisations, some managers prefer to outsource knowledge tasks, retain control and power, and ridicule their internal expertise rather than giving them rewards and recognition. As can be read in Beckman (1999), Quinn, Baruch and Zien (1997) argue that corporate incentive systems reimburse safe, bureaucratic behaviour rather that risk-taking and individualistic behaviour which distinguish an innovative person. Jacobsen and Thorsvik (2002) agree with this statement and further suggest that most organisations have a proclivity to punish learning since new remedies have to be invented which is expensive. Research also reveals that innovators prefer a mix of financial and nonfinancial incentives and to feel content about their work they need a sense of adventure, appreciation and recognition. Quinn, Baruch and Zien (1997) state that "Unless the culture or incentives are very strong, those with existing power positions can subvert progress by refusing to undertake change or to provide needed expertise for a new venture". Quinn, Baruch and Zien (1997) further states that the keys to successfully reward learning are:

> ➢ Remove disincentives to learn including those practices that reward status quo and promotions based on seniority.
> ➢ Provide the opportunity to learn by the aid of shared information or job rotation
> ➢ Provide the opportunity to display learning, practice and performance
> ➢ Recognize and reward learning

Rewards can take a vast number of forms such as money, recognition, time off, empowerment, work selection, advancement and development. In addition, rewards should celebrate successes as well as desired behaviours such as collaborating, experimenting, learning and risk-taking and the rewards should come as early as possible and often.

According to Coleman (1999), a vast number of organisations try to build KM programs before establishing the cultural foundation necessary for this program. It does not matter how good the technology systems supporting knowledge management are. If these foundations are not sufficient, negative attitude, poor return on investment and resistant behaviour are inevitably the result. If this issue is not sorted, those people asked to participate in KM programs often see such a request as extra work, not of great benefit to them, not of great benefit to the organisation or possibly of benefit to others but of little value to them.

Coleman (1999) states that, people are unwilling to share what they have learned to others for free and one remedy is to introduce reward structures to encourage knowledge sharing. This can be a radical change for technical consultants who think they are

installing a new information system and end up with compensation issues. These kinds of issues regarding behavioural change do not belong to their expertise hence having a human resource professional can be imperative. Without their expertise, two thirds of these information system projects are doomed. To make people share knowledge they must be convinced that they do not loose anything. When sharing knowledge one still retains what one knows. Wiig (1995) suggests that given the organisational culture of many contemporary organisations, people in an organisation are of the opinion that their value to the organisation is just what they know and if they share their knowledge they will jeopardise their position in the company. Wiig (1995) further suggests it is the responsibility of knowledge professionals to explain and motivate the employees to share knowledge. This can be achieved in different ways:

➢ Making knowledge workers understand how vast a person's expertise is and how little of it can be acquired and made explicit. By telling "everything" they know they will only have contributed to a small amount thus their value has not been diminished.
➢ Make employees to understand that by telling what they know, their value will increase since other will ask them for help.
➢ Many employees tend to exaggerate the expectations of what they need to know. In Wiig (1995) an example is stated. One of the senior management in an organisation felt that to be competent in his position, he needed substantial knowledge in all topic areas within his purview. His purview comprised of 125 topics! When confronted with this list he realised it was impossible for anyone to be an expert in all these areas.
➢ The management has to understand the value of sharing and reward those who do it.

Additionally, employees may also feel that they have shown to the rest of the organisation that they do not have sufficient knowledge for their position. But people are much more than their knowledge, experiences and behaviour. Consequently, if trust is not a part of the organisational culture, knowledge sharing is unlikely to occur. Trust is an imperative prerequisite to knowledge sharing and to establish trust is essential. Coleman (1999) mention bonding and to create "context" as one of the best ways to establish trust. Context is commonly referred to an understanding of the external world. However, in this perspective it is also a mental framework in which someone is placed. It gives an idea of what their values, ideas, believes and characters are. With this knowledge, the individual can begin to develop an idea of how the other might treat them and in time develop trust.

2.7 Knowledge technology

IT is becoming increasingly important to KM in construction organisations. However, the construction industry has not yet been able to recognise and understand the benefits of IT (Egbu and Botterill, 2002). Transferring knowledge across projects is a major challenge for construction organisations. Construction work is more or less exclusively project based, characterised as short-term and task-oriented, promoting a culture where learning is inhibited. Specialist and technical knowledge is lost from one project to the next

hindering an organisation's ability to develop knowledge and generate new ideas. Egbu and Botterill (2002) argue that IT can promote the transfer of knowledge between project teams thus enabling development of new knowledge for innovation. However, the type of IT used by construction organisations depends on the context of the work that is done. Organisations should implement tools that will be of specific use for a specific purpose, rather than embracing IT as a general way of working.

2.7.1 Commonly used Knowledge technology

Technology alone will not make an organisation a knowledge-creating company. Knowledge technologies are more likely to be applied in the daily work and the roles of people are vital to success. This consideration is essential since the level of expertise of individuals using knowledge technologies is likely to have an impact upon the decision on the choice of IT-tool. A study conducted by Egbu and Botterill (2002), provide an indication of the typical tools and technologies employed by organisations in the construction industry to manage knowledge. From a list of technologies and techniques, respondents were asked to rank their usage and effectiveness from 1-5. Figure 2 depicts how frequently used certain technologies are in construction organisations where 1 = never and 5 = always.
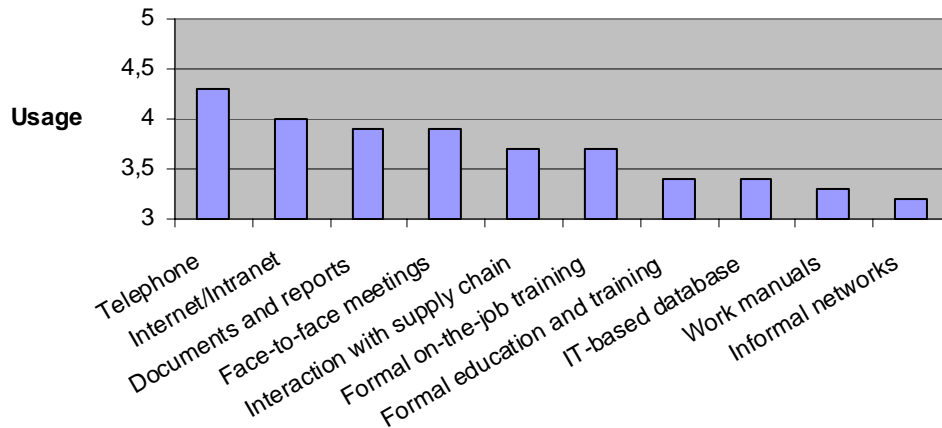
Figure 2. A graph illustrating the usage of KM technologies

As depicted in Figure 2, the most frequently used techniques and technologies in construction industry are: telephone, internet/intranet/e-mail and documents and reports. These are closely followed by face-to-face meetings and interaction with the supply chain. Consequently, it is obvious that more conventional technologies for acquiring, developing, sharing and storing knowledge are still used frequently in construction organisations.

Figure 3 depicts how effective these technologies are considered to be where 1 = of no effect and 5 = highly effective.

Figure 3. A graph illustrating the effectiveness of KM technology

The result shows that more or less the same tools were considered to be the most effective in managing knowledge. The telephone became most important for KM activities since it could be used to capture and distribute structured knowledge and enable people to share tacit knowledge. There is only one discrepancy between the two lists. Work manuals are more frequently used although it is not considered to be as effective as mentoring.

2.7.2 Knowledge repository

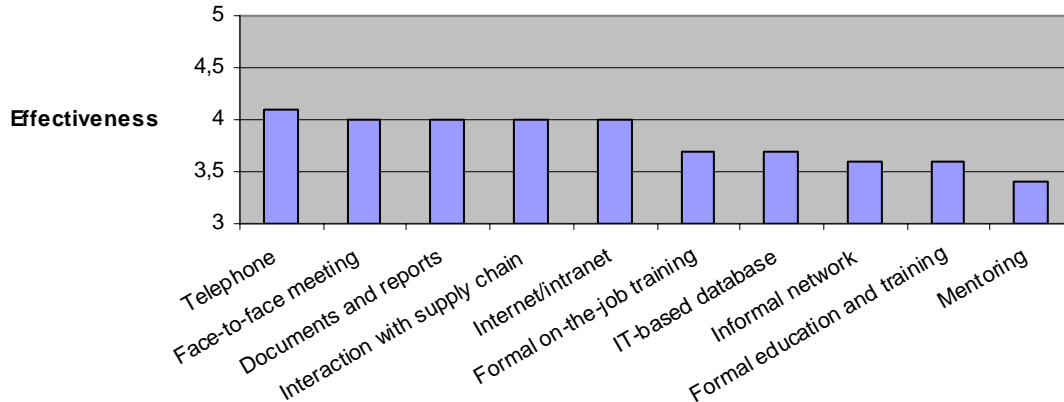One knowledge technology which is mentioned in the literature over and over again is so called *knowledge repositories*. Two definitions of knowledge repositories by Tobin (1998) and Liebowitz and Beckman (1998) are stated in Beckman (1999)

➤ "A knowledge repository organises, and makes available to all employees basic information on the company's organisation, products, services, customers and business processes".

➤ "A knowledge repository is an on-line, computer based storehouse of expertise, knowledge, experience and documentation about a particular domain of expertise. In creating a knowledge repository, knowledge is collected, summarized and integrated across sources"

Borghoff and Pareschi (1998) argue that an increasing number of people and organisations have just begun to understand how beneficial computer network can be for large scale data sharing as well as knowledge sharing, thus improving the learning capacity of the organisation. Through the years, many definitions of an organisational knowledge repository, or corporate memory, have emerged but of varying quality. The definition stated by Borghoff and Pareschi (1998) is consistent with the purpose of this thesis and reads "a corporate memory is an explicit disembodied, persistent representation of the knowledge and information of an organisation". The main objective of a corporate memory is to improve the competitiveness of the organisation by

improving the way in which it manages knowledge. The most suitable organisation of a corporate memory depends on how that corporate memory will be used.

The knowledge for the corporate memory can be gathered actively or passively. Active collection means that certain people within the organisation are scanning communication processes in order to detect new experiences. When using passive collection, workers recognise by themselves that certain knowledge has sufficient value and should be stored in the corporate repository. The storage of knowledge involves two steps according to Borghoff and Pareschi (1998): evaluating and indexing the new knowledge. The evaluation process should, if performed correctly, generate answers to questions such as: is the knowledge really new? Should the knowledge be integrated with documents already stored in the corporate memory? Is the knowledge sufficiently general to be useful? As was the case for collecting knowledge, it can also be distributed and retrieved actively respectively passively. Passively means that an employee recognises the need for a certain piece of information to be able to solve a task, thus consulting the corporate repository. In the case of actively, it is decided that a piece of information stored in the corporate repository should be distributed to a number of employees.

Based on the assumption that knowledge can be collected and retrieved in both an active and passive manner, Borghoff and Pareschi (1998) distinguishes four types of corporate memories, see Table 3.

Table 3. Types of corporate repositories

	Passive Collection	Active Collection
Passive distribution	The knowledge attic	The knowledge sponge
Active distribution	The knowledge publisher	The knowledge pump

The knowledge attic is the simplest form of knowledge repositories. The corporate memory is used as an archive and can be consulted when needed. In practice this repository is most feasible. It focuses on the bottom-up aspect of organisational learning and in order to function sufficiently it requires a high discipline of the workers.

The knowledge sponge is not frequently used. However, when used, the organisation is actively trying to develop a more or less corporate repository.

When using *the knowledge publisher,* lessons learned is left to the individual workers. The maintainers of the corporate memory are analyzing the incoming lessons learned, combining them with knowledge already integrated within the corporate memory and forwarding it to those workers who will benefit from it. This is normally done through briefings, newsletters, etc.

The knowledge pump is the most complex type of corporate memory. This model will, in theory, ensure that knowledge developed within the organisation is exploited to improve the performance of the organisation. Borghoff and Pareschi (1998) advocate the knowledge pump being the most suitable IT-system for connecting and supporting electronic repositories and network communities. The knowledge pump is not intended to

be a piece of software to be installed, instead document management systems, digital libraries and groupware becomes systems which are integrated within the Knowledge Pump. It is intended to be a general-purpose set of technologies applicable across multiple platforms, not a tool adapted to a particular application. Borghoff and Pareschi (1998) argue that there are some prerequisites needed to be fulfilled when implementing this kind of IT-system. These are portability, ease of use and immediate value. Portability means one code set for all platforms. Ease of use mean near zero installation cost and reliable. Immediate value means providing a set of functionalities above recommendations. The operation of the knowledge pump can be seen from three different perspectives; individual, community and the organisation.

The *Individual* are able to review any item or make a more general recommendation. A recommendation consists of a rating and comments. Most people are happy to receive a good recommendation but few may be motivated to submit them. The benefit for submitting a recommendation is less than receiving them thus recommendations are likely to be under provided. Borghoff and Pareschi (1998) suggest that to alleviate this problem, recommending an item should be as easy as possible. Users should be able to make a recommendation from wherever they are working. Furthermore, the effort spent in making a recommendation must be kept to least effort possible. Past experience has shown that the individual is concerned about personal privacy and reviewers may be reluctant to sign their recommendations or critiques. Allowing these reviews to be anonymous may assuage this problem but it will be in conflict with desire to create a sense of community.

If technology like the knowledge pump is to be successful, it will be for similar reasons that e-mail and internet have proved to be successful. It must be providing a common medium for communicating and sharing information in addition of supporting *communities*. In this context, community means a social group that exhibit, in various degree, shared relations, social conventions and interaction and a sense of membership or boundaries. One of the goals with the knowledge pump is to support the community awareness of membership and boundaries in ways not possible by e-mail or newsgroup.

From the *organisational* perspective, the knowledge pump has the potential to create a number of benefits. By mapping the vast number of communities within an organisation, it is possible to connect different communities into larger ones. It can also facilitate uncovering of competencies of an organisations employees.

One successful approach, adopted by many organizations, to build organizational knowledge is translating important experiences into reference cases expressed in suitable representations (Wiig, 1993). This approach is applicable for many purposes where the knowledge can be represented in a reference case or a story form. It is often written in a free-form natural language. Computer repositories are frequently used to gain the knowledge needed by the knowledge workers when faced with difficult challenges. Depicted in Figure 4 is an outline of a typical knowledge gaining process by the aid of computer support.
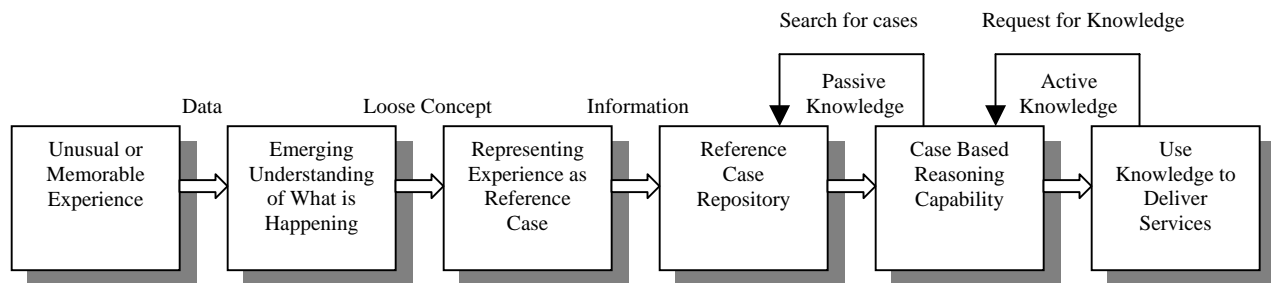
Figure 4. Learning through repositories

Wiig (1993) argues many organizations are aware of the significance of capturing and storing knowledge in a repository. However, most employees author the reference cases which require specific mind-sets to identify the characteristics that best classify the various types of experiences.

2.8 Professional service organisations

There are many types of service organisations, some service organisations are particularly dependant on well-educated and skilled employees and these belong to the professional service organisations (Sverlinger, 2000). Nachum (1998) defines professional service organisations according to two features:

First, knowledge is their core recourse, and it is both the input and output in their production processes. Second, their clients are other firms or institutions, and their output is used as input into the production processes of other businesses.

According to Brooking (1999), consulting engineers sell a product that derives from the knowledge and experiences of their employees and because of this the definition according to Nachum (1998) also comprises consulting engineers and thus project management companies. The risk in this kind of organisations is that employees with valuable expertise leave the organisation and in the consulting engineer organisations assets is directly linked to the individual. Maister (1993) states in Sverlinger (2000) that professional service organisations involve a high degree of customisation in their work, this means that little of the organisations activities and management information can be dependably made routine. Furthermore, professional service organisations have a high degree of interaction face-to-face with the client. Consequently, it demands of organisations to attract and retain highly skilled individuals. Consulting engineer organisations work exclusively with temporary assignments or projects. Hence, special attention on processes, management and organisation is required and is different from those in traditional mass producing industries. Alvesson (1992) uses the following six criteria's written by Gummesson (1990), Hedberg (1990), Starbuck (1990) and Sveiby and Risling (1996) in order to categorise a professional service organisation:

1. essential features of problem solving and non-standardised production
2. creativity of the individuals as well as within the organisational environment
3. strong individualism and independence of the individual

4. most employees are highly educated professionals
5. traditional assets are not central (the critical elements are in the head of the employees, in network, custom relations, manuals and service delivery systems)
6. strong dependence on employee loyalty and therefore vulnerability to exist

These six criteria focus on the employees' characteristics rather than the organisation, but one should bear in mind that the employees work in creative teams and networks together with the client, using the organisational service delivery system (Sverlinger, 2000).

2.9 Organisational learning

Learning is an important issue in every organisation, but the need varies strongly depending on distinguishing features of the organisation and the environment in which they operate. On a fundamental level, individuals create all knowledge. The organisation can not create knowledge or learn by itself, strictly speaking. Instead, it supports creative individuals or provides contexts in which they can create and transfer knowledge (Nonaka and Takeuchi 1995). Jacobsen and Thorsvik (2002) states that following remedies are generally considered to be facilitating learning:

- ➢ An organisational culture encouraging sharing of knowledge through openness for adapting experiences, encouraging responsible risk taking, and be willing to accept failure and learn from it.
- ➢ The organisation must continuously experiment with new work procedure.
- ➢ A close and swift current of information which imply decentralisation.
- ➢ Great emphasis must be placed on amassing information.
- ➢ The reward system must encourage risk taking and not punish someone for making a mistake.
- ➢ The organisation must recruit people with the ability to learn.

In order to create an intelligent organisation, one has to distinguish between training and education. Skills and know-how are basically developed through training while understanding and knowledge is developed through education. Skill is used to perform routine work without deep understanding and broad background knowledge. But knowledge is a prerequisite to perform advanced work. When we train, we have a proclivity to focus on transferring *pragmatic and automatic* knowledge and when knowledge is transferred, we think of that as education. This type of knowledge is *idealistic* and *systematic*.

Because of the vastness of existing knowledge, it may be impossible to locate relevant prior knowledge. Hence a vast amount of relearning will take place which is actually important although not very cost effective. The need for repetition is costly, first for training, and later for less than perfect performance during the learning period. However, to become proficient in any area requires that same issues are dealt with several times. People must work repeatedly with any new topic to gain the sufficient level of understanding needed for the topic to become first *systematic* knowledge, and after more repetitions, *pragmatic* knowledge and finally, when repeated a vast number of times,

automatic knowledge which in turn lead to consistent behaviour. Wiig (1993) exemplify this with an example. An electrical engineer once said after working for ten years with design of electrical circuits that: *"I finally think that I start to understand Ohm's law"*. This statement gives an idea of many experts' experiences.

Wiig (1993) distinguishes between two types of learning processes: top-down respectively bottom-up learning. In a top-down learning situation a person initially learns about basic principles from idealistic perspectives. Idealistic knowledge obtained during the first learning stages is complemented with systematic knowledge. When learning becomes more practical, pragmatic knowledge is developed through a better understanding of how to use the systematic and idealistic knowledge. As understanding progresses and other types of training are introduced, automatic knowledge or skills are developed. When learning bottom-up, individual events are observed as isolated occurrences without any framework. If the employees are exposed to many similar events, they might be able to develop some automatic knowledge. However, this automatic knowledge is most commonly without understanding of the underlying principles thus employees will not have developed a capability to handle variations from these situations. According to Wiig (1993), bottom-up personal learning is personal discovery processes that suffer from considerable limitations. In some cases the knowledge may be based on inappropriate perceptions and misconceptions thus resulting in incorrect knowledge.

If the objective is to provide people and organisations with knowledge to act more intelligently, they need schemas, programs and scripts instead of just routines (Wiig 1993). Jacobsen and Thorsvik (2002) are of the opinion that a high level of formalization inhibits the learning potential of the organization. Mouzelis (1968) defines in Jacobsen and Thorsvik (2002) bureaucracy as an organisation which is not capable of learning from old mistakes. An organisation built on routines, rules and formal procedures lacks the flexibility needed for innovative thinking. However, this is considered to be something of a paradox. An organisation does not have a direct memory thus earlier experiences is often transformed into rules and routines. At the same time, these rules and routines are inhibiting organisational learning through its bureaucracy. Employees need to be provided with a broad overview of what is known and be allowed to form their own impressions and opinions and to integrate these perspectives into their own experiences. To provide this understanding requires education rather than training. Successful programs provide frameworks for how to think about the activities that produce risks and place them in context with social skills.

In order to diminish the negative impact of bureaucracy, the organisation should adapt a structure facilitating organisational learning (Jacobsen and Thorsvik, 2002). Firstly, the organisation needs to be as flat as possible. The learning must take place where it all happens i.e. where the manufacturing is. These are the employees that supply services and they are the ones who notice if something needs to be made differently, not the senior management. This inevitably leads to the need of a decentralised organisation. Teams must have the capability and availability of being creative based on past experiences and not being afraid of making mistakes. Secondly, the amount of rules and routines must be

kept to a minimum. Formalisation tends to focus on how the tasks are performed and not the result. Thirdly, great emphasis should be places on horizontal communication.

2.10 How to create and transfer knowledge

Creating and maintaining knowledge is a process of sharing both tacit and explicit knowledge between individuals in an organisation. It is necessary to change knowledge from tacit to explicit to make it communicable and this is important for learning and for transfer of knowledge. Nonaka and Takeuchi (1995) have identified four interaction modes for knowledge conversion based on accessibility:

1. **Tacit knowledge to tacit knowledge (Socialisation)**
   Socialisation is a process where tacit knowledge can be gained from other persons, thereby created, by watching, imitating and practice. To achieve this one have to share experience i.e. two colleagues work together and observe each other and learn what the other do e.g. mentoring. This form of transformation is rather limited since it presupposes that employees are physically near and in sight of each other.
2. **Tacit knowledge to explicit knowledge (Externalisation)**
   Externalisation is when tacit knowledge is transformed into explicit knowledge in order to communicate it. One person's tacit knowledge is articulated orally or in writing in order to make it available for others. For example an employee finds a good way to solve a task and writes down how to do it and communicates it to others. This is an essential step in knowledge conversion.
3. **Explicit knowledge to explicit knowledge (Combination)**
   Combination is a process where concepts from individuals are systemised and categorised into a knowledge system. Through different medias such as documents, meetings, telephone calls and digital networks individuals exchange and combine knowledge. During education at school knowledge creation usually takes this form.
4. **Explicit knowledge to tacit knowledge (Internalisation)**
   Internalisation is a change process of transferring different bodies of explicit knowledge into tacit knowledge. Employees use explicit knowledge and adjust it to ones tacit knowledge.

Nonaka and Takeuchi (1995) states that socialisation and combination are used in every organisation, but externalisation and internalisation are the best or most effective. It is through these forms of knowledge conversion that organisations can learn, create new knowledge and guarantee the use of it.

Several managers are of the opinion that it is prudent to create expertise and start new programs by having their own staff learn by themselves without help from outside expertise. They consider brief courses, self study and starting small pilot programs as sufficient learning situations. However, practical experience of knowledge building processes show that relying solely on self development is costly and very prone to errors. When managers advocate this type of knowledge creation they highlight the fact that in-

house staff have the best knowledge regarding the organisation's goals, practices and products better than an outsider. It is difficult to argue against this statement but it is also true that any established field, new to the organization, already has a vast body of knowledge, accumulated during a long period of time and is very expensive to duplicate and reinvent (Wiig, 1993). Wiig (1993) further states that knowledge can be created through ten common approaches see Table 4.

Table 4 Knowledge creation

Knowledge-Building Process	Commonly Expected Results
Receive Existing Knowledge from External Sources	
• Formal education	Broad and profound understanding. Emphasis is more on theory
• Formal training	Skills & some theoretical understanding. Emphasis is more on practice
• Reading books	Depending on the books. Quality may be grand. Almost exclusively theoretical
• Receiving knowledge & information through media	Limited control of quality and profoundness of the knowledge
• Obtaining intelligence from friends, co-workers	Can be highly targeted. Emphasises surface rather than underlying understanding
• Computer-based multimedia	Highly targeted to specific knowledge areas. Costly to change but very effective
Create New Knowledge	
• On-the-job learning • Learning through personal experiences • Conducting research • Personal innovation	

2.11 Organisational change

An implementation of KM activities will inevitably lead to a significant change in the organisation. Organisational change is categorised by Jacobsen and Thorsvik (2002) into four different dimensions. The first dimension regards the comprehensiveness of the change. Comprehensiveness is commonly distinguished into incremental and strategic change. Incremental change means a vast number of small changes over a longer period of time and strategic change occurs when the organisation experience a significant change in a relatively short period of time. The second dimension concerns whether the change is proactive or reactive. If the change is proactive it means that the change is made in a preventive objective. If the change is reactive it means that the organisation is responding to something that has already happened. The third dimension concerns whether the change is structural or cultural. Structural changes focus mainly on changes in work distribution, specialisation, coordination, control and reward systems. Cultural

changes focus on changing the attitudes and opinions of the employees. Past experience show that in real life it is very difficult to distinguish between these two types and in order to succeed, management has to execute structural as well as cultural change. Finally, changes can be categorised into planned respectively unplanned. Planned changes are based on learning where the organisation is actively adapted to new circumstances. Two prerequisites for planned change are firstly, a clear goal for the organisation and secondly, the organisation must have clear knowledge regarding the three following items:

> The organisation must have a profound understanding regarding the problems in the past and the presumed challenges generated by the future organisational change.
> The organisation must know what type of means they have at their disposal in order to come up with an appropriate remedy
> The organisation must be aware of the consequences of its actions. Only then will one be able to know whether the remedy will solve the problem or not.

It should be noticed that in most cases, changes are implemented and planned, based on insufficient information. Consequently, this may lead to a completely different result than was originally intended.

2.11.1 Reluctance to change

A central issue to ensure a successful change in the organisation is to overcome the reluctance to change. Jacobsen and Thorsvik (2002) highlight nine reasons for the reluctance; (1) by change, one goes from a familiar and secure condition to something unknown. More or less all changes lead to confrontation with the unknown. Fear as a consequence of change may lead to reluctance towards future changes; (2) an organisational change will often lead to a renegotiation of the existing contracts between the employee and the organisation. In addition, there is usually a tacit "contract" between the individual and the organisation. By the aid of this "contract", the individual knows what the organisation expects and consequently organisational change may lead to an interruption of these unwritten expectations; (3) having worked for an organisation for quite some time will hopefully generate a feeling among the employees that what they are doing is important for the future of the company. An organisational change can hinder this feeling and make the employees feel like they have lost some of their identity; (4) it is not uncommon that an organisational change will lead to a change of office. This is not necessarily popular among the employees, thus resulting in reluctance; (5) an organisational change usually results in a shift of power and influence. This may lead to reluctance to change among employees since it will lead to a diminished influence. Those employees loosing power are usually not very fond of change; (6) if an organisation is about to change, employees may have to face demands of additional knowledge in order to cope with the new organisation. Change may lead to revaluation of existing knowledge; (7) organisational change usually leads to double work. The new tasks have to be conducted simultaneously with the new ones; (8) an important aspect which needs to be considered is the social bonds that may be cut off during an organisational change.

Loosing contact with old colleagues and fellowship is a natural consequence as well as working with new people whom one may dislike; (9) finally, but equally important, are the aspects of external actors. A reorganisation may result in loosing valuable clients because a reorganisation can create certain turmoil within the organisation.

2.11.2 Strategies for change

The implementation of successful KM initiatives requires clearly defined objectives and a well-planned strategy (Al-Ghassani et al. 2002). Jacobsen and Thorsvik (2002) distinguish between several types of strategies for implementing organisational change. Here follows a short description of three of them.

The *first* strategy is one they call dictatorial change. This method is very similar to the chain of command used in the military, Bourgeois and Brodwin (1984) claims in Jacobsen and Thorsvik (2002), that this is not very suitable for civilian purposes for several reasons. Firstly, there is no way management can know everything regarding every little detail. Secondly, very few leaders have the influence needed to achieve the reorganisation successfully. Thirdly, the process is very time consuming and time is usually something management lacks. Fourthly, it is not likely that everyone within the organisation will perceive one strategy in the exact same way. Finally, the manner in which the strategy is implemented is generally not appreciated by employees. Few are fond of being told what to do, dictatorially.

The *second* strategy is called charismatic change strategy. Preferably larger changes may be implemented frictionless by using a person with a certain charisma. A charismatic person makes sure the colleagues are discontent with the current situation and then uses this dissatisfaction to create and facilitate the organisational change. However, this type of change is associated with significant problems. One of the major problems is that one seldom knows who the charismatic leader is and some people is not even sure what charisma is. In addition, just because a person has been charismatic in a previous situation, it does not necessarily mean that it will happen again.

The *third* strategy is called organisational development. As a theory, organisational development focuses upon influence, personal development and cooperation. This theory came as a result when trying to find alternatives to the more common model where every organisational change is governed exclusively by management. A central theme in this theory is that emphasis is placed on participation of every involved employee. A great participation allows for more aspects and opinions which may otherwise be lost. In order to succeed through organisational development, emphasis must be placed on creating an environment that facilitates change. Attitudes and opinions have to be altered thus an effective organisational change must start with a cultural change (Jacobsen and Thorsvik, 2002). Right after when the theory of organisational development was established, it was considered by many to be the only true way to implement organisational change. However, French and Bell (1984) states in Jacobsen and Thorsvik (2002) some prerequisites to ensure success. Firstly, key actors both internal and external must realise that there is a need for issues to be solved. Secondly, external expertise, such as

consultants, is the ones that should execute the change. Thirdly, management must fully support the change. Fourthly, chances of success will increase if the organisational change commences in a small scale. If a minor change is implemented successfully in the beginning, the climate for further changes will improve. Past experience shows that if the management has been able to highlight the fact that in spite the change, the work will continue in a similar manner, chances of success will increase. Finally, it is imperative that the organisation allocate sufficient time and resources.

Even though the organisational development has been the dominating change strategy, it has faced sever criticism. Critics argue that it is not a uniform strategy. Instead, it is remedies gained from different fields, mostly psychology. Furthermore, organisational development appears as a universal strategy regardless of the problems facing the organisation. The critics further advocate that organisational development disregard the fact that changes do not always occur through collaboration, instead conflict and abuse of power is a common issue in this context. In addition, it is widely known that organisations do not always have enough time to implement a change in the manner recommended by the theory (Jacobsen and Thorsvik, 2002).

3 METHOD

This chapter describes the chosen method and the reasons for selecting the method. Furthermore, it also discusses how the literature was collected and how interviewees were selected.

3.1 Choice of research model

The task and approach in this thesis is consistent with Yin's (1994) technical description of a case study as an empirical study investigating a contemporary phenomenon within real-life context, particularly when the boundaries between context and phenomenon are not clearly evident and in which multiple sources are used. Yin (1994) further states that in general, case studies are the preferred strategy when "how" and "why" questions are being posed and that interviews are an essential source in a case study since most case studies are about human concern. Hence, interviews were concluded to be the most appropriate way of collecting empirical data. However, there are a vast number of ways available of collecting empirical data e.g. interviews, questionnaires, group discussions and telephone interviews, and which one to choose depends on the context. Questionnaire was not used due to the fact that the respondents' opportunity to speak freely is seriously diminished and the questions could only be answered by a limited amount of people thus making interviews more appropriate. A group discussion was neither a satisfying alternative due to the fact that we would be forced to have many group discussions to gather the same amount of facts. In addition it could be difficult to elicit everyone's opinion. Telephone interviews were also ruled out since interviewees tend to give routine answers when interviewed over the phone and it is impossible to perceive the body language of the interviewed.

Interviews were conducted with four technical consultant companies located in Gothenburg and three significant clients, recommended by some of the interviewed regional managers. Our research procedure can be divided into three steps. The first step was to make a literature study on the subject and establish a frame of reference. The second step was to conduct interviews which allowed us to create an understanding of how KM-issues are handled by the different companies. The third and final step was to analyse whether there were any discrepancies between theory and practice and if there exist any consistency between the different companies regarding their work with knowledge management issues.

3.2 Theoretical study

A comprehensive literature study was conducted in order to gain knowledge on the subject. The study included books, scientific articles and papers and concerned several fields such as; knowledge, knowledge management, organisational change, organisational learning and professional service organisations. The bulk of the books were loaned at Chalmers University of Technology and the University of Gothenburg while the papers and scientific articles were found at various databases such as Emerald Library and Science Direct. The literature has been used to establish a frame of reference before

collecting the empirical data, since it would facilitate asking appropriate interview questions. The frame of reference is more comprehensive and covers several fields that are not included in the discussion in order to give the reader a broad understanding of the subject and related issues.

3.3 Empirical study

Interviews have been carried out in order to identify current problems within technical consultant organisations regarding their management of knowledge and identify how the companies ensure transference of knowledge from senior engineers to junior engineers as well as the organisation. The chosen method provides more information leading to a broader understanding of the topic as the interviews will act as a complement to the theoretical frame of reference. The empirical study of this thesis is based on interviews at Ramböll, SWECO, WSP and Bygg-Fast. The interviewed companies where chosen because of their dominating position in the region. These represent the technical consultant companies while Banverket, Drott and Akademiska Hus represent the clients.

3.3.1 Interviews

To reduce the duration of the interviews and to minimise loss of information (Trost, 1993), the interviews were recorded with a tape recorder. Each interview was conducted at the interviewees' office and lasted between one and two hours. The interviews manifested in open discussion where the interviewees were presented with a mixture of simple straight questions and more elaborate questions. Trost (1993) distinguishes between qualitative and quantitative information gathering. If the study should conclude in numbers such as frequencies and percentages, a quantitative study should be conducted. In a qualitative interview, more complex and informative answers are received. If the researcher is interested in trying to understand people's way to reason and react or to distinguish a certain pattern in the way they handle issues, a qualitative interview is recommended.

The empirical study of this thesis has been based on a mixture of quantitative and qualitative interviews. This type is according to McClelland (1995) referred to as a semi-structured interview because it is implemented in a structured manner, but it also mixes quantitatively and qualitatively based questions. Semi-structured interviews provide a good balance between the sometimes sterile Yes/No structures and the more broadly defined qualitative approach.

The interviews were conducted during the autumn of 2004 with a total number of 16 interviews. The selection of interviewees was based on their position within the company. The regional manager was interviewed to get a comprehensive understanding of how the companies work with KM issues. This was complemented with interviews with a junior engineer and a senior engineer on every technical consultant company to see whether they have the same or similar opinion in this matter. Otherwise, if interviewing only one person at every company, there is a risk the answers would be bias and not accurate. This would compromise the reliability and validity of this thesis. Furthermore, clients were

also interviewed to see whether they place consideration on same KM issues as technical consultant companies.

3.4 The analysis

The findings from the empirical study were then compared to the theoretical frame of reference to see whether any discrepancies could be distinguished. This analysis helped to identify current hindrances and development opportunities concerning knowledge sharing and knowledge development and how they could be connected to the organisational strategy and integrated in the daily work. The analysis of the current situation was then used as a foundation for the conclusions and recommendations. In the chapter conclusions and recommendations items are suggested that project management companies ought to consider when integrating KM activities. These suggested items have been developed based on the presentation of the problems in the first chapter of this thesis.

4 INTERVIEW FINDINGS

In this chapter, findings from the interviews are presented. Interviews were conducted with four project management companies and three clients. All statements below come exclusively from the interviewees at respective company thus it is not the opinion of the authors. Finally our interview findings are presented as objectively as possible.

4.1 Company A

Company A is a consultant company in the construction industry and acts within the fields of property development and project management and their offices are located in the south of Sweden. The company has approximately 50 employees and a little more than 80% of them work with project management and property development.

4.1.1 Learning

When searching for information, internet is used on a regular basis by all employees. Internet is an efficient tool for gaining information regarding regulations, laws, contractors, customers, etc. In addition to the internet, newly employed have their own mentor who they may ask. To gain project related knowledge, it is more appropriate to get in touch with project engineers. Company A is too small to have an intranet as a base for knowledge. As it is today the intranet is a forum for annual reports, company information, templates, guidance, business systems, etc. If the intranet should be used as a knowledge base, it must be reliable, easy to use and updated on a regular basis. When creating this data base, one has to consider the senior employees and how proficient they are at handling IT-systems.

To be successful as a project manager one has to have a lot of experience and one way of acquiring experience is to work with a mentor. Mentoring is used in company A for a newly employed to amass a large quantity of knowledge and information, both socially and work related. In this context, mentoring is a close collaboration between a junior and senior engineer. The best way to introduce a junior engineer into the organisation and the construction industry is to put him in a project from the beginning. This is why mentoring is advocated by management and project managers instead of a trainee programme. The introduction time for a newly employed junior engineer is usually 3 months. As mentioned earlier, company A is a rather small company and according to the employees this facilitates learning as it is easier to get a close contact with colleagues which is an essential complement to the mentorship. Although mentoring is considered to be beneficial and advocated by management, it became clear during the interviews that it is equally important to let junior engineers work with different senior engineers within the organisation, primarily because every person has different ways of sorting out problems, perform work tasks, etc.

An effective way of creating new knowledge within an organisation is to educate the employees by letting them participate in various seminars, lectures and courses. Company A has lectures twice a year by external lecturers on various subjects. Additionally, company A also offers some personal education at the employees' disposal. These

courses normally last approximately for half a day. Some of the employees ask for even more seminars and lectures but the size of the organisation hinders this.

One of the essential issues in technical consultant companies is to charge clients for every employee regardless if they are junior or senior engineers. However, it is difficult to make the client pay for a junior engineer since they normally lacks the experience needed to perform the work of a project manager. Therefore, one has to make the client understand that junior engineers can be beneficial to the client in other ways. E.g. they can perform administrative work at a lower hourly cost. One of the interviewees suggested that the junior engineer should be brought into the project without charging anyone just to introduce him to the client and other people involved. Eventually, when the junior engineer has become more involved, it is possible to charge the clients for his work at the same time as the original senior engineer focuses on another project. One has to remember that this varies from client to client. Some clients are more open to the idea of having a junior engineer involved as they see a long term relationship with the company. If the company has a client with whom they have never worked with before, the introduction of a junior engineer may not be the most appropriate.

4.1.2 Disseminating knowledge

During the interviews, it was established that the best way of disseminating knowledge and information already present in the organisation is by face-to-face interaction. Company A have employees with different competences such as project management, architects, property development etc. and it is common that several employees are engaged in the same projects thus creating teams from the company. Communication within projects is imperative for learning and by varying the constellations within these projects teams, knowledge is better disseminated. Company A admit that they disseminate knowledge quite poorly since lacking a strategy for this and they admit this has to be improved. A suggestion by one of the project managers is to set aside maybe half an hour of the internal meetings to better establish knowledge transfer within the organisation. During this half an hour, the project managers will have the opportunity to present the projects they are working on at the moment and explain complications, solutions, etc. to prevent "*inventing the wheel twice*". This would hopefully lead to a discussion where questions will be pondered and answered.

According to the regional manager, in order to facilitate knowledge sharing, the organisation must be as flat as possible and the work should be divided into projects, i.e. as the company is organised today. A consequence of a flat organisation will be close communication between employers and employees which is significant for knowledge sharing. A flat organisation leaves no room for titles since it is perceived to create rivalry. Appreciation should depend on a persons knowledge and knowledge sharing, not the title. Since the organisation is as flat as possible, incentives and reward systems are limited to appreciation and recognition and not promotion. In company A, promotion is manifested in form of managing larger projects.

During the interviews it was established that workplace design is one of the key issues for improving knowledge sharing and communication. In this case they do not have their own office but sit in groups of four in separate rooms. One has to be flexible and movable enough though, so the constellations can be changed depending on project teams. However, there must be room for privacy if the situation demands it. In addition, the groups must not exceed four persons since it can be too noisy and hard to concentrate.

In order to make sure that projects managers share their knowledge, it is of paramount importance to have created an environment facilitating knowledge sharing. Some employees may find it difficult to share mistakes and faults to colleagues and other prefers to keep their knowledge to themselves in order to stay competitive in the organisation. This is an issue which must be sorted out by management. The employees must feel appreciated and there has to be a sense of wellbeing and trust within the organisation. Feeling insecure and fear of loosing your job will inevitably lead to inhibited knowledge sharing and the worst thing one can do to damage the feeling of security is to make employees let go.

4.1.3 Maintaining knowledge

The opinion whether the knowledge and age gap is a problem varies depending on who is interviewed within the company. One of the interviewees considered the gap to be an opportunity instead of a problem since sufficient planning would allow for a consecutive flow of new and younger employees which would be beneficial to the company. The two interviewed project managers considered the gap to be a problem and said that it is important to address this issue as soon as possible. They also stated that an even greater problem will be the lack of network of clients among new employees. This will be immensely difficult to repair and to alleviate this problem, the junior engineers must be introduced by senior engineers to future clients, suppliers, etc.

A technical consultant company sell services based on their knowledge and is therefore dependent on the employees. Consequently, it is essential to make the employees want to stay in the organisation. Primarily, it is incumbent upon the management to create an environment the employees are content with. They have to feel safe, they must feel that they have an opportunity to influence their work situation and that they are developing. There is a vast number of ways to get the employees to feel this way e.g. wage, colleagues, work tasks, etc. Yet another way to improve company spirit, which has been adopted by company A, is to let the employees purchase some of the company stock. 30 percent of the company is owned by its employees and 85 percent of the employees have seized this opportunity to purchase a block of shares. The regional manager states, even if all the prerequisites are fulfilled to make an employee stay, non-governable situations may still occur. Employees quit and there is little one can do about it except to wish them good luck in the future and make sure that the company has not grown dependent on their customers.

One of the most important characteristics for an employee at a technical consulting company is to be humble and have a will to learn. If the company lacks the necessary

knowledge for a project, it will be dismissed. Based on past experience, company A do not consider sub-consultants as an option when it comes to the core business. They do not consider themselves as an employment service. Earlier problems occurred when a sub-consultant did not ask about an issue as the sub-consultant thought that they should have known the answer from the beginning. This put company A in quite a predicament and resulted in a tacit policy stating it is better to turn down jobs instead of hiring consultant to perform core business.

4.2 Company B

Company B main activity is project management within construction related fields such as building and civil engineering. They also offer services within facilities management, quality & environmental management, property development, and tenant support. Company B has approximately 110 employees and offices in primarily the Nordic region.

4.2.1 Learning

According to the regional manager talking to people is the most efficient way of getting new knowledge and information and using former projects as a reference base is also a rather common event to gather knowledge. Internet is a source for primarily customer information, regulations, AMA and product information. One of the project managers stated that knowledge concerning law issues is normally gathered by asking colleagues. Questions concerning technical issues are normally sorted through the personal network, both internally and externally, which has been built up during the years and by experience. Company B is part of a rather large consultant group with many different companies and areas of technology and it is therefore important to create and to have a network within the group and the intranet is an opportunity for junior engineers to create this network. To receive additional and new knowledge, exhibitions are visited and conferences and seminars are attended.

Mentoring is not practiced on a regular basis. Instead, it is incumbent upon the manager to make sure that the junior engineers are introduced within the company and its routines as swiftly as possible. It normally takes a few months before the junior engineer can be introduced in projects and beneficial to the organisation. Company B intends to introduce younger employees into projects by assisting the project manager, preferably in several different projects with different project managers instead of just one. One of the project managers stated that this is probably the easiest and most natural way to bring in younger employees into the work and organisation. However, in order to succeed the project must amount to a certain size.

Trainees is something accepted by company B. The trainees, who are employed at different companies within the group, are gathered a few times per year to have tutorials and lectures. The trainees do not alter between the different companies but one aim of the programme is to create a network throughout the group. Additionally, employees under 30 have the opportunity to invite clients under 30 to mingle and to get together in a more

informal manner. To have knowledge about each other and to know peoples proficiencies is the most important criteria for success.

The age gap is quite obvious within the construction industry and if it is going to be a problem depends on who you ask. The medium age is 45-50 and the problem is to introduce younger people and to make the clients understand that it is imperative that junior engineers are brought into the industry. The only way of learning the profession is to participate in projects and learn on site. Therefore, younger employees have to be introduced to clients and projects which can be difficult to motivate to the client. They have to understand the reason for bringing in a junior engineer and it is up to the service suppliers to explain the benefits. If junior engineers participate as an assisting project manager in one project, they will be able to do a vast number of administrative duties at a lower hourly cost and in the next project he will be able to handle a larger reasonability which will in the long run make the client the real winner. When introducing a junior engineer it is better to do this with a rather large client with whom one has a good relation to. They understand that they have a responsibility for the survival of the trade and aims at long-term work relations according to the regional manager.

Education is above all received in projects. Project Management Institute (PMI) is used by the organisation and they offer their employees to be certified accordingly. Thus, the employees, mainly the junior engineers, are offered to attend courses depending on how far they have progressed in the company. It is incumbent upon the employees to make requests regarding what courses they want to attend. Available courses for employees are easy to find on the intranet. If the topic is of common interest such as the introduction of AB04, which is an update of the existing construction regulations in Sweden, the company arrange a course for every employee to attend.

4.2.2 Disseminating knowledge

The interviewees emphasised the fact that knowledge is primarily disseminated in projects. This is the foundation of all knowledge dissemination. Once the projects are completed, they try to have some kind of feedback to evaluate how the project progressed by the aid of questionnaires submitted by the client. More general knowledge regarding the company is normally disseminated in meetings. Company B have meetings every quarter where for example strategic and competence development issues are discussed on a standing agenda. They also have what they call Monday meetings where they chitchat about tenders and other work related issues. One of the project managers suggested that some kind of forum for disseminating knowledge would be preferable. This could for instance be a meeting every six months where the project managers discuss pros and cons of their current projects. However, as it is today, spontaneous meetings is considered to be more efficient to transfer knowledge instead of organised meetings.

How the company is organised have an immense impact on learning and knowledge exchange. The project management company within the group is divided into three units; the regional manager, project management and project structure. The first unit comprises of the regional manager. He works 50 % as a project manager and 50 % as the regional

manager. The second unit consists of the project managers. There is no manager of this group, it is considered to be useless since they are very individual in their work. The third and final unit have a manager and comprises of people who work with web-based projects, business systems, development and support. The reason for this grouping is that it helps getting an overview of the daily work. Furthermore, the second unit is to some extent informally divided into the two categories; building and civil engineering, as the difference is significant. The ideal would be to have a project organisation consisting of several project managers in one project, but not very realistic as it would be too expensive for the client and it is impossible to have two managers responsible for the same project.

The work place design is also important for learning and knowledge transfer. It has to be a transparent environment with open doors that lead to a better sharing of knowledge. It should be easy to talk to co-workers. Having a cafeteria is the company's way to create a natural place to meet and socialise with employees from other companies within the group and clients.

Appreciation is considered to be the best incentive to make senior engineers share their knowledge with their colleagues. Higher salary just because they share knowledge is not practiced at company B and the regional manager does not think it is a good idea. However, one can refer to keep the present level of wage if they are available to the junior engineers. Primarily, the senior engineers are covering their knowledge and their clients. Profit thinking, lack of time, prestige and the fact that project managers work alone in projects are major reasons for the restraining of knowledge sharing while socialisation is considered to be an effective way in preventing it. This is achieved by a good working climate and common activities. It is mainly, according to the regional manager, a management issue to prevent senior engineers from *"taking their knowledge to the grave"* and the company must not be dependent upon one project manager or one client. Employees must feel that the clients are not their clients but allotted to them by the company. However, one of the project managers said that in most cases one has to get assignments on their own and it does not matter which company one is working for.

An intranet is an exceptional way to disseminate knowledge within a technical consultant company. The group have a rather sophisticated intranet where one can easily find persons with the right knowledge and different reference objects. One problem though is to get the employees to update their CV's on a regular basis. It is not the responsibility of the employees to add new information on the intranet. However, when completing a project, they have to inform the person whose responsibility it is to update the intranet. The updating is made by an employee in addition of his normal duties which is project management. The intranet is constructed in a manner which allows the employees to search by using key words for other employees and their experiences. Accordingly, one can not find the actual knowledge but one can find the people who have the right knowledge regardless of location in Sweden. It is up to the employee to classify their knowledge into categories e.g. bridge, house, tunnel etc. In addition, the intranet comprises a chat room where one can ask questions which will hopefully be answered by

another employees and this is considered to be a good way to get in touch with the right people.

4.2.3 Maintaining knowledge

Salary, work environment, benefits and personal development are said to be vital for preventing people from quitting. However, sometimes it is necessary to change job, it is something more or less everyone do at some point in life. But the advantage with project management is that one changes work tasks, project groups and clients all the time but not employer. It is a certain safety to be employed in a larger company; one has some sort of back-up, more resources and help getting assignments. As a consequence, this makes it impossible to compete with small project management firms regarding price, instead one have to emphasise other advantages.

In most cases clients ask for one person with the right competence and one with whom they know, they do not care about the rest of the company. Therefore it is important to have employees with the right competence regarding core business. In some cases the clients demand some kind of back-up if something would happen to the project manager e.g. long time sickness or accidents. Company B is a rather large company with more resources i.e. more project managers with the right competence. However, sub-consultants are used by company B to even out peaks in business cycles and as additional competence.

4.3 Company C

Company C supply project and construction management services for all types of building, industrial and civil engineering projects. The main fields of expertise are design and construction management, property development, time and cost control, tendering and procurement, construction law, as well as environmental and quality management. The number of employees at company C amount approximately to 100.

4.3.1 Learning

The way of amassing knowledge and information differs between junior and senior engineers. Internet is used primarily by junior engineers when searching for information about contractors and clients. In addition to the internet, junior engineers get in contact with clients and gain knowledge e.g. work procedures and routines, by asking senior colleagues and it is therefore important to know what colleagues are working with, which clients they know and past projects. Senior engineers also ask colleagues for information and knowledge but they seldom use the internet because a lot of knowledge is manifested in form of experience. Using books to answer questions is often a bit abstract and it is better to have a discussion with colleagues and project engineers. Company C uses what they call a project handbook which is available on the intranet. It is an efficient tool for gaining access to the company's templates, routines, etc. Company C has a quite elaborate intranet which comprises a database with all employees, their CV and past projects but it is not used to gain knowledge in the daily work. It is up to the employee to

update their CV and this is something which must be improved in the future. Newspaper and trade press is considered to be efficient when gaining news and additional information regarding new products and work procedures.

Mentorship is not yet used at company C although there are directives that they shall use it. Once the mentorship is fully implemented, it is better to have one mentor but the junior engineer should work with different colleagues as it would generate an insight in several work procedures instead of one and thus give the opportunity to get more experience and be introduced to more people. As it is today, the newly employed has to initiate the mentorship on their own and there are no routines for introducing the junior engineer into the organisation. Every employee, primarily junior engineers, should have a plan for personal development and it should be established in collaboration with a responsible manager. Personal development and education is primarily received in projects and the manager has to find projects for the junior engineer, although there has to be a senior engineer with the possibility to introduce this person in the project.

The opinion among the interviewees differs regarding education i.e. courses and seminars. The two interviewed project managers said the range of courses was quite poor and the information concerning seminars is lacking. One of these two would like to see courses in contract law at least once a year, since this is one of the most important issues for a project manager. On the other hand the regional manager stated that there is an array of courses available for the employees. As mentioned before, the idea is that every employee has a plan for personal development which is annually discussed with the manager and this plan also includes what types of courses the employee should attend. This is the idea but it has to be improved in the future.

Sub-consultants are used to a rather limited extent as they are only used at certain occasions when specialists are needed, not when it comes to core business. Company C highlight that by using sub-consultants the idea with knowledge sharing and education of junior engineers is not feasible.

When introducing a younger employee into different projects, one has to make sure the clients know why and what they pay for, e.g. it is not feasible to charge the client for two employees attending the same meeting. It is incumbent upon the company to make the clients understand that there are certain tasks which the junior engineer can perform at a lower hourly cost thus turning them into the real winners. However, some clients are more susceptible and some projects are more suitable for introducing junior engineers. The project has to amount to a certain size and the company must have a good relationship with the client in question. In addition, it is equally important to get the senior engineers understand the benefits of having a junior engineer as an assistant. One opinion among senior engineer could be that they can do the work better and faster than a junior engineer.

4.3.2 Disseminating knowledge

The work of a project manager is very individual and there is no systematic way to disseminate knowledge in company C, thus a lot of work that has been performed in the past by others has to be made all over again. Consequently, there is no ongoing process to ensure that experience is disseminated. There ought to be a strategy for this but it is hard to tell how it should be constructed. Concrete knowledge is embedded in reference projects but is not actively disseminated. Abstract knowledge from projects is harder to describe and disseminate and all interviewees agreed they lack the necessary forum to do this. A proposition by one of the interviewed project managers is to establish regular meeting with the sole purpose of knowledge and experience sharing. During these meetings, project managers describe their current projects, problems, mistakes, innovations and things that were considered to be a problem but were solved since doing this and that. The meetings do not have to be more complicated then this, since the intention is to create a discussion. In order for these meetings to be successful, they have to be prioritised as high as project meetings and the attendees have to know the purpose with the meeting otherwise it will come to nothing. Advantages with these meetings will be their contribution to learning as well as improving the solidarity with the company.

Company C is a flat organisation and divided into the two categories building and civil engineering. The idea with this grouping is that employees with similar background should easily be able to get together and discuss education and meet clients in order to improve their domain. However, they do not sit in this grouping since this knowledge "label" would hinder colleagues between the two categories from sharing knowledge and experience. A constantly recurring dilemma concerning workplace design at project management companies is the fact that many of the project managers is mostly situated at the temporary projects offices. However, even though the organisation of the company is important for knowledge dissemination, there are other factors that will have a profound influence this subject. One of the interviewees advocated the work climate to be more important than how the company is organised since a good work climate makes it easier to talk and discuss about work related issues with colleagues.

Creating the right culture and work climate is essential for making the employees share their knowledge and experience and it is the management's responsibility to incorporate this kind of thinking into the organisation. The work climate is also important to make the project managers work for the benefit of the company instead of their own. They must feel that they want to contribute to the organisational learning. Incentives in form of money for knowledge sharing is not a good idea according to all interviewees as there is no accurate way to measure and evaluate this. Promotion is not a suitable possibility either because the organisation is flat. However, one way of promotion is to be entrusted to manage larger projects but this should be based on your competence and not how much knowledge you share. The one thing you can get for knowledge sharing is appreciation and that brings us back to creating the right work climate.

Protecting ones territory and lack of time are considered as major reasons for not sharing experiences. This is also related to the work climate and culture and whether one feels comfortable at the company or not. If feeling appreciated at the company there is usually

no problem discussing work related issues even after working hours. Another reason for not sharing knowledge is the fact that project managers are normally located at temporary project organisations. It is therefore incumbent upon the manager to make sure that employees regularly come to the office for example by making "knowledge meetings" holy where one can meet, discuss work related issues and fraternise with colleagues.

As it is today the intranet is not frequently used by the employees to gain knowledge. To successfully use IT as a knowledgebase, some criteria must be fulfilled; every employee must know the benefits of the intranet, access independent of where one is located, easy to use and up to date. One of the interviewees considered it a good idea to have a database of earlier projects describing who the project manager was, a short summery of each project and pros and cons.

4.3.3 Maintaining knowledge

The opinion whether the age gap is or will be a problem differs between the interviewees. One interviewee's opinion is that the age gap is not the problem, instead it is the knowledge transfer that has to be sorted. The other interviewees though of it as a problem or rather that it will be in 5-10 years and to prevent it, the management must allot time for senior engineers to focus on educating junior engineers. One must bear in mind though, that this is a monetary issue and there must be a balance between working in projects and education of junior engineers.

Technical consultant companies are very dependent upon their employees and their knowledge thus it becomes immensely important to make the employees want to stay within the company. Accordingly, the client purchase in most cases the person they know have the right competence and not the company. According to the interviewees there are a vast number of criteria which have to be fulfilled in order to accomplish this. Firstly, the salary must reflect the amount and type of work performed. Secondly, work climate and work environment have to be pleasing and it is essential not to underestimate the impact of appreciation from colleagues and management. Finally, the employees have to feel that they are developing and that they have an opportunity to affect their work situation. It is important for the company not to grow dependent upon a single project manager or one client hence it is preferable if several project managers have contact with same clients i.e. one has to create a company instead of a group of individuals. There are several ways of making employees feel solidarity with the company e.g. to have lunch with those project managers who are seldom at the office, common activities, meetings and on-site access to the intranet.

4.4 Company D

Company D offers private and public sector clients expert project management services within the construction sector. Company D undertake assignments within offices and retail, education, healthcare, housing, civil engineering, communications, industrial facilities and projects entirely outside the construction sector. At present, there are about 130 employees located nationwide.

4.4.1 Learning

A lot of the information is gained from the company's intranet. According to one interviewee, using the intranet is the absolute easiest way of amassing knowledge and information since it allows one to swiftly find employees with right knowledge. Conversely, another opinion is that the intranet is not used in any greater extent since the interviewee can not se how to benefit from it. A significant problem when working as a project manager is that one works alone thus making it difficult to know what the other employees work with and what kind of knowledge they possess. Otherwise a good way of amassing knowledge is to ask colleagues both internally as well as externally. One opinion among the interviewees is that this kind of spontaneous meetings is the best way of sharing and gaining knowledge. Spontaneous meetings occur when one interacts with colleagues regarding a particular problem and once it is solved, it will result in new experiences and additional knowledge. Hence, establishing a personal network provides a broad range of knowledge and is essential in this line of work. Seminars and meetings are also attended in order for the employees to gain new knowledge. These are, however, more informative instead of educating. Internet is mainly used for finding information regarding contractors, products and clients.

Mentoring is implemented at company D and every newly employed have a mentor and their objective is to introduce them into the company both socially and professionally, make them feel welcome, introduce them to clients and projects and provide them with suitable work tasks. A senior engineer accepting to be a mentor has to realise that it comes with certain obligations such as availability and supportiveness for the junior engineer. There is no pronounced time limit for the mentorship and it is important for junior engineers to work with several senior engineers, while having the same mentor. Introduction courses are also available for the newly employed to introduce them in the organisations routines and work procedures.

Attending courses and seminars is a way to learn and receive additional knowledge. A wide array of courses is available for the employees at company D and they are listed on the intranet and discussed in unit meetings. During personal development discussions with the employer, one discusses what courses the employee would like to and should attend. It is hard to get an opinion about what courses one wants to attend in the beginning of an employment, this is something that grows gradually. Construction law is the education project managers find to be most useful. One difficulty when it comes to education is that it can be hard to set aside time from the projects. An additional advantage besides learning is that during courses work related questions and experiences are discussed on the subject. However, learning and education is primarily received in projects and therefore it is important to get junior engineers into projects as swiftly as possible. It is incumbent upon the manager to explain for the client that having a junior engineer participating in projects will be of benefit for the client and should not be considered as an additional expense. The project, however, must be of a certain size or rather complex otherwise it will be difficult to find useful work tasks for the junior

engineer. It is also an advantage if the company has a good and long-term relation with the client.

The usage of sub-consultants should be done to a limited extent otherwise knowledge in the organisation would be diminished and learning inhibited. If it is a large project, one tries to find the staff needed within the company but if the amount of staff available is not enough or the project requires specialist knowledge, it will be necessary to hire the right competence through sub-consultants.

4.4.2 Disseminating knowledge

During the interviews, it was established that human contact is the foundation for all knowledge dissemination. It does not matter how sophisticated the intranet is or how elaborate the knowledge systems are, in the end it is all about the personal network. Another way to facilitate knowledge dissemination is workplace design. At company D, those units that work closely together also sit together as it is believed to improve knowledge sharing. The employees prefer to sit in an office landscape due to the fact that this facilitates discussion among employees. However, some integrity is needed thus screens separate the workplaces. Meetings are also a common forum for knowledge dissemination. They have unit meetings once a month where one or two project managers sometimes present current projects which usually lead to a discussion around related issues. These meeting should not be held too often and they have to be scheduled far in advanced otherwise there is a chance that the attendance will suffer. As it is today, there is no organised system for knowledge dissemination and consequently there is no way of measuring or guarantee it either.

Company D has a very flat organisation. This, together with working in projects, is the best way to organise the company concerning knowledge exchange. In a hierarchic organisation, knowledge and experience stays and disappears within the different levels and this will not do in our line of work. Having more people working in the same project would facilitate knowledge sharing. However, it is not feasible in most cases since it would be too expensive at the same time as two people can not be in charge of the same project. In addition to this, there are some technical groups within the company that represent the different areas of technologies and their purpose is to discuss and distribute development of existing technology. Retaining knowledge is a basic human behaviour and sufficient communication is the best way to prevent it. A better communication between employees also creates a better work climate, which in turn creates trust. Having incentives in order to ensure good knowledge dissemination is not practiced at company D. The interviewees do not consider it to be a good idea primarily because it is difficult to measure. Instead, it is better to make the employees understand that it is a part of the work to exchange knowledge and ask colleagues when faced with a problem. Working alone in projects, lack of time and the fact that many project managers are located in temporary project organisations is considered to be the major reasons why knowledge and information is not distributed and shared within organisations.

In order for the intranet to be beneficial it has to be easy to use, legible and accessible independent of where one is located. Company D has a very elaborate intranet with large quantities of information and knowledge, one of the interviewed project managers even said that there may be too much information and knowledge. It is a very good way to search for past projects as well as for persons with the right knowledge. However, employees must take the time to learn how to search for the knowledge and how to use the intranet in an efficient manner. It is up to the employees to make sure that their CV is up to date which has not been a problem in the past since employees are keen on showing what kind of earlier projects they have been involved in.

4.4.3 Maintaining knowledge

The opinion whether the age gap is or will be a problem in the future differs among the interviewees. Two of the interviewees consider the age gap to be a problem which has to be sorted out as soon as possible although they do not know how. The third interviewee was of the opinion that there are plenty of younger employees between the age of 25 and 35 with enough experience to replace the senior engineers in the future. The toughest part, however, is to replace the personal network not the senior engineers.

A technical consultant company is dependent on competent employees and in order to make the employees stay within the organisation, one has to offer them a salary with which they are content and assign them interesting work tasks allowing the employees to develop. What the company also can do is to create a good working climate and to make the employees feel content and secure through activities such as company gatherings, study trips, allowing employees to do activities with clients etc. The policy and values of the company also have a significant impact on how the employees feel and what type of people the company will attract thus influencing the work climate and the colleagues. If employees do not like to work in a large organisation like company D, they will quit quite soon. It is impossible for companies to create the right environment which is suitable for those people who would like to start their own business. According to one interviewee, no one will stay within a large company for 10 years and then quit and start their own business. Either you adapt and stay or you quite earlier than that.

It is possible to get some assignments if the company brand is perceived as something positive and is associated with security, safety and competence. Otherwise, it is more usual that the clients purchase the consultants based on personal relations or recommendations. During the interview, it was established that the benefits of having a personal network with clients can in many ways be overestimated when it comes to getting assignments. In order to get full advantage of ones network, the project manager must maintain the relationship with clients and that the client organisation does not change. This becomes more or less impossible to do when working for a single client for some years. Some clients, however, are required to purchase projects according to the act on public procurement. This act states that the client can not purchase e.g. consultants based on personal relations. This puts the company in focus rather than the individual project manager.

4.5 Clients

Clients have an immense part in order for technical consultancy companies to survive and to have a possibility to work with knowledge management issues. The client also plays a role in the education of junior engineers since they purchases services provided by consultant companies.

The interviewed clients normally purchase project managers based on personal relations or past experience instead of the reputation of the consultant company where they are employed. One interviewee stated that larger consultant companies are of the opinion that it is better to procure all consultant services from one company. This is not the case according to the interviewed clients, instead they want to choose the ones they know i.e. one purchase consultants based on the personal network. However, when it comes to large roles in large projects the company plays an important part to the project manager and the client by providing back-up, insurance, quality systems etc. The company must be able to guarantee that if something happens to the regular project manager they can provide a new with equivalent competence. The problem is that the new project manager is not posted up in the project because it would be too expensive to have several project managers involved in the same project just as back-up. This applies for one- or few-man consultant companies as well as larger consultant companies. However, the advantage with larger companies is that they may have systems which allow other employees to swiftly get acquainted with colleague's projects by the aid of computer systems, intranets, routines, templates, etc. When it comes to smaller roles in projects or smaller projects, the price for the service is a decisive issue and in these cases the larger companies can not compete with one- or few-man consultant companies.

In order for junior engineers to get experience and be educated in the profession of project management they have to participate in projects. One way of doing this is to work as an assisting project manager or as a project administrator although this will inevitably result in an initial additional expense for the consultant company. However, some clients are not foreign to the idea of contributing to this expense since; firstly, they also have a responsibility for bringing in new employees to the industry, secondly, it is in their interest that contractors and consultant companies have competent employees and thirdly a significant number of the client's staff is recruited from these actors. One interviewee stated that they try to create roles suitable for junior engineers in their projects to support the regrowth of the trade. Yet another way to introduce junior engineer into projects is to emphasise the benefits for the client e.g. administrative and supportive work at a lower hourly cost. As a prerequisite though, the project must be of a particular kind or size allowing the junior engineer to receive meaningful work tasks.

5 DISCUSSION

In this chapter, the emphasis shifts towards a general discussion of findings and analysing them using the theoretical frame of reference. The discussion is divided into the same categories as the previous chapter. Within each category problems and development opportunities are presented based on our and the interviewees' perception of how their companies work with knowledge management issues and how it can be improved.

5.1 Learning

The kind of forum used when searching for knowledge and information varies depending on what type of knowledge and information one is looking for. Internet is used if the information is in regard to contractors, laws, regulations, products etc. When it comes to project and work related knowledge the interviewees' all agreed that the personal network of colleagues and project engineers is most commonly used and by far the most effective way of gaining knowledge and information. This is consistent with the result from the survey conducted by Egbu and Botterill (2002) which is mentioned in the theoretical frame of reference and states that telephone and face-to-face meetings are the most efficient forums for disseminating knowledge. The findings show that the interviewed companies use the intranet to find information regarding regulations, work processes, templates etc. The intranet can also be an efficient tool for creating a personal network i.e. an intranet is a very efficient way of getting in touch with the right people although only two of the companies use the intranet in this manner. None of the companies used it for gaining the knowledge itself. Both junior and senior engineers use the intranet but it is especially useful for the newly employed as it will facilitate establishing a personal network within the company. It is our opinion that the intranet should be used more as a source of information and knowledge as it can be a very efficient tool if managed properly. Furthermore, the management has to make sure that the employees know the benefits and opportunities of using it and not the least, how to use it.

The work of a project manager is very much based on knowledge and past experiences and one way of acquiring this, for a junior engineer, is to work with a mentor. Mentorship is implemented at two of the four companies. The companies who have accepted mentorship advocate it as the most efficient, rapid and natural way of introducing a newly employed into routines, work procedures and above all, projects. It is important though to make sure that the newly employed work with several senior engineers at several different projects while having the same mentor. This gives newly employed the opportunity to discover different aspects of project management as every person has different ways of sorting out problems, perform work tasks etc. It is our opinion that newly employed should work with their mentors during their first project in order to establish a close relationship and develop trust between the two. This coincides with Coleman (1999) who states that if trust is not a part of the organisational culture, knowledge sharing is unlikely to occur. The senior engineers who agreed to help a newly employed must understand that it comes with a certain responsibility such as availability

and supportiveness for the junior engineer. Two of the companies do not have mentoring as mentioned above. Instead, at one company, it is the regional manager's responsibility to make sure junior engineers are introduced into the company, its routines and as swiftly as possible being positioned in projects as an assisting project manager. The final company has no routines what so ever for introducing newly employed into the organisation and the junior engineers have to initiate their own mentorship. However, there are directives that mentoring for newly employed shall be introduced but it is not systemised yet. During the interviews, we found out that the companies do not use mentoring in a traditional meaning i.e. a life long collaboration between two persons. However they use a similar thinking in order to introduce newly employed. We believe that it does not matter what you call it or who is responsible for the introduction of newly employed as long as there are routines and strategies for the development of the junior engineer.

Courses and seminars can be a very effective way of gaining new knowledge on an individual level and if disseminated properly, it will create new knowledge on an organisational level. There are a wide array of courses and seminars available at all companies and they are easy to find on the intranet. If the purpose is to provide people and organisations with knowledge to act more intelligently, they need schemas, programs and scripts not just routines (Wiig 1993). Every employee should therefore have a personal development plan which is discussed together with the manager and this states among other things what courses and seminars they shall attend. It is incumbent upon the employees to make request regarding what courses they want to attend. However, some newly employed perceive it as difficult to decide how useful various courses and seminars are since they lack the knowledge needed for this evaluation. This makes it even more essential to establish routines and a personal development plan for the junior engineer, in the beginning of the employment. It is our opinion that if the topic is of common interest for the entire organisation, the company should arrange courses for every employee to attend. This is the case at one of the interviewed companies.

Learning and education is primarily received in projects and therefore it is imperative to introduce junior engineers into projects very rapidly. However, it can be difficult to make the client pay for a junior engineer as they normally lack the experience needed to perform the work of a project manager. Hence, one has to make the client understand that junior engineers can be beneficial to the client in other ways. If junior engineers participate as an assisting project manager they will be able to do a vast number of administrative duties at a lower hourly cost and should not be considered as an additional expense. If one has a good relation with a client and trust between the two has been established, it is easier to introduce an assisting project manager into the projects. Furthermore, some clients, depending on how much they build, are more open to the idea since they have a responsibility for the survival of the trade at the same time as it is in their interest that contractors and consultants have competent employees. It is equally important to get the senior engineers to understand the benefits of having a junior engineer as an assistant otherwise they may be of the opinion they can do the work better and quicker by themselves. From an assisting project manager perspective the project is more decisive than the client in order to get meaningful work tasks, i.e. size and

complexity of the project. Our opinion is that the size of the project should not be of any problem since there are always work tasks to perform regardless of size. A prerequisite however, is to show the benefit to the client.

Usage of sub-consultants is believed by some of the interviewees to inhibit learning within the organisation as it will be difficult to create a feeling of solidarity towards the company and develop trust, which is a prerequisite for knowledge sharing. Some companies use sub-consultants to a limited extent though if the project requires specialist knowledge or to even out changes in the business cycles.

5.2 Disseminating knowledge

In our opinion, none of the interviewed companies have fully accepted knowledge management as a systemised routine for disseminating knowledge within the company, i.e. there is no prepared process of getting right knowledge to the right people at the right time in order to bring the greatest benefit to the organisation (Sverlinger, 2002). Consequently, they do not do anything to ensure that the knowledge have been disseminated either. In the last chapter we discussed learning on an individual level. However, in order to make the knowledge beneficial on an organisation level, it has to be properly disseminated throughout the entire organisation. The main problem though, is that the work of a project manager is very individual and they are located at temporary project resulting in just spontaneous visits to the office. Additional issues which are believed to inhibit dissemination are lack of time and prestige. It is therefore incumbent upon the manager to make sure that employees regularly come to the office as it was established during the interviews that the best way of disseminating knowledge is through face-to-face interaction and this can be achieved either through spontaneous meetings or organised meetings. It is the authors' opinion that in addition to the spontaneous meetings, which constantly take place, one has to create a suitable forum for knowledge dissemination which can be a meeting held on a regular basis e.g. once every six months. A prerequisite for these meetings is that they are considered important enough or otherwise there is a chance that other things are prioritised. During these meetings, some project managers will have the opportunity to present their project, pros and cons, problems etc. In order to be successful these meetings must be well planed and anchored within the organisation. The purpose is to disseminate knowledge by creating a discussion and in order to achieve this, the subjects must be pre-determined which allows employees to prepare questions. These meetings would, if successfully implemented, contribute to less rework, quicker analysis, decision and execution.

Jacobsen & Thorsvik's (2002) states that an organisation needs to be as flat as possible and further emphasise on horizontal communication, for organisational learning and knowledge dissemination. All companies have a flat organisation which is consistent with this statement and a consequence will be improved communication between employer and employee and between employees which is essential for knowledge dissemination. The employees must understand that it is part of the daily work to exchange knowledge and ask colleagues when faced with a problem. Furthermore, a flat organisation leaves no room for titles and rivalry thus promotion should be manifested in handling larger

projects, although promotion should be based on ones competence and not how much knowledge one share. Incentives for making employees share their knowledge is not practiced at any of the companies as it is considered to be too difficult to measure and they can not see any benefits by using incentives of any kind. Instead, management has to create the right climate and culture in order to establish trust among employees, hence proper knowledge sharing. Some employees may find it difficult to share mistakes and faults to colleagues and other prefers to keep their knowledge to themselves in order to stay competitive in the organisation. In order to over come this, employees must feel that they want to contribute to the organisational learning and that they work for the benefit of the company. During the interviews though, it was established that sharing knowledge was not a problem, if one got a question one answered. However, it is the authors' opinion that, sharing knowledge should take place without anyone necessarily asking questions.

Knowledge is best shared with those who one has a common task with e.g. working in a project towards same goals. The problem, however, is that the daily work of a project manager is very individual resulting in a solidarity towards the temporary project organisation instead of the company where they are employed. Therefore the project management companies should try to man the project with teams instead of individuals. However this is not an easy thing to accomplish, since it can be too expensive and two persons can not be responsible for the same work tasks, but it should not be impossible. This can not be achieved in every project, hence management must try to create a common goal within the company without necessarily having employees working together.

Knowledge dissemination is also dependent on the workplace design. All companies have created an open design with open doors together with an office landscape. Two of the companies have also acknowledged that if several persons or units within a company work on either same or similar projects they ought to sit together as well. This would improve the communication between these people and hopefully result in less rework. However, one has to be flexible enough so the constellations can be change depending on project teams. Communication within projects is imperative for learning and by varying the constellations within the project teams, knowledge is better disseminated. It is our opinion that if the office is designed with open doors and landscape, the company must provide certain rooms where one can discuss in private issues with e.g. the client.

IT is becoming more and more important to KM in the construction industry. Construction work is, as mentioned before, more or less exclusively project based and knowledge is lost from one project to the next. Hence, transferring knowledge across projects becomes a major challenge (Egbu and Botterill, 2002). Many organisations are aware of the significance of capturing and storing knowledge in a repository. However, the problem is that employees capture and store knowledge and it requires a specific mind-set to identify the characteristics that best classify the experiences (Wiig, 1993). An intranet is an effective forum for repositories and for disseminating its knowledge if managed properly. Prerequisites for an efficient use of the intranet are reliability, easy to use, updated on a regular basis, legibility and accessible independent of where one is

located. It is our opinion that the intranet should be constructed in a manner which makes it possible to search for either reference projects or employees with a particular competence. If the project manager is faced with a problem when building a particular building, it should be easy to use the intranet to see if other project managers have faced similar problems on similar projects. Consequently, the first thing to search for is what one is building e.g. hospitals, bridges, ports, houses, etc. After that, the next step will be to decide whether one would like to contact the project manager or if one would like to read about the project. The information about the project managers constitutes their CV's, and earlier projects. This makes it important that employees update their CV's regularly. The information about reference projects consists of general things like who the contractors were, specific problems, things that were considered to be a problem but were not because they did this and that, pros and cons, bottlenecks, price, administrative requirements, etc. In order for this to be successful, the reference projects must remain objective, avoid story form and minimise anything that could be misinterpreted. If the information coincides with what one is looking for, the next step would be to contact the project manager to discuss the project further. Furthermore, the intranet should not comprise too much knowledge and information as it will be difficult to find what one is looking for and employees must take time to learn the intranet and how to search for knowledge. In addition to the reference and the employee repositories, the intranet should also include a chat room were one can ask questions which will hopefully be answered. According to Diedrich (2004), technical solution can be a very efficient tool for knowledge dissemination. However, sometimes companies that have accepted KM as a way of work tend to have an exaggerated confidence to its IT support. When constructing an intranet, it is not unusual that the desire to design the perfect system becomes more important than the result i.e. the technical solution becomes more important than the actual dissemination of knowledge and one tends to forget the daily work in which the system shall be applied. The intranet must therefore be constructed in a manner which considers the current situation and what the employees need and want.

5.3 Maintaining knowledge

A technical consultant company sell services based on their employees' knowledge and it is therefore immensely important to make sure that the employees want to stay at the company and that they identify themselves with the company instead of as an individual. The policy and values of the company will affect how the employees feel and what type of people the company will attract hence influencing the work climate and colleagues. Furthermore, it is primarily up to the manager to create an environment and work climate that the employees are content with. This can be very difficult to do as many of the employees are located at temporary project offices and are seldom at the office. However, there are a number of ways to improve the employees solidarity towards the company e.g. salary, work environment, benefits and personal development, a feeling of appreciation from colleagues and managers, opportunity to affect their work situation, feeling of security, access to the intranet at the temporary projects, the manager can have lunch with those project managers who are seldom at the office, common activities, etc. Yet another way to improve the solidarity towards the company is to allow the employees to buy shares in the company. It is our opinion that this is a good way of improving the

solidarity and should be acknowledged by those companies which have the possibility. However, sometimes it is necessary to change jobs and it is something more or less everyone does at some point in life. There is little the management can do to prevent this and they should probably not do anything except whishing them good luck. Furthermore, it is impossible for companies to create the kind of environment which is suitable for those people who would like to start their own business. Therefore, it is essential for the company not to grow dependent on one project manager or one client thus making it appropriate that several project managers have contact with same and several clients.

There is no way of telling whether the age gap will be a problem in the future or not. It is our opinion though that it does not seem to be a problem even though some of the interviewees were of a different opinion. During the interviews, it was established that some considered the age gap as a problem unless something is done to sort it out, thus it appears that the management has come to understand that employing junior engineers are the best thing to do. Furthermore the management must allot time for senior engineers to focus on educating junior engineers and introduce them to clients. One of the interviewees stated that the replenishment of junior engineers were a bit low and considered this to be a problem. However, we disagree with this statement based on the interviews and the study made by Swedish Technology and Design [Svensk Teknik och Design] who came up with the age distribution depicted in Figure 5 (www.std.se, 2004).
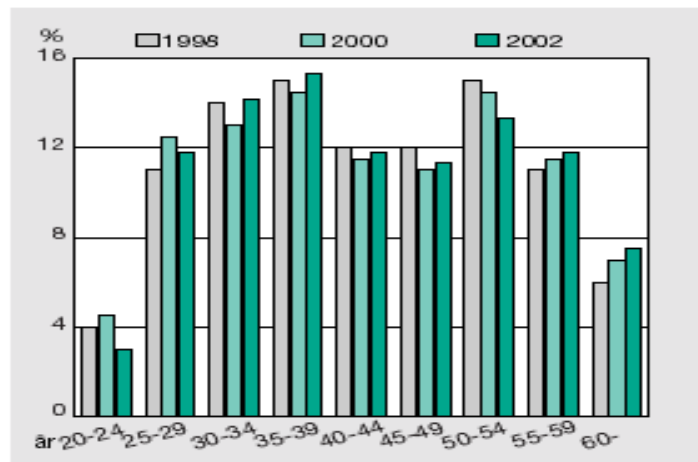

Figure 5. A graph illustrating age distribution in architectural and technical consultant companies in Sweden

As can be seen in Figure 5 the age gap is not as significant as generally considered. There are a sufficient number of employees between the ages of 40-50, at the same time as there are plenty of younger engineers between the ages of 25-39 who eventually can take over. The graph further shows that the main part of the senior engineer has approximately 10-15 years before retirement and there is time to educate junior engineers.

It is possible in some extent to get assignments due to the company brand if it is perceived as something positive and associated with competent employees. However, the client usually purchase the services based on personal relations and recommendations. The company can be of benefit though if the project is substantial and demands for a

certain back-up. The company can provide a security by the aid of common and elaborate work procedure and routines which allows other project managers to get involved rapidly into other persons' projects if something would happen to the original project manager. It is up to the manager to introduce these routines and work procedures into the daily work and point out the benefits with a company for the client. As already mentioned, it is important for a consultant company to keep employees due to their knowledge but in addition to this it is equally important to keep them because their personal network with clients since they normally purchase the individual instead of the company. However, during the interviews, it was established that sometimes the personal network can be overrated. A personal network is a very dynamic thing and it is constantly changing. If a project manager works full time on a project for a couple of years there is a certain risk that their personal network has changed to such extent that the company plays an important part in getting new assignments.

5.4 Aspects by clients

As earlier discussed the best way of educating junior engineers is to introduce them into projects as early as possible. A prerequisite for this is that the client understands that they play a key role in this matter and that they are of the same opinion as the technical consultant companies. During the interviews, it was established that some of the clients are not foreign to the idea of contributing to the additional expense of bringing a junior engineer into the project since they have a responsibility towards the regrowth of the trade i.e. bring in junior engineers to the industry. Furthermore, it is in their interest that consulting companies have experienced and competent employees and they recruit most of their employees from these actors.

All interviewed clients agreed that they in most cases purchase project manager based on personal relations or recommendations instead of the reputation of the company. However, certain projects demands for a back-up and emphasis then shifts from a personal level to an organisational level i.e. the company's systems, routines and work procedures. One- or few-man consultant companies usually have a back-up in form of network with other one- or few-man consultant companies but this is not sufficient and the clients prefer to allot the key roles in these projects to larger companies. However, the larger companies have great difficulties in competing with smaller firms regarding price, therefore it is our opinion that when it comes to smaller roles and projects, the smaller firms have a clear advantage and there is nothing the larger companies can do about it. Instead, they should emphasise the benefits by employing a larger project management company.

6 CONCLUSIONS AND RECOMMENDATIONS

In this chapter conclusions are drawn with the purpose of providing technical consultant organisations with advantages of knowledge management and ways to improve knowledge sharing, knowledge dissemination and learning. This chapter is categorised in the key issues that were established during the study; Mentoring, Meetings for knowledge dissemination, Organisational aspects, IT, Creating the right climate and finally Age gap. First the aim and objectives with this master thesis are reiterated, to facilitate the reading of this chapter. Thereafter, in accordance with the key issues, conclusions and recommendations are made and presented. The key issues are based on theory, interviews and our own analysis.

The aim of the thesis is to *suggest key issues necessary for an organisation when implementing a sustainable knowledge management work procedure*. The strategy is based on considerations of organisational as well as technological aspects.

The first objective of this thesis is to identify current problems within project management organisations regarding their management of knowledge i.e. how the companies create, disseminate and maintain knowledge and experiences. Secondly, the thesis tries to identify how the companies transfer and ensure transference of knowledge from senior engineers to junior engineers as well as the organisation and thereby bridge the gap of the age distribution that is so apparent in today's construction industry.

Mentoring

The work of a project manger is primarily based on knowledge and past experiences and an effective way of acquiring this knowledge is to work with a mentor. Mentoring is the most efficient, rapid and natural way of introducing a junior engineer into company routines and projects and ought to be implemented at every project management company. We think that the newly employed should work with their mentor during their first projects in order to establish a close relationship and develop trust between the two. Trust is absolute imperative otherwise there is a chance it will come to nothing. However, in order to get the best out of it, the manager must make sure that the junior engineer work with several different project managers on several different projects while having the same mentor. This allows the junior engineer to discover several aspects of project management which is important since the junior engineers must try to find the work procedure most suitable for them. It is equally important that senior engineers who agreed to help a newly employed understand that it comes with a certain responsibility. The senior engineer must be available and supportive to the newly employed to ensure they are properly introduced and at the same time they must understand the benefits of having a junior engineer as an assistant otherwise they may think it is better to do the work by themselves. In order for junior engineer to have the opportunity to work in project with either their mentor or with another project manager they have to be introduced to clients and the company must be able to motivate why a junior engineer should be brought in. It can be difficult to make the client pay for a junior engineer as they normally lack the experience needed to perform the work of a project manager. The manager must therefore make sure that the clients understand that junior engineers can be

beneficial in other ways such as performing administrative work at a lower hourly cost. Additionally, some clients are more open to the idea of having a junior engineer involved and it is up to the manager and senior engineers to establish who these clients are.

Meetings for knowledge dissemination

Most sharing of information and knowledge takes place through interaction between individuals and the work of a project manager is very individual i.e. they work alone on various projects often located at temporary project offices. This implies a need for the company to maximise opportunities for employees to meet, both spontaneous and planned as the most efficient way of disseminating knowledge is through face-to-face meetings. Spontaneous meetings occur when one has a question regarding the daily work and visits the person who might answer it or if one happens to meet a colleague at the office. However, the problem is that many of the project managers are rarely at the office and as a natural consequence there will be few spontaneous meetings for some employees. Hence, the management has to create an organised meeting, maybe every six months, with the sole purpose of knowledge dissemination between colleagues. During these meetings, some project managers will have the possibility to present their current projects, pros and cons, expected problems, remedies etc. To make these meetings successful they must be well planed and anchored within the organisation. In addition, the management must make employees see the importance of attending these meetings otherwise there is a chance it will come to nothing and other issues are prioritised.

Organisational aspects

The best way to organise a project management company in order to establish a good learning and knowledge dissemination between its employees is to have the organisation as flat as possible. A consequence of a flat organisation will be improved communication between employer and employee and between employees which is essential for learning and knowledge dissemination. The are several different incentives available for sharing knowledge such as money, appreciation, benefits, time-off, promotion etc. However, a flat organisation leaves no room for titles thus promotion can only be manifested in managing larger projects. The problem though, is that promotion ought to be based on one's competence and not how much knowledge one share. Incentives for making people share knowledge and experiences is a good idea but it is immensely important that the companies find a way of measuring this properly or it will be of no benefit to the company and do more harm than good. In our opinion, the organisation needs to employ external expertise in this area in order to make the measuring fair and to establish proper incentives.

An additional way of organising a project management company is to divide the work into projects. Knowledge is best shared with those who one has a common task with and therefore the project management companies ought to man the project with teams instead of individuals. This is not an easy thing to accomplish since it can be too expensive at the same time as two persons can not be responsible for the same work tasks but it needs to be sorted. This is not applicable for every type of projects but the management should strive for it when possible.

IT

Construction work is more or less exclusively project based and a lot of knowledge is lost from one project to the next thus making knowledge transfer between projects of paramount importance. An intranet is an effective forum for repositories and for disseminating its knowledge if handled properly. Prerequisites for an efficient use are reliability, updated on a regular basis, legibility, accessible independent of where one is located and easy to use. The intranet ought to be constructed in a manner which makes it possible to browse for either reference projects or employees with a sought-after competence. The reference projects must remain objective, avoid story-form and anything that can be misinterpreted should be kept to a minimum. Additionally, the intranet should not comprise too much information or knowledge since it would be difficult to find what one is looking for. The intranet should preferably also include a chat room where it is possible to ask work related questions nation wide. However, the intranet could be an efficient tool for knowledge management but, it is not unusual that the desire to design the perfect system becomes more important then the result. Consequently, when designing the intranet one has to consider the current situation and what the employees need and want.

Creating the right climate

A prerequisite for knowledge management is that employees share knowledge and identify themselves with the company instead of as individuals. It is therefore incumbent upon the management to create an environment and work climate that facilitates this. This is a problem that project management companies are especially subjected to since several of the employees are located on temporary projects. In order to overcome this problem the employees must identify themselves with the company and feel committed. There are a number of ways to improve the commitment e.g. salary, work environment, benefits, personal development, a feeling of appreciation from colleagues and managers, opportunity to affect, access to the intranet at project offices, social gatherings etc.

Age gap

There is no way of telling whether the age gap will or will not be a problem in the future. Our opinion is that it will if not managed in the right way. To overcome this possible problem the companies must employ junior engineers. Furthermore the management must allot time for senior engineers to focus on educating junior engineers and introduce them to clients. A prerequisite to introduce junior engineers in projects is that clients understand that they play a key role in this matter and that they are of the same opinion as the project management companies. This study shows that some clients are not foreign to the idea of contributing to the additional expense of bringing in a junior engineer. They understand that they have a responsibility towards the regrowth of the trade at the same time as it is in their interest that project management companies have experienced and competent employees.

6.1 Final comments

Project management companies have come to realise the problems regarding efficiency, introducing younger employees, maintaining knowledge present in the organisation and

they consider KM activities as a possible remedy. As it is today KM activities will give the companies a competitive advantage, but in the future it will probably become a necessity in order to survive. However, to make it successful every employee has to realise the benefits and work towards the same goals. Then, and only then, can KM activities be as beneficial as first intended.

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