AALTO UNIVERSITY SCHOOL OF SCIENCE AND TECHNOLOGY
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KNOWLEDGE BASE SOLUTIONS FOR A SERVICE DESK ORGANISATION

Thesis submitted for examination for the degree of Master of Science in Technology

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Tiivistelmä:

Tietämyskanta on järjestelmä organisaatioissa jatkuvasti syntyvän tiedon hyödyntämiselle. Tätä tietoa ovat esimerkiksi ohjeet ja dokumentaatiot eri tapahtumien käsittelemiseksi. Viimeisten vuosien aikana tietämyksen hallinta ja organisaation muisti ovat saaneet erityistä huomiota ja niitä on yleisesti väitetty yhdeksi yrityksen tärkeimmistä kilpailuvalteista 2000-luvulla.

Tämä työ keskittyy service desk -organisaatiossa työskentelevän IT-asiantuntijan työn tukemiseen ja tehostamiseen tietämyskannan avulla. Työssä kartoitetaan markkinoilla olevien valmiiden ratkaisujen kirjoa, ja tutkitaan niiden soveltuvuutta kohdeyrityksen käyttöön. Kohdeorganisaationa toimii Tieto Oyj:n finanssi ja vakuutusalaa palveleva service desk.

Tutkimuksen aikana havaitaan tietämyksenhallinnan olevan riippuvainen, pelkän teknologian lisäksi, monesta muustakin tekijästä. Työssä määritellään järjestelmän suurimmat haasteet, vaatimukset kohdeorganisaation tietämyskannalle, ja tämän pohjalta suositellaan toimia tietämyksen hallinnan parantamiseksi. Uutena lisänä esitellään interaktiivisuus ja muita Web 2.0 tekniikan toiminnallisuuksia. Lisäksi pohditaan tietämyskannan yhdistämistä muihin järjestelmiin ja tietolähteisiin.

Avainsanat: tietämys, tietämyksenhallinta, tietämyskanta, tietämyksen jakaminen, yhteistyö, tietämyksenhallintajärjestelmä, service desk, ITIL

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ABSTRACT OF THE MASTER'S THESIS

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Abstract:

A knowledge base is a system, used by a group or an organisation to store and access the knowledge that is created and discovered in daily operations. Recently knowledge management and organisational memory have received special attention, and they are commonly brought up as one of the main competitive advantages in the business environments of the twenty-first century.

This study focuses on supporting and enhancing the work of IT specialists in a service desk organisation by a knowledge base. A range of existing solutions and their suitability for the uses of the case organisation is explored. The case organisation is Tieto Oyj - more specifically, a service desk supporting clients in the finance and insurance industries.

In this study, successful knowledge management is found to be dependent of several other factors, in addition to technical factors. The major challenges, as well as the requirements of a knowledge base for the case organisation, are addressed. Based on these findings, actions for improving knowledge management are recommended. In addition to existing solutions, interactivity and other Web 2.0 features are presented. Connecting the system with other systems and information sources is also discussed.

Keywords: knowledge, knowledge management, knowledge base, knowledge sharing, collaboration, knowledge management system, information sharing, service desk, ITIL

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Espoo, 26.5.2010

Marko-Petteri Rosberg

KEY CONCEPTS

Best Practices

Proven activities or processes that have been successfully used by multiple organizations. (Macfarlane and Lacy, 2007c)

Information and Communication Technology (ICT)

The convergence of information technology, telecommunications and data networking technologies into a single technology. (CCTA, 2002a) Information Technology (IT) is the technology involving the development, maintenance, and use of computer systems, software, and networks for the processing and distribution of data. (Merriam-Webster, 2010)

The Information Technology Infrastructure Library (ITIL)

ITIL is a set of best practices for management and provision of operational IT services based on English government guidance for service management in the late eighties. It has been proven to work in ICT organizations all around the world. (Macfarlane and Lacy, 2007d; Rains, 2008)

Knowledge (Explicit and Tacit)

It is agreed that knowledge is "justified true belief". When information is put into a logical and understandable context, it becomes knowledge. Knowledge is highly personal and can be divided into two types; tacit and explicit. *Tacit knowledge* is the form of knowledge that is difficult to express, formalize or communicate. *Explicit knowledge* is the form of knowledge that can be formalized and stored in documents and databases. (Nonaka and Takeuchi, 1995)

Knowledge Base

A central point where knowledge is stored, accessed and shared. Knowledge Bases deal with large amounts of data and they can be of human readable or machine readable form. Knowledge Bases can include sophisticated functions to support decision making. (See sources of chapter 3.3)

Knowledge Management

The process for gathering, analyzing, storing and sharing of knowledge and information within an organization. It allows managers to identify and characterize knowledge contents, needs and opportunities to ensure that proper knowledge is available whenever and wherever it is needed. (Wiig, 1993) (Liebowitz and Beckman, 1998)

Knowledge Management Systems

Systems designed specifically to facilitate the sharing and integration of knowledge. Knowledge Management Systems can also be seen as a framework for constructing a Knowledge Base. (Graham and Hart, 2000)

Service Desk

A service desk is a functional unit made up of a dedicated number staff responsible for dealing with a variety of service events, often made via telephone calls, web interface or automatically reported infrastructure events. The primary aim of the service desk is to restore "normal service" for the customer as quickly as possible. This may require fixing a technical fault, fulfilling a service request or answering to a different kind of a query. (Macfarlane and Lacy, 2007e)

User-centered Design

User-centered design is a design philosophy and a set of methods created to best address the user's needs and tasks. This is done by involving the user in the design process from the very early stages. (Nielsen, 2010; Leventhal and Barnes, 2008)

Quality

Quality can be seen as delivering services and products that perform well, and with features customers will appreciate, find valuable, and will continue to demand. (Wiig, 1994.)

ABBREVIATIONS

ASP	Application Service Provider
CAB	Change Advisory Board
COBIT	Control Objectives for Information And Related Technology
CSF	Critical Success Factor
CSI	Continual Service Improvement
CSS	Customer Satisfaction Survey
DSS	Decision Support System
EFQM	European Foundation for Quality Management
ERP	Enterprise Resource Planning
EUF	End User Feedback
HDI	Help Desk Institute
HP	Hewlett Packard
ICT	Information and Communication Technologies
ISO	International Organization for Standardization
IT	Information Technology
ITIL	Information Technology Infrastructure Library
ITSM	IT Service Management
KB	Knowledge Base
KCS	Knowledge Centred Support
KM	Knowledge Management
KMM	Knowledge Management Module
KMS	Knowledge Management System
KPI	Key Performance Indicator
OLA	Operational Level Agreement
OMT	Operation Management Tool
PC	Personal Computer
R&D	Research and Development
SAAS	Software as a Service
SD	Service Desk
SDFSF	Service Desk Financial Services Finland
SEAP	Service Enabled Application Platform
SWOT	Strength, Weaknesses, Opportunities and Threats
SIP	Support Instructions Portal
SKMB	Service Knowledge Management Base
SKMS	Service Knowledge Management System
SLA	Service Level Agreement
SPOC	Single Point Of Contact
ST	Solution Tool
TQM	Total Quality Management
UC	Underpinning Contract
UCD	User-centred Design

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1 INTRODUCTION

1.1 Background

A wise man has great power, and a man of knowledge increases strength.

Book of proverbs 24:5

As human beings, we do not have any innate weapons against the predators in nature. We do not have sharp teeth, long claws, and we are not strong or fast, compared to for example lions. Our principal defences are knowledge and communication, and our ability to develop new skills.

Knowledge management has been researched since World War II. In the fierce conditions and demands of the time, observers noted that building a second airplane of a certain type was considerably faster, and produced fewer defects than the building of the first one. This proved, objectively, that workers learned from their experiences.

The financial crisis that began in 2007 has added to the pressure of cutting costs in a large number of companies. Many companies have set as a goal, and increased focus on their core competencies. Subsidiary functions and services are often outsourced or discontinued.

IT services often fall into this category. The virtualization of servers, growing complexity of programs, and utilization of cloud computing has made it difficult for many, especially smaller, companies to allocate sufficient resources and know-how to build and maintain the IT infrastructure required to support their activities. The advantage brought by sheer scale, centralization, and off-shoring, may enable an external service provider to produce higher quality IT services for smaller costs.

Large companies commonly outsource their entire IT infrastructure and its support services. Service agreements may include, inter alia: workstations, servers, data communications, information management, IT support, software management, and a variety of control and monitoring services. IT is usually seen as a tool that enables the workforce of a company to work efficiently, and if

something goes wrong or a problem occurs, workers contact the IT Support. The IT Support aims to solve these issues as quickly as possible, within the agreed service levels, allowing workers to continue with their tasks. To ensure all this goes smoothly, service suppliers have established contact points, based on the *Single Point Of Contact* principle, that workers will contact when they need assistance in IT matters. These contact points are called *service desks*.

Centralization may lead to a single service desk providing service to dozens of organisations, resulting in a very wide range of supported software and hardware. In order to facilitate and enhance the daily work of the *service desk agents*, and to reduce their memory load, companies have adopted knowledge bases. Knowledge bases are used to store and reuse the knowledge generated in daily operations. These systems are basically aimed at, much like in the World War II airplane building example, solving a second comparable incident is faster than a first one.

Knowledge is an increasingly important resource in organisations, and to succeed in a continuously changing, global economy, a company must have the tools to manage it. (Davenport and Prusak, 1998b) Effective knowledge management has great impact on the quality of the service of IT Support - it reduces time spent processing incidents, and thus overall costs. It can be seen as an important weapon against the competition. The *Information Technology Infrastructure Library* (ITIL), a set of best practices widely used by ICT companies, offers very little guidance to knowledge management and almost none for establishing a knowledge base. This study will attempt to address this deficit.

When deploying a knowledge base, there are three principals factors that have to be taken into account; human, organisational and technological. (Liebowitz and Beckman, 1998) This thesis is written mainly from the technological viewpoint.

1.2 Objectives of the Thesis

The main objective of this study is to determine, from the point of view of the case organisation, the current state of knowledge base tools used in the organisation. It will define the requirements for a new solution and then, based on these requirements, investigate the suitability of the solutions available on the markets. In chapter 7.4, some possible future scenarios are presented, along with instructions to those that may find them useful.

The research questions can be roughly divided into three groups. The first part focuses on knowledge and its management in ICT organisations.

1. What is knowledge?
2. How can knowledge be managed? (Knowledge Management)
3. Best practices of Knowledge Management in an ICT organisation
4. How is knowledge used in the case organisation?

Part two deals with issues related to the knowledge base, and the focus is on handling these questions from the point of view of the service desk.

5. What is a knowledge base?
6. What are the key issues when establishing a knowledge base used to support a service desk?
7. What are the pitfalls of current solutions?
8. What are the suggested solutions for the future?

The last part of the questions deals with issues of importance according to *the Information Technology Infrastructure Library*; quality, and its continuous improvement. The study addresses the following questions:

9. What is quality?
10. How can quality be measured?
11. How successful KM effects on quality meters?

1.3 Structure of the Thesis

The first three chapters define the theoretical base for the research part of this thesis.

Chapter two introduces us to the service desk, as well as its connections to organisations, functions, responsibilities, and key standards and practices. Recently the adaptation of the Information Infrastructure Technology Library has grown almost exponentially in the IT industry. This library of best practices will be presented in detail. The last part of the chapter defines quality from the perspective of IT Support production, and examines the presumptions and requirements for continuous quality improvement.

In the third chapter the most important theories related to the term *knowledge* are explored. Two forms of knowledge are defined; *tacit knowledge* and *explicit knowledge*. The most important current knowledge management methods are introduced, along with common problems and solutions. The last part of the chapter focuses on the technological part of knowledge management. In this chapter we will discover what a knowledge base really is, define its most important functions, and find out what the barriers for using it might be. Finally, three slightly different process flows for using knowledge bases are examined.

Chapter four concentrates on the case organisation, *Tieto Oyj*, introducing it, and describing how its service desks evolved to their present state. *Service Desk Financial Services Finland*, the unit studied for this thesis, is introduced to give the reader sufficient information of how the knowledge base is used in daily operations. The end of the fourth chapter deals with how quality is defined and metered in the case organisation.

Tools used for knowledge management are analysed in chapter five. In the first part of the chapter the currently used knowledge base tools in the case organisation are presented. As knowledge management tools are closely related to issue tracking systems, one is introduced before the knowledge management tools. The last part of the chapter focuses on the tools available in the markets, and defines their pros and cons. Due to its soaring importance, the suitability of solutions incorporating social media cannot be bypassed. Hence, social media

tools that can be integrated as part of a knowledge base, are presented in a subchapter.

The sixth chapter describes the methods used in this thesis. To ensure the results are suitable for the intended purpose of supporting service desk agents in their work, a user-centred approach is chosen. Thus the principles and methods of *user-centered design* are presented.

Chapter seven presents the results and conclusions of this research. The first subchapter analyses current tools and related problems. Then, based on this study, requirements for a new solution are defined. In chapter 7.3, various solutions are benchmarked against these requirements to discover if there are existing solutions suitable for the case organisation. Potential future scenarios are presented, with a SWOT analysis of each one. Towards the end of the chapter, the proposed solution is dissected; *what should the case organisation do to eliminate problems and to take the greatest possible advantage of the knowledge base?*

In the final chapter of this thesis the results of the study are discussed; *how well were objectives achieved, and how correct are the obtained results?*

2 INTRODUCTION TO THE SERVICE DESK

Due to an increasingly competitive market situation, companies are looking for cost-effectiveness through greater exploitation of *information technology* (IT). Rapid development of technology (e.g. virtualization) and software has made IT management increasingly challenging. In case a critical system failure occurs, a business unit, factory or even an entire company may stop functioning until the problem is solved. In order to shorten the time it takes to solve these issues, to improve support quality, overall IT management, and improve performance and cost-effectiveness, companies have set up service desks (SD). Today this kind of service is often outsourced to a specialized service provider. The service provider may have one SD providing support for dozens of customers, enabling substantial cost savings.(Macfarlane and Lacy, 2007e; Jae-Nam Lee, et al, 2003)

This thesis focuses on the type of SD that provides support for multiple organisations with outsourced IT management. In this chapter we will present detailed information of the SD structure, operation, and standards and best practices. Service quality and methods for continuously improving it are introduced towards the end of this chapter. The last part deals with the SD future insights and tracks down some future trends.

2.1 The Service Desk

The definition *service desk* (SD) used in this study, originates from the *Information Technology Infrastructure Library* (ITIL)*: A Service Desk is a functional unit made up of a dedicated number of staff responsible for dealing with a variety of service events, often made via telephone calls, web interface or automatically reported infrastructure events.* A SD is a *Single Point Of Contact* (SPOC) solution between the user and the IT Service Provider. One of the purposes of a SPOC solution is to eliminate ambiguity in who to contact. This type of solution may be referred to as a help desk, technical support, IT support, call centre, customer hot line, or something else that illustrates its purpose or functions. The people working in SDs are called *service desk agents*. (Rains, 2008; Macfarlane and Lacy, 2007e; CCTA, 2002b)

There are three types of SDs:

- Local: physically near the user (see Figure 1)
- Centralized: agents are placed in one larger unit for improved efficiency
- Virtual: the agent can be anywhere in the world, and in any suitable environment, but the customer gets an impression of a single centralized SD. (Macfarlane and Lacy, 2007e)

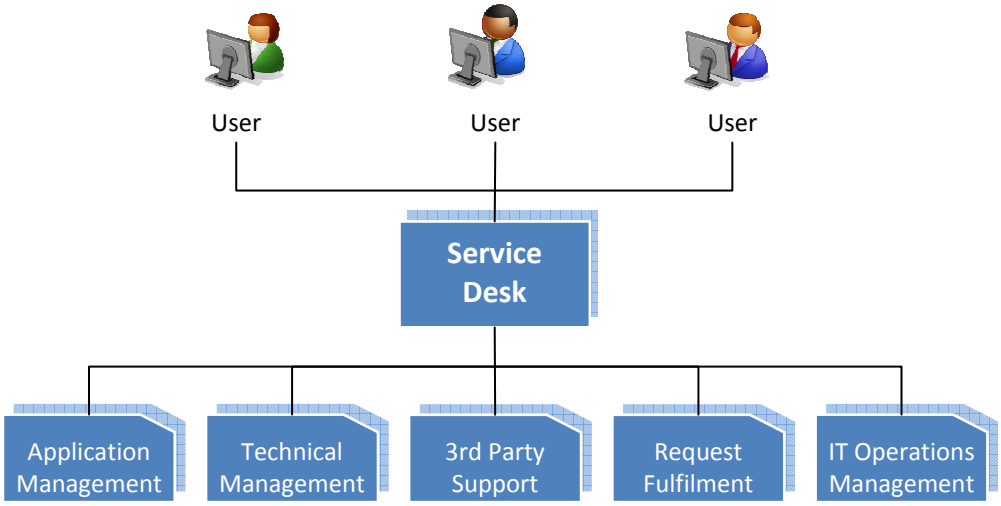

Figure 1. Local SD according to the ITIL (Macfarlane, Lacy 2007)

The primary aim of the SD is to restore the state of services to the agreed functional level as quickly as possible when incidents have occurred. This may require correcting a technical fault, fulfilling a service request, or answering to different kinds of a queries - in other words, anything required to enable workers to continue with their tasks. The SD is responsible, among other things, for logging and classifying all relevant incident, and service request data, providing first-line investigation and diagnosis, and resolving the incidents and service requests they are able to. The SD provides primarily first-line investigation and diagnosis. If an incident or a service request cannot be solved at the first support level in sufficient time, it is escalated to higher support levels, or to eventual internal or external third parties. However, regardless of where the investigation takes place, the SD will still be responsible for communicating with the users, keeping them informed of incident progress, notifying them of impending changes, agreed outages and so forth. The SD also meters its own quality and produces statistics of the predefined system attributes. (Macfarlane and Lacy,

2007e) The most common service channels are phone, email, walk-up and web request, but use of new service channels, such as chats and social media, is gaining popularity. (Rains, 2008)

2.2 Practices, Frameworks and Standards

In Figure 2, collections of practices, frameworks and standards currently used in IT companies are presented according to their popularity. Some of them can be certified, while others are industry de facto standards (cf. ISO 20000 and ITIL). In this chapter we will explore ITIL and its complementary practice collection, *Control Objectives for Information and related Technology* (COBIT). *ISO 20000* is introduced due to its position as the first standard for *IT Service Management* (ITSM). The most commonly used quality standards, *ISO 9000*, *Total Quality Management* (TQM) and *Six Sigma*, are introduced in chapter 2.3.

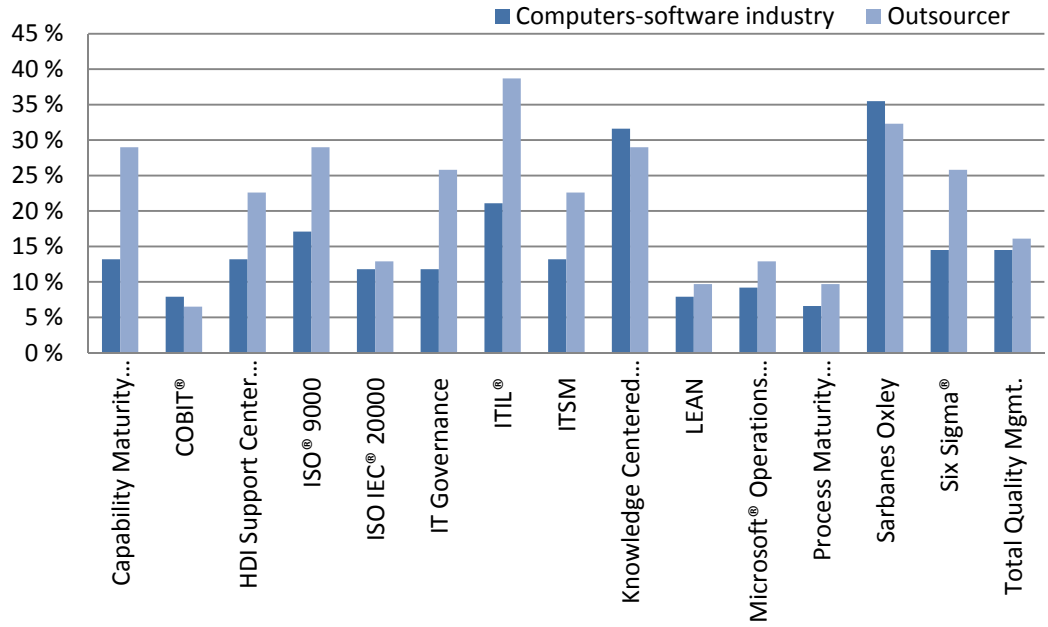

Figure 2. Practices and frameworks used in support centres (Rains, 2008)

2.2.1 The Information Technology Infrastructure Library

ITIL was originally developed for the English government bodies TSO (The Stationery Office) and OGC (The Office of Government Commerce) to provide guidance for service management in the late eighties. It is a collection of best practices which have been found effective in IT companies around the world.

Over the years it has developed into a de facto standard. (CCTA, 2002b) In 2006, a survey found that 30% of IT companies utilized ITIL in managing their operations. According to a similar survey in 2008, 80% of IT companies utilized ITIL (Marquis, 2008). The latest version (ver. 3) of ITIL was published in May 2007. (Macfarlane and Lacy, 2007e)

ITIL ver. 3 is based on an iterative and multidimensional lifecycle model. The three main steps of the service lifecycle are *service design, service transition* and *service operation*. As shown in Figure 3, the core of this cycle is the *service strategy* and the outer periphery consists of *continual service improvement*.

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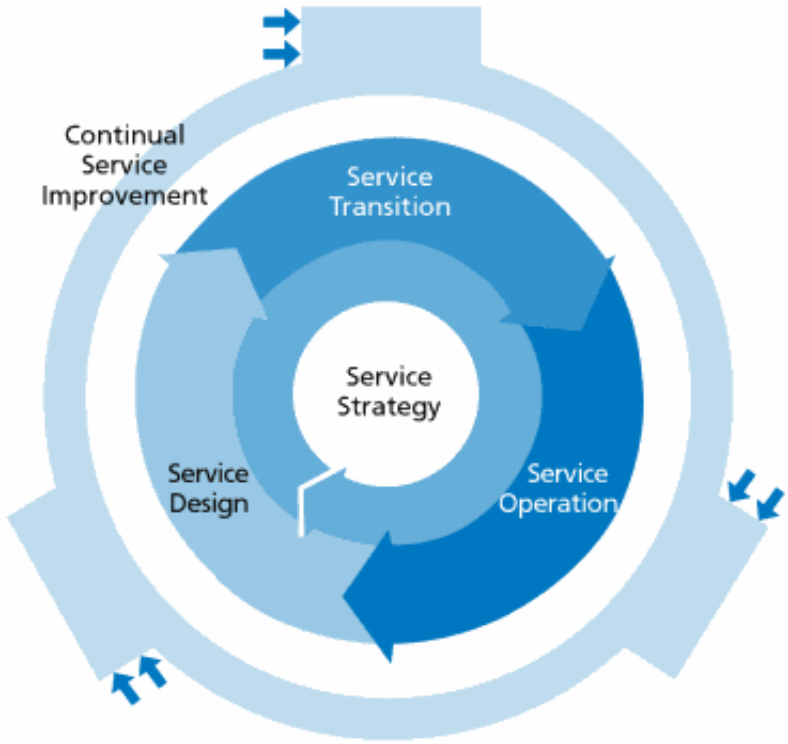

Figure 3. The ITIL ver. 3 lifecycle model (Macfarlane and Lacy, 2007d)

Each concept is elaborated in a book bearing its name. These works provide the guidance necessary for building an integrated approach as required by the ISO/IEC 20000 standard. (Macfarlane and Lacy, 2007e) These framework books are described below:

1. Service Strategy

   This volume focuses on service design. It provides guidance on how to design, develop and implement Service Management. The processes of Service Strategy are *financial management, demand management* and *service portfolio management.* (Macfarlane and Lacy, 2007d)

2. Service Design

   This part of the lifecycle provides guidance for the design and development of services and service management processes. There are five service design processes: *service catalogue management, service level management, capacity management, availability management, IT service continuity management* and *information security management*. (Macfarlane and Lacy, 2007b)

3. Service Transition

   When the new and changed services are designed, the organization must be transformed. This part of the lifecycle provides guidance for transitioning new and changed services into operations. The seven service transition processes are *transition planning and support, change management, service asset and configuration management, release and deployment management, service validation and testing, evaluation, and knowledge management*. (Macfarlane and Lacy, 2007e)

4. Service Operation

   This part of the lifecycle focuses on the delivery of services for day-to-day activities. As this volume carries significant importance to this thesis, we will take a deeper look at the *Service Operation* processes. These are the main processes of a SD.

   - *Event Management*

     Events are defined as any detectable or discernible occurrence that has significance for the management of the IT infrastructure. Typically events are notifications created by an IT service, configuration item or monitoring tool, such as a notification to service desks agents when an email server storage space is filling

up. The purpose of event management is to provide mechanism for early detection and prevention of incidents. (Macfarlane and Lacy, 2007c)

- *Incident Management*

  An incident is an unplanned, complete or partial, interruption of an IT service, or a reduction in the quality of an IT service. Incidents can include failures, questions, or queries reported by the users. The primary goal of *Incident Management* is to restore the normal service state as quickly as possible. (Macfarlane and Lacy, 2007c)

- *Request Fulfilment*

  Request fulfilment is the process of dealing with service request from the users. Many of these are small changes, low risk, frequently occurring or low cost requests. Request fulfilment automates the bureaucracy of requesting handling, and thereby increases the level of control and reduces the costs of providing the service. (Macfarlane and Lacy, 2007c)

- *Problem Management*

  ITIL defines a problem as an *"unknown cause of one or more incidents"*. Problem management bears the responsibility of managing the lifecycle of all problems. Its objectives are *"to prevent problems and resulting incidents from happening, to eliminate recurring incidents and to minimize the impact of incidents that cannot be prevented"*. (Macfarlane and Lacy, 2007c)

- *Access Management*

  Access management is *"the process of granting authorized users the right to use a service, while preventing access to non-authorized users"*. It ensures that employees have the right level of access to work effectively. (Macfarlane and Lacy, 2007c)

5. Continual Service Improvement

   Continual Service Improvement (CSI), while not a part of the lifecycle, is vital to companies utilising the model. CSI provides instrumental guidance in creating and maintaining value for customers through better design

introduction and operation of services. Its six processes are; *the 7-step improvement process, service reporting, service measurement, return in investment for CSI, business questions for CSI and the service level agreement*. (Macfarlane and Lacy, 2007a)

The relations between the most important processes for SDs can be clarified with the following imaginary example. The process in its entirety is shown in Figure 4.

1. A worker calls the SD, saying he or she has run out of disk space, and thus cannot save important presentation material on a network drive.
2. The SD agent searches the knowledge base for a workaround, finding an entry labelled *Remove unnecessary files*. According to the entry, the SD agent advices the user to remove files so she or he can continue working. Simultaneously, to solve the root cause, a *problem management* process is started.
3. During the problem management process, a file server administrator finds the problem is caused by a lack of sufficient storage space. The administrator recommends adding disk space to solve the problem, and triggers a change management process.
4. For the change management process, a *Change Advisory Board* (CAB) is established to estimate the risks and costs of the changes, and for scheduling the process. The CAB decides to replace the current disk with a larger one, effectively solving the root cause of the incident.

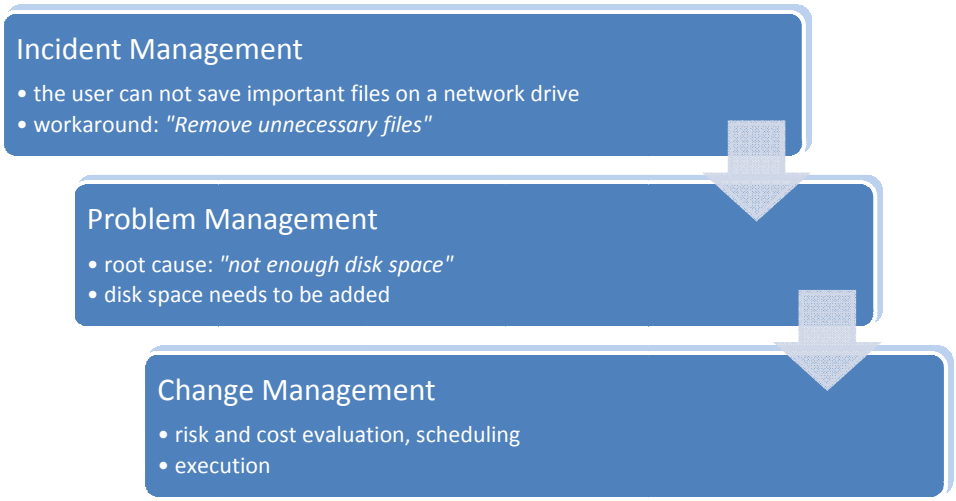

Figure 4. The incident, problem and change management processes according to ITIL ver. 3

ITIL offers a set of agreement templates, further illustrated in Figure 5. These agreements, enforced with sanctions, ensure the agreed service levels are maintained. The *Service Level Agreement* (SLA) is a written agreement between an IT service provider and a customer. The SLA defines the service level, including reaction and solution times for incidents, and sanctions when these are not met. The agreement between an IT service provider and an internal unit is called an *Operational Level Agreement* (OLA). The OLA is an internal agreement covering the delivery of services which support the IT organization in its delivery of services. Agreements between an IT service provider and a partner, or subcontractor, are called *Underpinning Contracts* (UC). (Macfarlane and Lacy, 2007b)

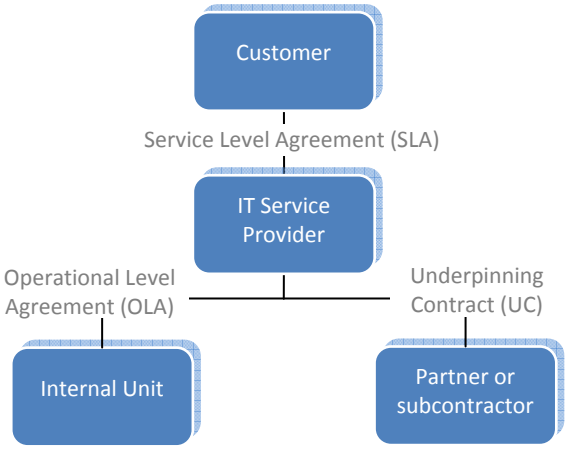

Figure 5. Agreements between different units and organisations (Macfarlane, Lacy 2007b)

In the ITIL SD framework employees are grouped at three support levels, according to their level of expertise. The SD is at the first level, meaning the SD agents have the basic knowledge and skills for executing their tasks. The support groups at the second and third level have a more specialized set of skills, additional resources, or more time to solve incidents. At the third level, specialists' skills, such as software development or engineering, are required. The third level may also be a third party, for example a software developer or provider.

Incidents that cannot be solved by the SD at first contact in the timeframe defined by the SLA, or due to lack of specific knowledge, are escalated to the second

level. The SPOC functionality specifies that the SD contact the customer even when the incident has been solved at the second or third level. (CCTA, 2002b)

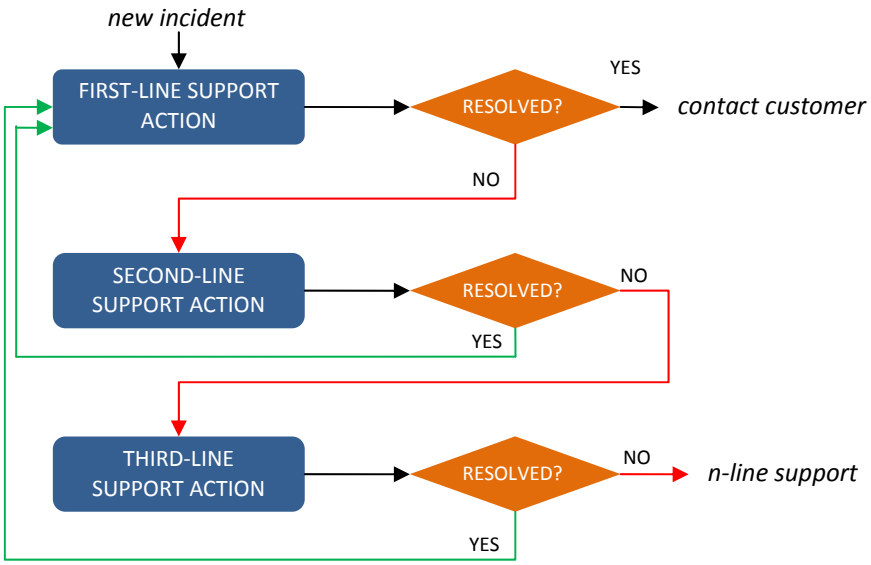

Figure 6. The incident resolution process flow as described in ITIL ver. 3 (Macfarlane, Lacy 2007b)

2.2.2 Control Objectives for Information and Related Technology

Control Objectives for Information and Related Technology (COBIT) is a collection of best practices to aid in optimising IT-enabled investments, ensuring service delivery, and providing a measure against which to judge when things do go wrong. It provides a framework to ensure that IT is aligned with the business, IT enables the business and maximizes benefits, IT resources are used responsibly and IT risks are managed appropriately. COBIT defines IT activities in a generic process model within four domains; *Plan and Organize, Acquire and Implement, Deliver and Support* and *Monitor and Evaluate*. (ISACA and ITGI, 2007)

2.2.3 ISO/IEC 20000:2005

ISO/IEC 20000:2005 is an international standard for managing and leading ICT services. It includes more than 170 requirements relating to operation management systems and processes defined by the standard. The standard promotes the adoption of an integrated process approach for the management of ICT services. It consists of two parts; the first part defines the requirements for the provider of ICT services, and the second part offers assistance and gives codes of practice to auditors. A company can gain the ISO 20000 certification through an

audit process, which, making it a more formal way of standardising operations, clearly distinguishes it from ITIL. (Van Bon, Jan et al., 2007; ISO, 2010)

2.3 Quality

This chapter will concentrate on different meanings of the word *quality.* We will explore the meanings of quality in ICT service production, and which frameworks can be used for managing it. The beginning of this chapter addresses questions such as what quality is and how it affects the stakeholders of a company, and how quality is defined in ITIL. The remainder of the chapter explores the approaches for quality management that are mentioned in ITIL.

According to Carl M. Wiig quality can be viewed as delivering services and products that perform well and with features customers will appreciate, find valuable, and will continue to demand. (Wiig, 1994.) Quality can also be defined as *fitness for use, superiority to competitors and meeting or exceeding customer expectations*. In the past many ICT organisations have had a strong focus on technical issues, while lately the focus has shifted towards quality of service. With high and constantly evolving demands, organisations must employ a more customer-oriented approach to reach a higher degree of customer satisfaction. (CCTA, 2002a) Customer satisfaction can be defined as *meeting or exceeding customers' requirements for product and service features, price, timeliness, and performance*. (Bauer, et al, 2006)

Bauer states that high quality in an organisation affects all stakeholders. An *organisation* applying high quality uses its resources in a profitable and productive way. *Suppliers* benefit from collaboration with quality organisations through information sharing, trust, decreased costs, reduced risk and many other ways. High quality products lessen, through fewer defects, the costs from repair rework and warranty actions, often leading to repeated orders by current customers and additional orders from new customers. Higher service quality will make the customer experience of the service more pleasant. Higher customer satisfaction will ensure continuity of work for the *employees*. Quality, having an effect on the price of products and services, may also increase revenue, allowing the company to raise employee salaries. Employees will benefit from the high quality also through feeling they have performed their work to the best of their ability. The *community* benefits from the high quality because all the parties

mentioned above are taxpayers. Quality also benefits society as a whole by requiring participation and collaboration by technical societies, neighbourhood associations, government agencies, religious organisations, educational institutions, corporations and businesses. (Bauer, et al, 2006)

Knowledge workers, workers holding a substantial amount of knowledge and analytical skills within a specific subject area, can make significantly better decisions with less information than less experienced workers with the same amount of information. The quality of *knowledge work* can be evaluated by the quality of decisions made, making expert decision makers valuable. (Wiig, 1993)

According to ITIL quality must be continuously improved and measured with *Key Performance Indicators* (KPI). Many KPI and *Critical Success Factors* (CFS) for each processes are specified in ITIL (ver. 2 and ver.3). Companies should choose few indicators that best suit their purpose. Following a detailed description of the case organisation, the KPIs used in the organisation are introduced in chapter 4.4. In ICT organisations *quality management* is used to ensure all activities necessary for the design, development and implementation of IT services satisfy the requirements of the organisation and the users, and makes sure it is done cost-effectively. Organisation operation management is specified in ITIL as the *Quality Management System* that defines the organisational structure, responsibilities, policies, procedures, processes, standards and resources required to deliver high quality ICT services. In the next paragraphs a number of different quality approaches that can be found in ITIL are briefly explored. (Macfarlane and Lacy, 2007c; CCTA, 2002a)

ISO 9000 and ISO 9001 are widely used standards for managing quality in organisations (ISO, 2010). The ISO 9000 standard defines quality management principles, and terms and definitions for quality management. The main principle of ISO 9000 is that corporations should have defined quality policies, quality objectives and quality management system. The quality management system should be continuously improved. ISO 9001 defines requirements for the quality management system.

The European Foundation for Quality Management (EFQM) is the most widely used organisational framework in Europe. The model is based on nine criteria. Five of these are *enablers* (leadership, policy and strategy, people, partnerships and resources and processes) and four are *results (*performance results, customer results, people results and society results*)*. Each of these criterions poses a number of questions that should be considered. EFQM framework can be presented as a box model that is shown in figure 7. (EFQM, 2010)

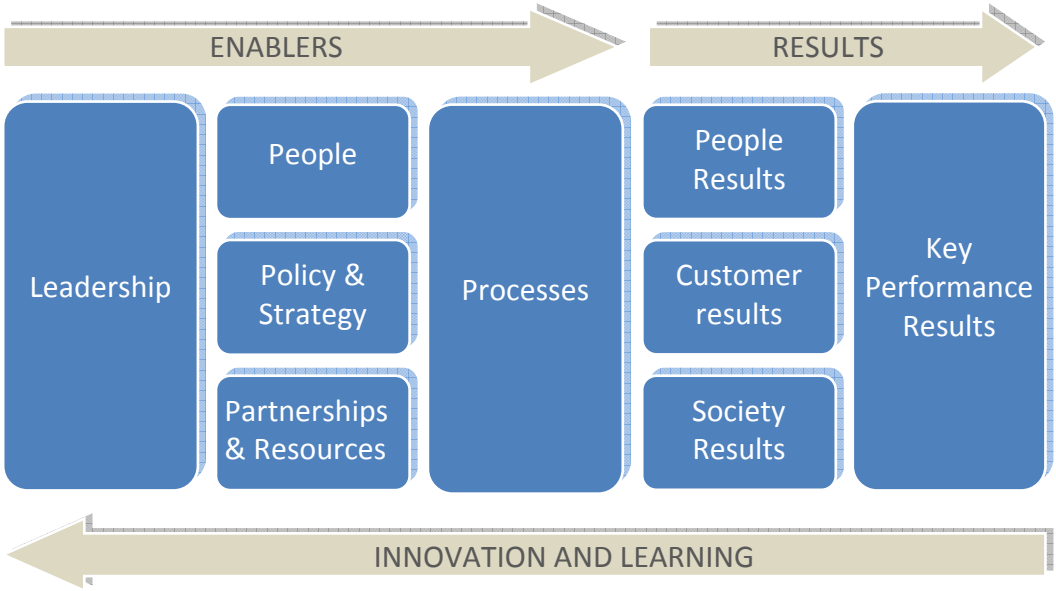

Figure 7. EFQM excellence model (EFQM, 2010)

Total Quality Management (TQM) is a philosophy and a set of guiding principles for managing an organisation. It involves quality management principles for all aspects of the organisation, including customers and suppliers and their integration with the key business processes. Everyone in an organisation must commit to continual improvement. There are four *gurus* with slightly different approaches to TQM:

- Crosby - company-wide motivation
- Deming - statistical process control
- Feigenbaum - system management
- Juran - project management

Each of these gurus gives different instructions for organisations exploiting TQM. (Dale, 2000.)

Six Sigma is a business strategy with tools to improve the capacity of business processes, made known in 1995 by Jack Welch of General Electric. It aims to increase performance and decrease process variation. There are five aspects of Six Sigma: *fundamental beliefs, organizational infrastructure, training, project execution*, and *methods and tools*. The essence of Six Sigma is captured in the sentence "*Do the right things, and do things right*". In service production this can mean a company needs to offer suitable services for the customer, and the services have to be produced the right way. The name Six Sigma derives from statistical terminology, meaning the ±6 sigma range around the mean that is 0.9999966. It means the process will produce defective product units at a rate of 3.4 per one million units. (Yang, 2005)

2.4 Service Desk Future Trends

The ICT service industry has changed from the product driven industry in the sixties to the service driven environment it is today. The need for support services will rise in the future, but these services must be produced more effectively with reduced expenses and limited resources. (Rains, 2008; Jae-Nam Lee, et al, 2003; Keinänen and Huttunen, 2009)Costs can be cut by improving processes, outsourcing or off-shoring services, or through automation and use of self-service. These were the main trends also at the 2004 *Help Desk Institute* (HDI) conference, and based on the *HDI Salary Survey* in 2008, they are still prominent. (Rains, 2008; Roos, 2004)

When striving for cost-effectiveness, mere outsourcing is no longer enough. Due to considerably cheaper labour, companies are off-shoring services to foreign countries. (Shao and David, 2007; Otala, 2008) One of the most famous examples is India, with its well-educated, English-speaking, and low-paid workforce. (Roos, 2004) Shao has predicted (Table 1) what kind of duties are likely to be off-shored and which are staying on-shore.

Table 1. Job allocation between jobs to be sent off-shore and kept on-shore (Shao and David, 2007)

Jobs Likely to Be Sent Off-shore	Jobs Likely to Stay On-shore
Routine Tasks • application development • detailed design • program coding and unit testing • system maintenance and support	**Specialized IT Skills** • global project management • large-scale system integration • system architecture • IT liaison
Commodity Services • system administration • network management • infrastructure management • help desk • back office support	**Localized Activities** • security expertise • preliminary requirement analysis • logic design • system testing/installation • user training
BPO • human resources • accounting • financial reporting	**Business Processes** • SCM • business analysis • inventory

Another way of cutting costs is to take advance of the greater use of automated services and self-services. (Roos, 2004) Automated solutions already exist on the markets today. These solutions attempt to solve problems before they become incidents, and can include features like mass-healing, self-healing, self-service and assisted services. When issues emerge, self-healing empowers users with a choice of how to proceed with problem resolution. Self-service refers to a portal where instructions help end-users solve problems on their own. If contacting a SD is needed, the assisted service provides the SD agent detailed support case information, reducing the time required to solve the incident. (Tific, 2010) According to Gartner self-service is still not able to provide the level of richness promised, such as automated ranked FAQs and intelligent knowledge agents. (Coyle and Brittain, 2009) Some companies using ITIL ver. 3 are beginning to morph their self-service portals to offer service catalogue capabilities. They have added service request management functions or modules to map to the service request fulfilment process. (Casonato, 2007)

Gartner predicted in 2009 that cloud services will mature in seven years. Cloud computing is also known as SEAP (Service Enabled Application Platform) - SEAP is a platform for building SAAS (Software As A Service) products. (Lahti,

2009) Jae-Nam Lee (2003) states that the future will belong to Application Service Providers (ASPs), that offers the deployment and management of applications via the Internet or a private network based on monthly or per-user fees. A shorter product roll-out cycle, ICT expertise, ease of use, and lower cost make ASPs attractive. The fact that ASP system failure can shut down critical operations and result in a major loss of client productivity is seen as a drawback. System compatibility, security and trust issues must be taken into account when using ASPs.

Roos (2004) states that the new generation of employees is more technically savvy, and calls it an *instant-on* generation that wants answers and resolutions instantly. This generation also expects that the support staff knows the infrastructure of the company they are working for. According to Otala (2008) the competition takes place via services and the winner will be the company that can continuously find new service needs for customers. To meet these requirements companies must have a strong foundation in knowledge and people.

3 KNOWLEDGE AND TOOLS FOR MANAGING IT

A company is the sum of the expertise of its employees – and sometimes much more than that. The results produced by a team of experts working together can be significantly better than the combined results of them working independently. (Toivonen and Asikainen, 2004)

According to Toivonen and Asikainen (2004), the core questions of a company are:

> *What kind of a system do we have in place to support expertise?*
> *How do we support the rise of expertise?*
> *How can we access and exploit emerging knowledge?*

People can learn alone, together, by reading books, through training, through apprenticeships, or by observing and learning from more experienced colleagues. It is essential to the learning processes that knowledge (either explicit or tacit) exists and is transferred from a person to another or others. (Toivonen and Asikainen, 2004)

In chapter 3.1 the focus will be on the fundamental question of *what knowledge is*. Different dimensions of knowledge, a few knowledge conversion processes, and theories concerning both knowledge and the processes are introduced.

The next subchapter (3.2) will concentrate on *Knowledge Management* (KM) as a systematic approach for managing knowledge. Successful KM deals with, amongst others, human factors, and technological and organisational issues. In this subchapter the key points of KM are introduced in more detail and common barriers for successful KM are presented.

KM*, Knowledge Management Systems* (KMS) and *Knowledge Bases* (KB) are all highly interconnected. As illustrated in Figure 8, a KB can be included in a KMS, and a KMS is part of the greater concept of KM. (Macfarlane and Lacy, 2007e)

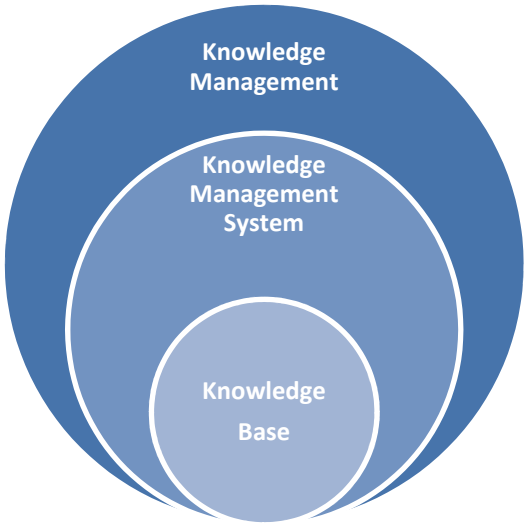

Figure 8. Relationships of the concepts modified from the text in ITIL v.3

Knowledge management systems (KMS) are introduced in subchapter 3.3. These systems aim to address the technological prerequisites of KM. These systems help organisations support the creation, capture, storage and dissemination of knowledge.

Subchapter 3.4 concentrates on KBs. The chapter defines what a KB is and discusses the main issues and challenges related to them. Three fundamental approaches, distinguished by their degree of control and openness, to using KBs are introduced.

3.1 Knowledge

Knowledge has become a more and more important asset for modern organisations. How successfully a company can compete is greatly influenced by its abilities in exploiting knowledge and developing new knowledge quickly. While the so called baby boomers are retiring, companies are losing a lot of important information and knowledge. Storing and keeping this knowledge inside the corporations has become one of the main concerns of companies today. (Otala, 2008) The terms *knowledge society*, *knowledge industry* and *knowledge company* are commonly used in literature to describe today's world. (Liebowitz and Beckman, 1998; Otala, 2008)

Liebowitz (2003) introduces a knowledge management framework that differentiates *data*, *information*, and *knowledge* from each other. ITIL has adopted a similar approach, adding *wisdom* to the framework (Figure 9). (Macfarlane and Lacy, 2007e) Truth without context is defined as data. Data refers to elements that

can be detected, such as texts, facts, codes, images and sound. When data is organized, analyzed and interpreted to acquire a meaning, it is called information. Information becomes knowledge when it is placed in a logical and understandable context. (Nonaka and Takeuchi, 1995; Gunnlaugsdottir, 2003) Knowledge is created out of information, but is individually specific (Huysman, 2004). It is important to note that knowledge is highly time-dependent. It needs to be created, managed and delivered for "just in time" accuracy. (George, et al, 2006) When ultimate discern of material and ability to provide a strong common sense judgment is added to knowledge, it becomes wisdom (Macfarlane and Lacy, 2007e).

Despite extensive debates and discussion no simple way of defining knowledge has been agreed upon. Western philosophers have generally agreed that knowledge is *justified true belief*. (Nonaka and Takeuchi, 1995; Otala, 2008; Fernie, 2003)

These are some of the definitions found in dictionaries:

- The fact or condition of knowing something with familiarity gained through experience or association acquaintance with or understanding of a science, art, or technique (Merriam-Webster, 2010)
- The fact or condition of being aware of something (Merriam-Webster, 2010)
- The facts or experiences known by a person or group of people (collinslanguage.com, 2010)
- The state of knowing (collinslanguage.com, 2010)
- Specific information about a subject (collinslanguage.com, 2010)

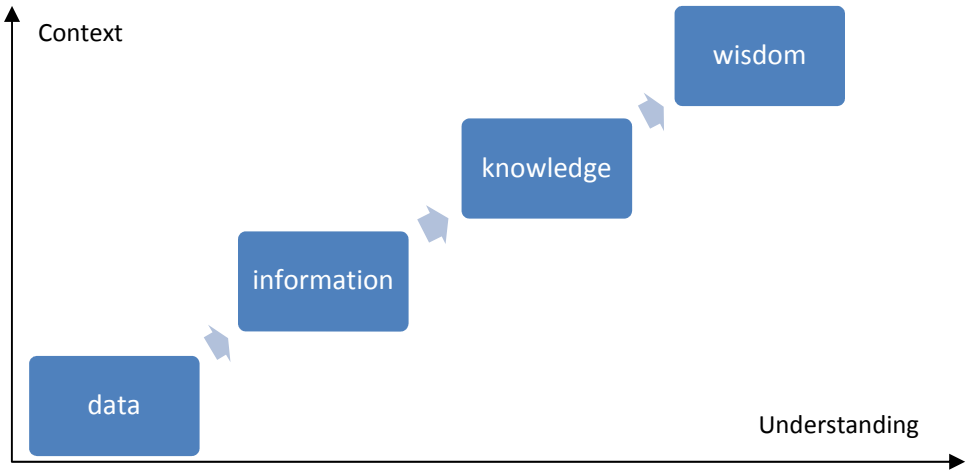

Figure 9. From data to wisdom (Macfarlane and Lacy, 2007e)

Knowledge can be compared with energy. Like knowledge it is often invisible, requiring special techniques for moving and storing it. It also changes its form while in motion. Alike material or energy, knowledge can also be divided into classes that describe its form. As with energy, the transfer and storage of knowledge is done by different mechanisms depending on what form of knowledge we are processing. (Salmela, 2008)

Knowledge can be divided to categories in many different ways. One of the most common classifications is classification to explicit and tacit knowledge. This can also be presented as an axis. On the other end of the axis there is tacit knowledge and on the other end there is explicit knowledge. This model was introduced and made popular by Japanese economists Nonaka and Takeuchi and is introduced next in more detail. (Nonaka and Takeuchi, 1995; Fernie, 2003) As an alternative model for categorising knowledge the model of Jay Liebowitz is introduced after Nonaka and Takeuchi model. These two models are quite different, which illustrates how complicated concept knowledge is.

Tacit knowledge is that part of knowledge that us very hard to express, formalize or communicate. Tacit knowledge can e.g. consist of personal working habits or "know-how".(Toivonen and Asikainen, 2004; Gunnlaugsdottir, 2003; Fernie, 2003) Polanyi advices us to envisage tacit knowing as a way to know more than we can tell. That is why a experienced sales person can be very affective and skilled at his work, but cannot formalise these skills or teach them to his or her colleagues. Polanyi has classified tacit knowledge further to three groups. *Skills* are the ability to act based on predefined rules that can be controlled by oneself.

Skills combine acts that are not identifiable e.g. ability to chop wood. *Know-how* includes skills and is the ability to act in social context. Know-how is following the rules that are established by other actors like a professional institution or a tradition. According to Polanyi the highest level of knowledge is the *expertise* or *competence*. It implies the ability to influence the rules by reflecting them. (Polanyi, 1983.) It is also typical that the amount of explicit knowledge used in daily work grows alongside with the growth of expertise (Figure 10). (Toivonen and Asikainen, 2004)

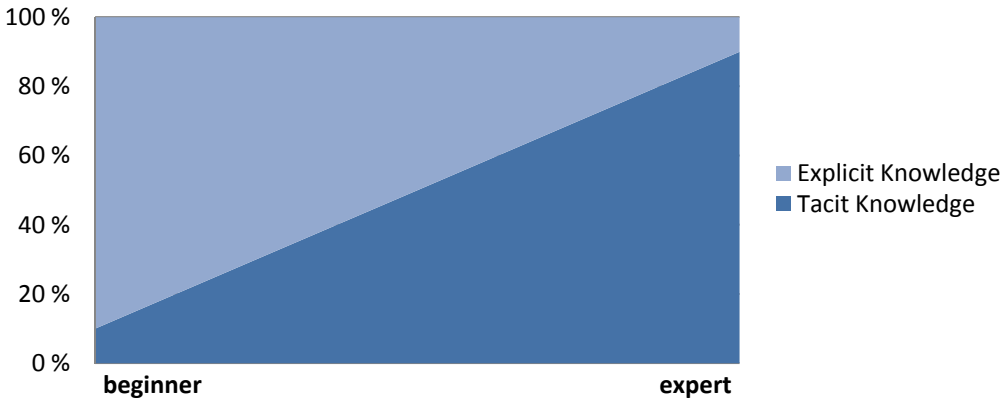

Figure 10. Type of knowledge in different expertise levels based on the text in (Toivonen and Asikainen, 2004)

Explicit knowledge is described as knowledge that can be expressed or codified. It can be saved in human or machine readable for example to paper, film, disc, tape or hard drive. The more structured the knowledge is, the easier it is to be stored, to be found, and to be moved. (Salmela, 2008) According to Martin Röll, knowledge is always bound to human beings and it is impossible to digitalise. Once knowledge is *explicated*, it becomes information. This kinds of statements are highly dependent on the definition of knowledge, which in this thesis becomes from Nonaka and Takeuchi. Based on their definition, knowledge can be transferred, through transformation processes and knowledge can be saved to knowledge bases in a documented form. If a different definition for knowledge is chosen then may be impossible to use term knowledge base, and term database should be used instead.(Nonaka and Takeuchi, 1995; Röll, 2004)

According to Nonaka and Takeuchi knowledge is born in conversion, for example when personal knowledge becomes public. These conversions are of four types:

1. Explicit to tacit (internalization): We learn by acquiring public knowledge. This knowledge is internalized. General knowledge is obtained from the Internet, TV, books and other public sources.
2. Tacit to tacit (socialization): We learn by socializing with other people, exchanging ideas and experiences.
3. Tacit to explicit (externalization): Personal knowledge becomes public or explicit knowledge through documentation process. After documentation it's in re-usable form for other individuals.
4. Explicit to explicit (combination): Explicit knowledge from different sources is combined, mixed or connected to create new innovations. (Nonaka and Takeuchi, 1995)

These conversation processes are shown in Figure 11.

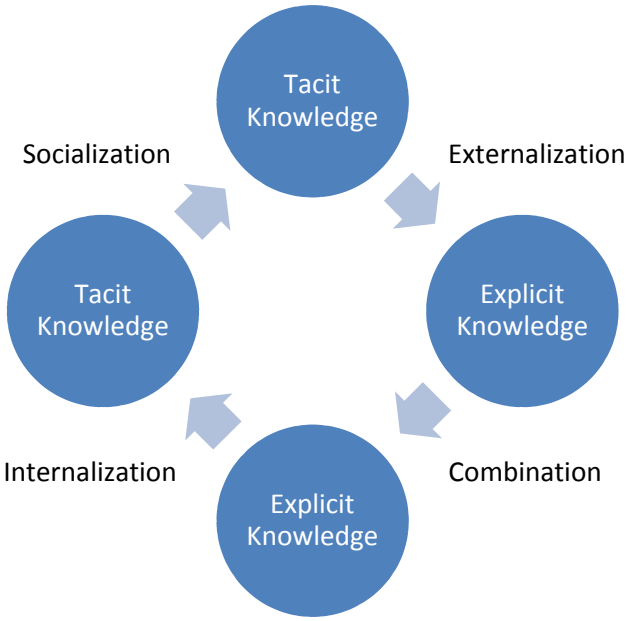

Figure 11. Types of knowledge conversion defined by Nonaka and Takeuchi (1995)

Jay Liebowitz (1998) has little bit different approach to classify knowledge. He has categorised it to five groups:

- *Procedural knowledge* deals with "how to" knowledge, actionable application of knowledge.
- *Declarative knowledge* deal with descriptive information and answers the question "what to do?".
- *Episodic Knowledge* uses similarity based or analogical reasoning whereby previous episodes, events or cases are stored, matched and retrieved for application to new situations.
- *Heuristic Knowledge* is developed through experience. It relates to rules of thumb and "information shortcuts" that separates the experts from novices.
- *Meta Knowledge* deals with reasoning knowledge and it is often said to be knowledge about knowledge. It is a higher level of abstraction or sophistication compared with the types of knowledge introduced above.

3.2 Knowledge Management

Knowledge as an economic force has been under study since the end of World War 2, but we still do not have thorough and robust models and approaches to make our knowledge bases more effective and efficient. (Prusak, 1997) Organizations are becoming more aware, that knowledge may be the key to organizational success in today's *knowledge society.* Knowledge can also be seen as an important competitive edge. It seems clearly too important to be left serendipity and hence it must be managed. The economy that is highly dependent on knowledge is also called *knowledge economy*. (Nonaka and Takeuchi, 1995; Wiig, 1993; Huysman, 2004; Fernie, 2003) Nonaka and Takeuchi stated in 1995 that the future belongs to “knowledge workers” that uses their heads instead of their hands (Nonaka and Takeuchi, 1995). Rapidly grown usage of computers and Internet has made this a reality. In Finland 100% of companies employing more than 20 persons used computer in their daily work in 2009. This proves that a big part of the daily work consists of so called knowledge work. (Tilastokeskus, 2009)

Organizations use knowledge management (KM) for many reasons. Firstly, the knowledge is often scattered around the organisation and organisations want to make this scattered knowledge domains more transparent. In knowledge economy

people gain continuously more knowledge specific to their own work process. To enable learning companies tend to use knowledge management. Secondly, knowledge management is used for ensure the transparency needed to reduce the re-invention of the wheel. When people know what everyone knows, they will automatically exchange knowledge. (Huysman, 2004) It is important to gather, store and asses all the important data, that can be useful for the future. In many cases the wheel is reinvented because of lack of the documentation of earlier experiences. (Marzi, 2004) The third reason to adopt knowledge management is, that reciprocal learning fills up knowledge caps. These caps would exist and come out for example when people leave the organisation or change positions. Globalisation also requires knowledge sharing among globally spread knowledge workers. (Huysman, 2004)

In a short amount of time there have been huge changes in the global market. Following things have changed from the point it was 10 years ago:

- An increase in the rate of change in industry and market landscapes, as barriers to entry have decreased and new opportunities opened up.
- An increase in employee turnover, as it has become more socially acceptable and often beneficial to change companies during a career to develop and share new experiences and perspectives.
- An increase in access to information via the Internet and a more global economy
- Greater market competition forcing company employees to share knowledge between departments and subsidiaries.

Companies also adopt KM because an effective knowledge management can turn these changes to company advantages, but it can also benefit the company in many other ways. (Macfarlane and Lacy, 2007a)

KM is a systematic set of practices used for the capture, storage and sharing of knowledge throughout an organization and to ensure increase and continuity of knowledge or conformity with company standards and to share knowledge between projects, teams and knowledge workers (Fernie, 2003; Marzi, 2004). Simply put it deals with how best to leverage knowledge internally and externally (Liebowitz and Megbolugbe, 2003).

KM focuses on:

- Creating knowledge repositories.
- Facilitating the capture, creation, transfer, use and sharing of knowledge.
- Managing knowledge as an asset, structuring it, organising an safeguarding it. (Abell and Oxbrow, 2001)

Knowledge management is often seen as a steering process of individual learning.(Huysman, 2004; Liebowitz and Megbolugbe, 2003) An important note is, that basically KM is always something, that someone does, which makes it ultimately a human problem (Casonato, 2007; EMC, 2009). According to Abell and Oxbrow (2001) the essence of knowledge management is connecting people with people, connecting people with information, enabling conversation from information to knowledge, and encouraging innovation and creativity.

According to Wiig (1993) KM can be divided further, based on the approach perspective, to the following three categories; business perspective, management perspective and hands-on knowledge perspective. The business perspective focuses on why, where and to what extent the organisations must invest in or exploit knowledge. This includes planning corporate strategy made possible by better knowledge management. The management perspective deals with determining, organising, directing, and monitoring knowledge-related activities required to achieve the desired business strategies and objectives. The hands-on knowledge perspective focuses on applying the expertise to conduct explicit knowledge-related work and tasks. This requires among other requirements, establishing a knowledge inventory system, conducting educational programs, creating and deploying knowledge based systems and applying knowledge to work objects. This thesis is mainly written from hands on knowledge perspective and focuses on how to conduct a knowledge base.

According to Earl at the simplest KM requires combination of technological and cultural actions (Prusak, 1997). ITIL has also adopted this approach and divides the main components of successful KM to the following two parts:

1. An open culture

   The knowledge, best practices and lessons learned must be shared across the company. Knowledge hoarding must be removed by encouraging

employees to share knowledge, and by rewarding it. Another important factor is willingness to learn. An environment where growing individuals knowledge base is rewarded and facilitated through open support and opportunities must be created.(Macfarlane and Lacy, 2007a; Casonato, 2007)

2. The infrastructure

   The culture may be open, but there must be also sufficient infrastructure for supporting this. This infrastructure can be technical application or system (e.g. online self training system) or it may be a process (e.g. activities to bring people together).

However, Earl states that to build a strategic capacity in knowledge at least four components are required. (Prusak, 1997) These components are shown in Figure 12.

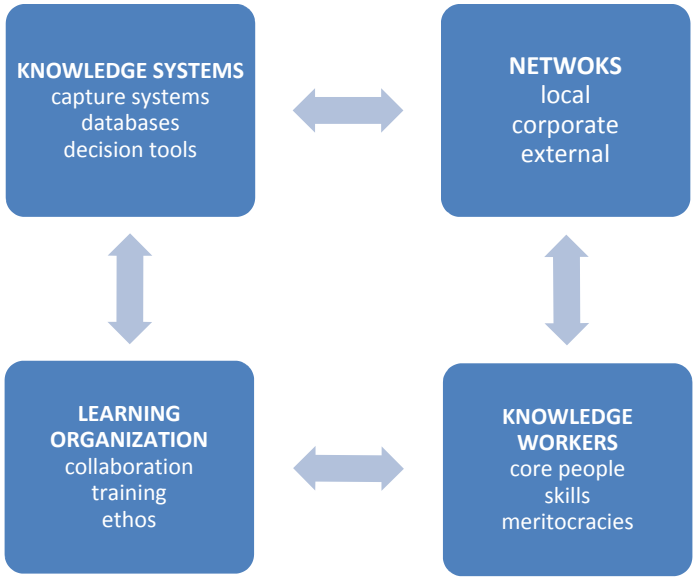

Figure 12. Key factors in knowledge management (Prusak, 1997)

Knowledge systems are used for capture, store and steward the experience, for making it accessible and for exploiting it. The *networks* prefer for networked interchange of papers, hypotheses, data and messages that facilitate the knowledge-building process. *Knowledge workers* represent the people challenge. It is characteristic for the knowledge workers that their experience, continuous knowledge acquisition and their skills makes them valuable to the organisation. The skill requirements of knowledge workers create high demand for training and

personal development. The knowledge is only maximised if the organisation can learn. A *learning organisation* can facilitate the learning of its members and continuously transform itself. In this thesis we are mainly going to target at Knowledge Systems, but one must note that good KM System cannot be built without paying attention to all these elements. (Prusak, 1997)

Salisbury reminds that knowledge is complex; it is factual conceptual and procedural. Many companies have failed in knowledge management, because they do not understand this. (Salisbury, 2003) The complexity and dimensionality of knowledge was also noted by Nonaka & Takeuchi who discovered explicit and tacit dimensions of knowledge. (Nonaka and Takeuchi, 1995) Salisbury has developed a knowledge management cycle model for managing knowledge that defines the core competence. The idea is that each step creates an input for the next phase, and thus creates an ongoing circle. The first step of this model (Figure 13) is the creation of new knowledge. New knowledge is created when members in the organisation solve a new problem or a part of a larger problem. The newly created valuable information must be preserved. This can include recording the description of the problem and its new solution. The next step is the dissemination process that includes sharing knowledge with other members of the organisation and with the stakeholders affected by the problems that were solved. Shared knowledge then becomes an input for new solving process. (Salisbury, 2003)

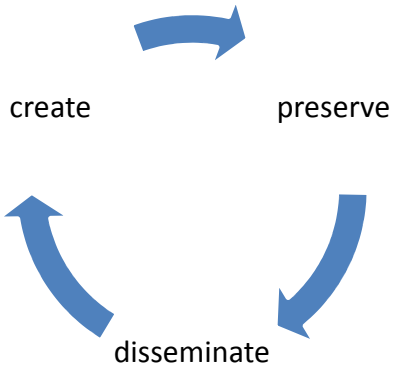

Figure 13. Knowledge Management cycle (Salisbury, 2003)

As mentioned earlier, the challenge of KM is how knowledge can be captured, acquired appropriated and shared. (Huysman, 2004) Liebowitz uses term organisational memory in his book for describing the process of storing and using

knowledge. He also states that organisational memory development is one of the key components of successful companies. (Liebowitz and Beckman, 1998) On the other hand it is impossible and unnecessary to save all the information born in the daily operations into documents and databases. This would lead to storage of unnecessary data, and because of the amount of the data, it would be very difficult to search for the relevant data in it. (EMC, 2009)

In today's Western culture knowledge sharing is often found difficult. We are raised in competitive society where knowledge is power and sharing it does not come naturally. In such group work trust, honesty, the willingness to learn and share are important qualities. (Gunnlaugsdottir, 2003) To promote knowledge-sharing, organisational conditions must be in such a way that people want to share. Huysman discovered that people often do feel a need to learn and share knowledge, when it will help them to perform their work better, more efficiently and with higher satisfaction. Establishing this kind of culture or atmosphere does not necessary require changes for organisation structures, rewarding systems, or positions. Huysman also discovered that codifying knowledge imply opening up individuals kept secrets. If going public would increase their vulnerability they tend to resist to share their personal knowledge. Knowledge sharing cannot be forced, because people will only share information when they have a personal reason to do so. Understanding this has led to term of second wave of KM. Classification to first and second wave of KM is shown below in table 2. (Huysman, 2004)

Table 2. First and second wave of knowledge management (Huysman, 2004)

Research Question	1st wave	2nd wave
Why is knowledge shared	Managerial needs	Part of daily work: as a routine
When is knowledge shared?	When there is an opportunity to do so	When there is a need to do so
Where is knowledge shared?	Operational level	Organization-wide
Whose knowledge is managed?	Individual: human capital	Collective: social capital
What knowledge is shared?	Codified	Tacit and Codified

How knowledge is shared	Repository systems and electronic networks	Via personal and electronic networks

3.3 Knowledge Management Systems

KM can be seen as steerage of communication process to generate knowledge and to ensure the development of knowledge base (Marzi, 2004). *Knowledge Management Systems* (KMSs) are designed specifically to facilitate the sharing and integration of knowledge. KMS can also be seen as a framework for constructing a Knowledge Base. (Graham and Hart, 2000)

Salisbury has defined a formal workflow for the KMSs, which is shown in Figure 14. (Alavi and Leidner, 1999)

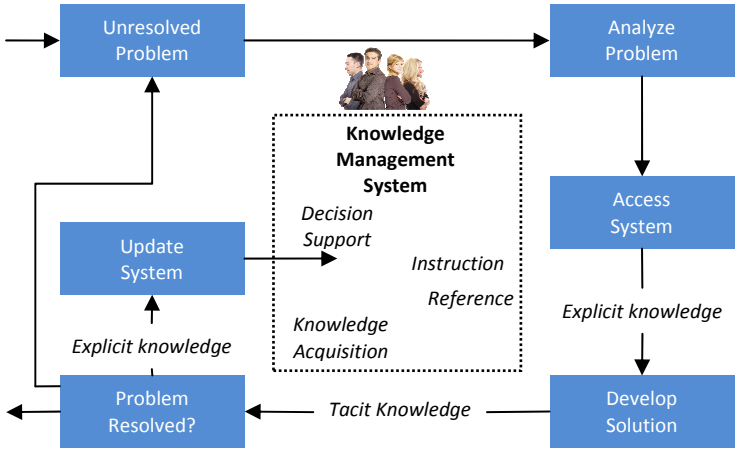

Figure 14. Knowledge management system workflow (Salisbury, 2003)

ITIL uses term *Service Knowledge Management System* (SKMS) for describing the same system. SKMS is described to be a broad system, that collects data and information from tens of different sources and integrates them under one user interface. It can collect following knowledge:

- The experience of staff
- Records if peripheral matters e.g. weather, user numbers and behaviour, organisation's performance figures
- Suppliers' and partners' requirements, abilities and expectations
- Typical and anticipated user skill levels

In this approach multiple Knowledge Bases are distributed among different information sources. (Macfarlane and Lacy, 2007a; Macfarlane and Lacy, 2007e) It has been argued that ITIL SKMS is too wide and complicated system to implement. It is said to be rather an aspiring model, than a best practice. (England, 2010).

Fernie reminds that the current KM actions are mainly directed at explicit knowledge. This knowledge represents only a tip of the iceberg, since 80% of the iceberg lies underwater and is ignored by a narrow focus on explicit knowledge. It is important to remember that the IT systems, that are used for capturing and manipulating knowledge, are mainly handling with coded and thus explicit knowledge. The tacit part and the underwater part of the iceberg is thus ignored. (Fernie, 2003; Goldblatt, 2000) Huysman (2004) discovered in her study with, systems used for storing past experiences of knowledge workers, that you cannot store experiences in a database and then just assume others to internalise them. A big part of knowledge sharing happens through face to face communication. According to Salmela (2008) there is much tacit knowledge and know-how in people's heads that cannot be explicated even by themselves. This kind of knowledge can be shared much more effectively for example through communities and teacher - apprentice training.

3.4 Knowledge Base

There seems to be multiple definitions for the word *knowledge base* (KB), or knowledge repository, slightly depending on what kind of business we are talking about. (Date, 1990.) In many cases KB is just a database, but in some cases it includes sophisticated expert systems and other artificial intelligence functions. According to J. D. Ullman there are few characteristics that are common for the KB systems; KB systems deal with massive amounts of data efficiently and offers the user a declarative language in which express queries of a general nature. (Ullman, 1988.) From the knowledge management point of view KB is used as *organisational memory* to capture information, knowledge and experiences born in daily work, and to later reuse that information to avoid the wheel re-invention. According to Liebowitz episodic knowledge suits well for SD sectors, where a *case base* is populated with cases for application to a new solution or problem. KBs are also used to capture the knowledge of critical support personnel and to

compile it in understandable form. (Liebowitz and Beckman, 1998; Graham and Hart, 2000; Gunnlaugsdottir, 2003; Huysman, 2004)

Although KB plays a crucial role in the SD support production, by providing essential information and instructions, it is not discussed profoundly in ITIL ver.3 books. ITIL talks about *Service Knowledge Management System* (SKMS), in which *Service Knowledge Management Base* (SKMB) is one part. This SKMB seems to be very much like KB, but SKMB is a much wider concept and includes more connections to different system and data sources than the KB we are researching in this thesis. (Macfarlane and Lacy, 2007e) The SKMS has also been stated to be highly speculative future vision that no company has been able to implement on its full scale. (England, 2010)

In literature KBs are often divided into two different categories, human readable form, and computer readable form.

1. Human readable form

   This kind of a knowledge base deals with unstructured free text articles. The main idea of the system is to search for similar past problems, suggest solutions and let the SD staff to decide how to use the knowledge found in system. (Lenz and Burkhard, 1997) It will also support SD agents to maintain an appropriate level of service by allowing use of knowledge created by other colleagues. (Huysman, 2004) This thesis concentrates on human readable form KBs that are designed to support SD agents, not to replace them. In technical support organisations KBs are usually of form case bases, which deal with unstructured data, but enable saving knowledge and important data in organised and structured way.

2. Computer readable form

   A KB is a special kind of database for knowledge management. It stores knowledge in a computer readable form, usually for the purpose of having automated deductive reasoning applied to them. It contains a set of data, often in the form of rules, that describe the knowledge in a logically consistent manner. A KB may use an ontology to specify its structure that is entity types and relationships and its classification scheme. (Koumoutsos and Thramboulidis, 2008)

Introduction of new data processing technologies can add value to the system for example through more sophisticated search functions, automatic article classification, and by connecting existing knowledge to create new. The KB may can include *Expert* System (ES) or *Decision Support Systems* (DSS), which help the user to make decisions by providing the needed underlying information. This kind of systems may also suggest solutions for problems and present their advantages, disadvantages and consequences. Other techniques commonly used to make KBs more sophisticated are *Online Analytical Processing* (OLAP) and *Case Based Reasoning* (CBR). (Liebowitz and Beckman, 1998; Marzi, 2004)

We are next going to take a look at the challenges and common pitfalls related to KBs. Many of the following issues are tightly related to each others, and failing in one part of these issues can often lead to failing in the other parts too.

Usage

According to Gartner the main cause of failure in establishing KB is the lack of usage. It summarises this in sentence "Use it or lose it". For avoiding confusion on which system to use, companies should use only one KB for a particular purpose. Gartner reminds that redundant technology can be one reason for consolidation. (Casonato, 2007) Usage of a system can also be ensured by integrating it into the processes. One way to do this is to use process models, which demand to search KB every time, a SD agent receives a new ticket. If there is no solution and the agent can solve the problem, the case is not completely solved until the new solution is documented and added to the KB. (KCS, 2010) These kinds of process models for using KB are discussed later in following subchapters.

With well constructed KB less experienced staff members are able to access knowledge created by more experienced workers. This reduces training requirements and increases the percentage of incidents that are resolved at the cheaper first level. (Liebowitz and Beckman, 1998; EMC, 2009) Use of KB articles created by colleagues also makes knowledge sharing and knowledge transfer possible. (Fernie, 2003)

According to Marzi (2004) the usage of knowledge bases and expert systems can also lead to a decrease of competence of employees. If users rely too much on the

KB they might lose competence by forgetting procedures and important information. Excessive use of a KB may lead to longer solution times, because the SD agent has to continuously check the KB for solutions, that they could have solved by their own. The key for avoiding this is, that the system suggests different solutions and let the SD staff to decide how to use the knowledge found in the system. (Marzi, 2004; Lenz and Burkhard, 1997)

Content

To get content into the KB an open knowledge sharing culture must be conducted. People must be rewarded for knowledge sharing and they must have a feeling that their knowledge is important to other colleagues, Gartner found in their research that a huge base of knowledge about how to execute a process resides still in people's heads. (Liebowitz and Beckman, 1998; Casonato, 2007) When acquiring this kind of knowledge, it must be externalized through a documentation process. The tools used in a company must support this process. (Gunnlaugsdottir, 2003). If there is too little content in the system users will not continue to use it because searches carried out against the KB are fruitless. Well defined processes are essential to ensure continuous content production. Too much content in the KB is also a problem, because finding appropriated knowledge becomes difficult.

Companies should define what kind of information is important to them and remove articles that are not used from the KB. It is not necessary to save all the information born in daily operations to the KB. (Graham and Hart, 2000; EMC, 2009; Davenport and Prusak, 1998a) The content in the KB must be managed in some way. This management involve for example formal reviews for ensuring that articles saved to the KB are of sufficient quality, and the articles are reviewed on a regular basis to be up to date. (EMC, 2009) The KM approaches introduced later in the subchapter gives some instructions for these issues.

Dependency

If a company is highly dependent on its KB a technical break can have significant consequences, and thus the operation of the KB platform must be ensured. Knowledge and information saved in the KB can also have harmful effects to the company or the company may lose its competitive advantages if this information falls in the wrong hands. For this reason, the security and user policy issues must be carefully considered. (Liebowitz and Beckman, 1998)

As discussed above many of the problems related to KB can be solved with well defined processes. Three different approaches, centralized, decentralized and a hybrid approach to the KM in ICT organisations can be found. These approaches differ from each others for example by the level of control and openness.

3.4.1 Decentralised Approach

One of the most famous KM approaches in ICT corporations is Knowledge Centered Support. KCS a set of practices and processes used in customer support and technical support organisations. It is an open model that is enabled by technology, but it recognises that people are the most important part of KM, because basically knowledge workers are the source of knowledge. The idea of KCS is that *knowledge is the key asset of the support organisation*. (George, et al, 2006)

KCS has four basic characteristic:

- Create content as a by-product of solving problems
- Evolve content based on demand and usage
- Develop a knowledge base of your collective experience to date
- Reward learning, collaboration, sharing, and improving (George, et al, 2006)

For optimum performance, KCS practices and the tools that support them must be integrated in other support and business systems, including incident management, change management, and service level management processes and systems. (George, et al, 2006) KCS workflow is shown in Figure 15.

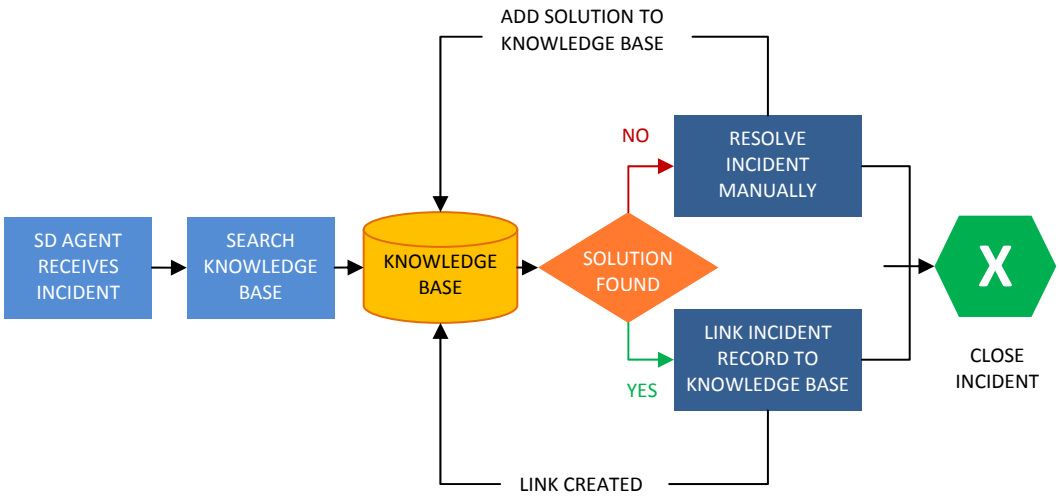

Figure 15. KCS workflow (George, et al, 2006; EMC, 2009)

Front-line incident management staff on the SDs and the second line support are the point of capture for much of everyday knowledge. Whenever a SD agent receives an incident he or she first looks for solution in a KB. If a suitable solution is found, it can be used for solving the incident, and after solving it a link between the incident ticket and KB entry is created. If there is no suitable solution in the KB, the SD agent will start a procedure for creating it. The incident solving process flow is not fully completed, before the new article concerning this particular incident is added to the KB. (George, et al, 2006) Because the content is created by the officers, KCS encourages a high level of content creation. In the KCS content is reviewed as it is used, and thus there is no need for specialised personnel checking, that the knowledge is up to date.

There are also a few downsides in KCS. Firstly, because everyone can create articles without any review process, there is a possibility that inaccurate or incorrect articles are added to the system. Secondly, utilising KCS can require considerable culture change which involves the entire organisation. (EMC, 2009)

3.4.2 Centralised Approach

Centralised KM approach is an alternative for decentralised KM approach. In this approach control over content creation, quality and accuracy is handled centrally. The main difference to KCS is that every article added to the KB must pass two formal review steps. The maintenance of an article is made through formal review

after some predefined period (e.g. 12 months). Centralised KM workflow is illustrated in Figure 16.

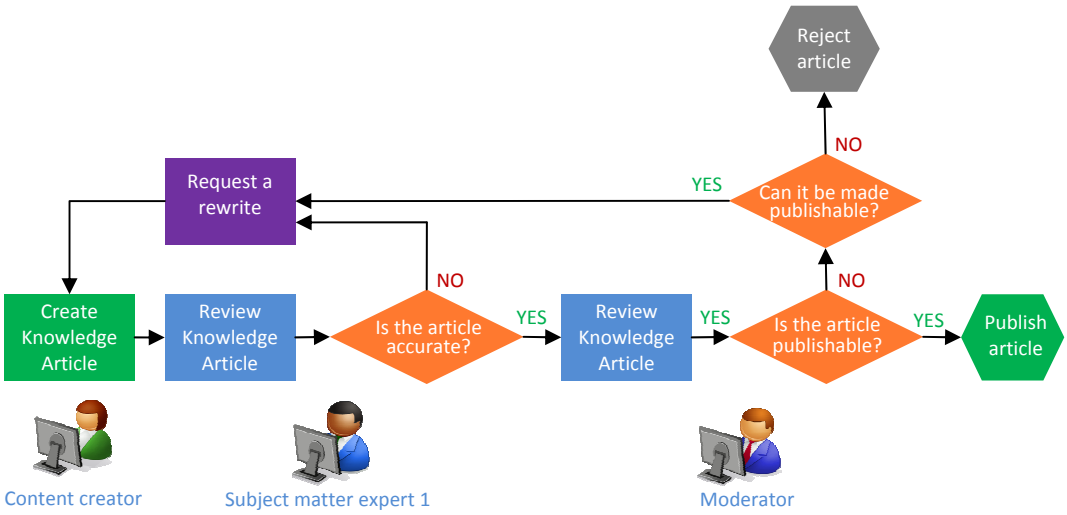

Figure 16. Publication procedure of a new instruction (Centralised Knowledge Management)

The major advantage in using centralised model is the level of control that it enables in compose and review processes. Increased complexity, resource demands and the process footprint can be seen as disadvantage.

3.4.3 Hybrid Approach

EMC introduces approaches introduced above to be substitutes to each other, but these approaches can also be used as complements to each others. According to Rusanow (2003) KM approach can also be a hybrid of these approaches, which she also states to be the best practice for KM. For example one can use KCS for managing KB, but use centralised approach when adding new articles to the KB. The company can adopt the best part of the both practices, introduced above, by using hybrid approach.

4 THE CASE ORGANISATION

4.1 Tieto Oyj

Tieto Oyj started its operations in Finland in 1968 with name Tietotehdas. On the early years it produced data center and mainframe services to corporate customers. Data systems were mainly produced and maintained for Yhdyspankki and for couple of forest industry companies. The customer base of the company grew during the 1970s and midi-computers were introduced alongside the existing mainframe computers. The use of personal computers became common in the 1980s and Tieto Oyj gained growth in that area. During the 1990s the company experienced rapid growth through a number of acquisitions, mergers and strategic alliances. Today's Tieto was formed when Finnish Tieto Oyj and Swedish Enator were combined to TietoEnator in 1999. The name was changed back to Tieto Oyj in 2009. (Tieto Oyj, 2010) Today Tieto is an IT service company providing IT, R&D and consulting services for large and medium-sized organisations. The main service areas are shown in Figure 17.

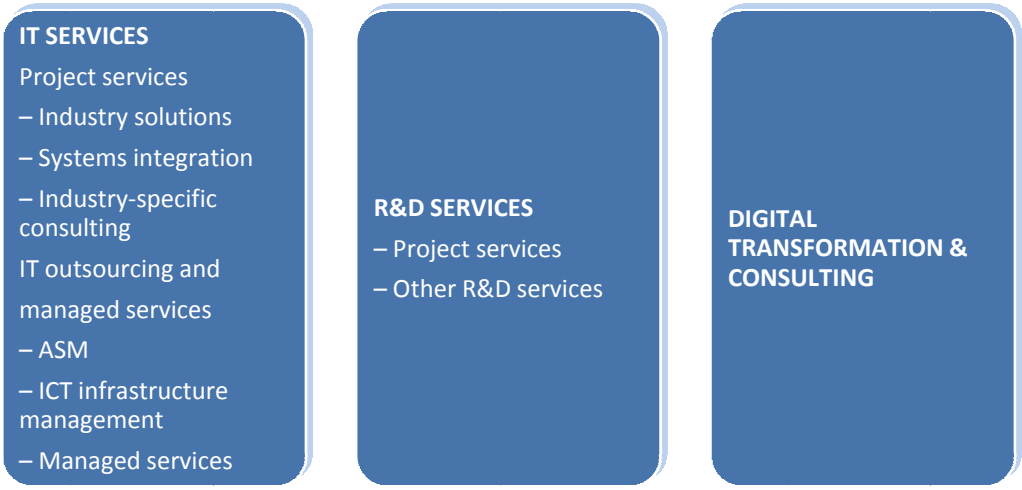

Figure 17. Tieto service areas (Tieto Oyj, 2009)

Business is divided to following sectors:

- telecom & media
- financial services
- industry group (among other things forest, energy, healthcare welfare, logistics, manufacturing, public and retail)

Main markets are Northern Europe, Germany and Russia, but Tieto serves its customers globally in certain areas of expertise, and have industry-specific

activities in selected countries around the world. (Tieto Oyj, 2009) In year 2009 total net sales of Tieto Oyj were 1 706 million euro and it had over 16 000 employees. (Tieto Oyj, 2010)

4.2 Service Desk History of Tieto

In annual report 1984-1985 Tietotehdas (The predecessor of Tieto Oyj) advertises, that it produces consulting, training, system maintenance, software and hardware services for corporations. In 1984 computers were commonly mainframe or IBM computers, but micro computers were gaining more popularity. (Tietotehdas Oy, 1985) Mainframe operators and workers in control desks can be regarded as precursors for SD. Their work included problem solving of main frame users, and of system maintenance. In the 1980s information technology was expensive and at a very early stage companies realized the opportunity to outsource IT services. Cost savings were achieved by virtualization and centralization of data centres.

In the late 80's *personal computers* become more popular and at the same time need for PC-support increased rapidly. Several companies resolved the problem by setting up local support groups or by placing a local support person to every business unit. When a problem occurred with the IT infrastructure the user contacted local support person, who tried to solve the problem via telephone or visited the place physically. New software was installed by local support person either from physical media (diskette, CD-ROM) or from network drive, and thus the support personnel needed to be physically near to customer. (Lindberg, et al, 2010)

When remote support tools became popular, companies started to seek for cost savings by centralizing IT support services. In annual review of year 1994 Tietotehdas is has divided its business in to three categories: professional services, processing services and software product services. Processing services offered operation, output and network services required for running the customer's data systems. (Tietotehdas Oy, 1995) In the early 2000s, ITIL started to slowly spread to Finland, and defined SD support processes much more precisely than before. In the past, things were made roughly the same way, but in ITIL processes were clearly defined on paper. This eventually led to the development Tieto Oyj’s today’s SDs. (Lindberg, et al, 2010)

4.3 Service Desk Financial Services Finland (SDFSF)

Service Desk Financial Services is part of the Tieto Oyj SDs in Finland. It produces Service Desk services for about 25 companies operating in finance- and insurance sectors. Services are provided according to ITIL, which ensures the compatibility with the other parts of Tieto Oyj's organisations and with the third party service providers.

As described in the ITIL ver.3 problem solving process is divided into separate levels. The first level is the SD, where SD Specialists and agents aim at resolving the problems immediately. The SD is be able to resolve most of the forthcoming tickets. The SD also handles a lot of tickets, that it only passes on to other parties (for example access control and managing tickets). SD uses sophisticated remote access tools for performing their job. This allows the SD agents to be located physically in one centralised place, that do not have to be near to customer. In case of a problem, that cannot be solved remotely, SD requests local support personnel to visit to customer (e.g. installing new hardware). The local support service is often bought from a third party. Tickets that cannot be solved by the SD itself, will be redirected to the second level.

On the second level, the experts have been divided into teams based on their field of expertise. These kinds of teams may be for example separated Windows and UNIX-teams. Problems that cannot be solved on the second level, are transferred to the third level.

The third level consists of the most experienced and competent experts in Tieto Oyj. At his level, the problems are handled by specialist, who has the highest level of expertise of the specific problem. From the third level the problem may also be forwarded to third parties, such as a telephone operator or the program supplier, or the third level support itself can be provided by third parties. For example complicated problems related to Microsoft Office may be forwarded to Microsoft's own specialist group.

If a problem is solved on the second or third level, it will always be returned back to the first level. The SD will inform a customer when the solution is found. SDFSF supports its customers on weekdays, at 7-18 and on other times, calls are directed to Tieto Oyj's 24 / 7 SD. SD 24/7 tries to solve the tickets on the run, but,

in a majority of cases, it only records the service request, and forwards them to SDFSF. These tickets are then solved in SDFSF during the office hours. Tieto Oyj's server management and control is handled by a large data centralized located in Ostrava, which ensures that the service is produced cost-efficiently.

The most important tool of SDFSF is Tieto Oyj's *Operation Management Tool* (OMT). It is used for recording service requests to tickets, for keeping track of the problem resolution process, for routing the service requests to different support levels, and for recording and sharing essential information needed for the process. The OMT also allows reporting and keeping the customer informed of the service request or incident progress. The system also automatically takes care that the tickets are solved in the agreed SLAs. The position of the OMT in SDFSF service production is shown in Figure 18.

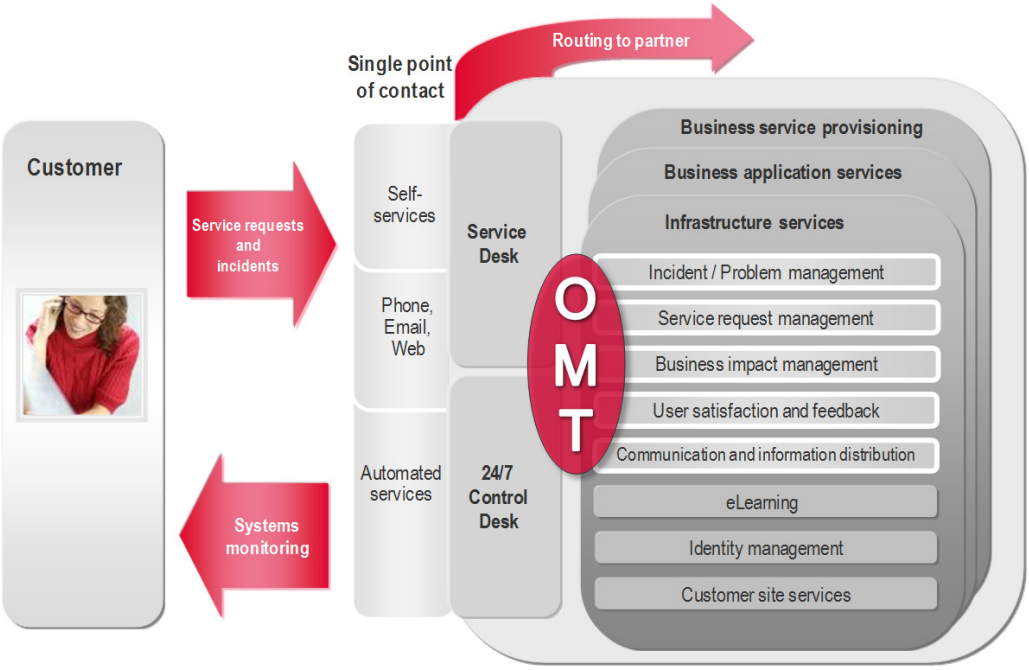

Figure 18. Role of the OMT in the support service production

4.4 Quality Meters

For measuring process performance, a SD must have performance meters. According to ITIL ver. 3 The *Key Performance Indicators* (KPIs) are clearly defined objectives with measurable targets. A SD should measure at least following KPIs:

- The first-line resolution rate
- Average time to resolve an incident
- Average time to escalate an incident
- Average SD cost of handling an incident
- Percentage of customer or user updates conducted within target times, as defined in SLA targets.
- Average time to review and close a resolved call
- The number of calls broken down by time of day and day of week, combined with the average call-time metric. This is critical for determine the number of staff required. (Macfarlane and Lacy, 2007c)

A SD should also measure customer and/or user satisfaction with different end user surveys. The idea is to ask questions, five to six at the most, about how the customer and/or user experienced the SD service. The respondents are usually randomly picked after they have contacted the SD, for example every second customer. (Macfarlane and Lacy, 2007c)

SDFSF uses Service Level Agreement violation metering for measuring how well the promised SLAs are kept. Also first-line resolution rate and average incident handling costs are measured. These meters are integrated to the OMT, so that the measurements are done automatically based on the data saved to the tickets. Also various phone statistics are measured based on the data from the call tracking system.

Standard SLAs in the Tieto Oyj are:

- Service hours from 8-16 to 24/7 depending on the customer needs
- Answering rate, for example 80%
- Resolution rate in the Service desk, for example 80%
- Continuously measured end-user satisfaction automatically in OMT
- Percentage of tickets reacted and resolved within SLA for all services

In the case organization End User Feedback (EUF) is collected by a *Customer Satisfaction Survey* (CSS) form (see Attachment 1) that is automatically send to a randomly picked user via email. In the form the user is asked to tell how he or she experienced the quality of service on the scale 1 to 4. Grade one is equivalent to *very poor* and 4 is equivalent to *very good*. In the end of the form, there is a free text form, where the customer can write free text comments. Based on the CSS forms a grade for EUF can be calculated. This grade is included in SLAs, and thus also monitored. In case of a grade one, the SD contact the user to determine the cause of a poor grade and to prevent recurrence.

5 CURRENT KNOWLEDGE BASE SOLUTIONS

Based on the study made in literature and the KM solution providers, it can be seen that knowledge base is often integrated as one part to a bigger and wider system used for KM. That is why it is often so seamlessly integrated in the ITSM tools, that it is impossible to distinguish it from a bigger entity.

In this chapter we are going to concentrate on the KB solutions that are currently used by SD service providers. In the beginning we are going to explore what is ITSM system, and for what purposes it is used. After that two KM modules integrated to the best ITSM tools (according to Gartner) are introduced.

Many knowledge management tools that are not integrated to any particular ITSM tool exist and are also widely used. To name a few, IBM Lotus software has been in use for over two decades. (Stephen Hardison, et al) Microsoft has its own platform for building collaborative knowledge bases called SharePoint. Dozens of these kinds of solution exists, and it is impossible to introduce all the systems used in the IT organisations within the framework of this study. However some of these systems are included in the benchmarking (7.3.).

The next subchapter focuses on social media tools that have been a famous research area during the last years. Interactivity and openness is characteristic for these systems. Based on the literature these tools have been successfully used in project organisations, but there is no clear evidence that these systems will suit for SD organisations. (Otala, 2008) This issue is discussed in more detail in results chapter 7.

The last subchapter introduces the tools used in the case organisation. First we are going to explore ITSM tool of the case organisation, called OMT and after that we are going to take a look at two systems used for storing and re-using the knowledge.

5.1 Solutions integrated with ITSM tool

Information Technology Service Management (ITMS) tools are central tools for corporations producing IT support. These tools are trying to address the customers need for incident, problem, change, knowledge, self-service and SLA management. Organisations use IT service desk tools to help reduce service and support costs, increase end-user productivity, align themselves closer to the

business, provide high-end user satisfaction, and be the hub for a larger ITSM suite of tools. (Coyle and Brittain, 2009) ITSM can be seen analogous to Enterprise Resource Planning (ERP) and thus ITSM systems are also called ERP systems. Based on HDI practices & salary survey 2008 (Rains, 2008) the most famous ITSM tools and the market shares were:

- BMC® (Magic, Remedy, Service Desk Express) (21,2%)
- Homegrown system/developed in-house (12,1%)
- FrontRange SolutionsTM (HEAT, ITSM) (11,2%)
- HP® (Peregrine, Service Desk, Service Managment Center) (9,1%)
- NumaraTM (Track-It!, FootPrints) (8,6%)
- CA® (Unicenter) (6,3%)
- Oracle® (PeopleSoft, Siebel) (4,0%)
- IBM® (Tivoli) (3,3%)

According to Gartner Magic Quadrant the leaders of ITSM software are BMC and HP. Both of the software has their own modules for KM. In the next two subchapters we are going to take a closer look at these systems and to their most important functionalities. One should note that the following software are tightly integrated to ITSM software and thus cannot be used stand alone. The KM module should be chosen based on the ITSM software that the organisation is running or planning to implement.

5.1.1 BMC Remedy and BMC Remedy Knowledge Management

BMC Remedy Knowledge Management is an additional component for BMC Remedy ITSM software. It allows seamless integration with other BMC Remedy software. Much of the knowledge capturing work is accomplished automatically by bringing in all the knowledge-oriented data from an existing trouble tickets. Users can also author knowledge documents that can be saved in more than 200 formats (unstructured data). The system also supports database sources (structured data).

The architecture is shown in Figure 19.

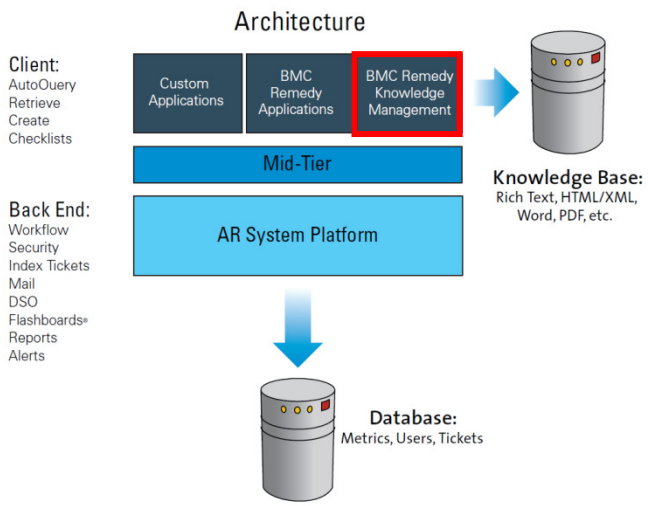

Figure 19. BMC Remedy Knowledge Management architecture

Searching can be performed while working in a trouble ticket. Some keywords and fields are automatically copied from ticket in order to make search faster and easier. BMC Remedy KM module supports for example following search features:

- Natural language processing
- Integrated hit list
- Relevancy ranking
- Boolean searches
- Approximate searching (fuzzy searching)

Authoring to BMC knowledge base is also easy. It includes best practice templates that can be used to turn a newly discovered solution into an article. Documents can also be created through rich text authoring, which supports copying from Microsoft Word. The authoring includes spell checking, authoring process workflow and version control.

BMC Remedy Knowledge management is scalable from small to large corporations. The full list of features is shown in attachment 2. (BMC Software, 2009)

5.1.2 HP Service Manager Knowledge Management Module

HP Knowledge Management Module (KMM) a module that is fully integrated with HPs ITSM software. The users can access it either directly from HP Service Manager or from an Internet browser. Knowledge Management Module supports

external knowledge sources that can be located in files or over the Web. The system architecture is shown in Figure 20.

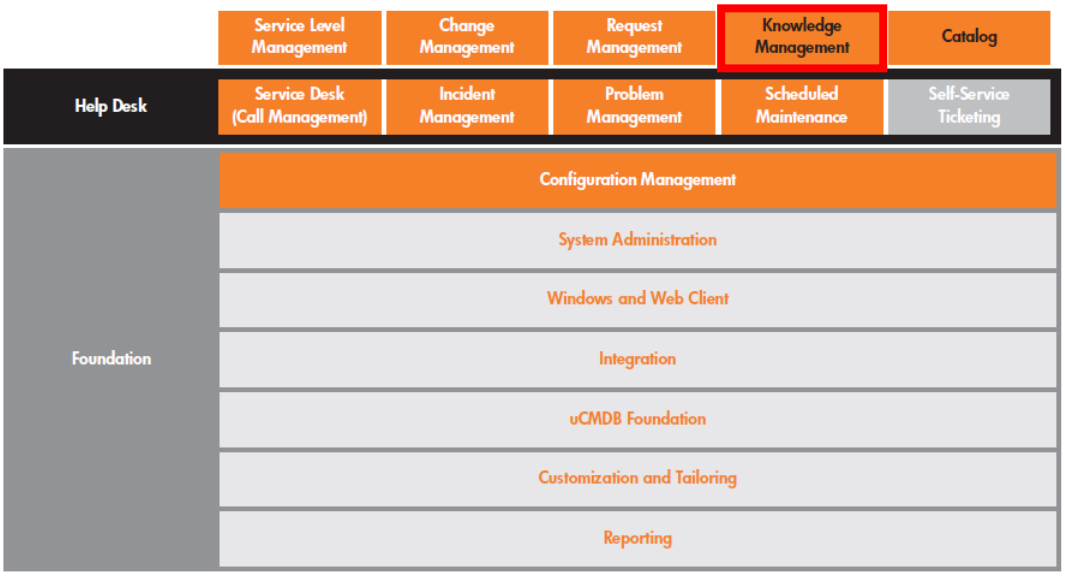

Figure 20. HP Service Manager system architecture (Hewlett-Packard, 2007)

The system complies with KCS approach and supports full knowledge life cycle and includes features to contribute, draft, import, approve, publish, and retire content to the KB.

Knowledge Management Module uses problem description automatically for KB searches. The search engine includes also natural language search capabilities. (Hewlett-Packard, 2008)

5.2 Social Media Tools

Social media, also called web 2.0 or in corporate use Enterprise 2.0 is a collection of new www-based community services. Common to all web 2.0 software is the users ability to add and edit content without predefined content structure. Social media provides an ability to participate and to organise in communities for everyone, and thus an ability to create new information rapidly. The social media services are:

- discussion boards
- wiki
- blog
- RSS services

- instant messaging (e.g. messenger and Skype)
- mash-ups
- groupware platforms
- community services (e.g. Facebook and MySpace)
- LinkedIn
- Share services (e.g. YouTube and Flickr)
- Secondlife (Otala, 2008)

According to Melakoski (2007) wikis and blogs are the most used services in Finnish corporations. Wikipedia is undoubtedly one of the world's largest knowledge bases. In 2010 there were over 19 million pages in the wiki and almost 12 million people contributing to it (Wikimedia Foundation, 2010). Otala (2008) tells in her book about many case examples where social media has been used successfully in companies. Tieto Oyj is already exploiting wikis, blogs and discussion boards in their MOSS based intranet. For this reason it is essential for this thesis to introduce this media and later to examine theirs compatibility to be used as SD KB. In the next subchapters we are going to take a closer look at the most famous social media tools used in companies.

5.2.1 Wiki

Wiki is a collection of linked web pages created gradually by a cooperating community. Wiki also includes a software that is used for managing this web pages. A central character of wiki is that many users have rights to edit the page content. Otala states that wikis are most famous social media tools used in companies. The free dictionary Wikipedia is one type of wiki. There are currently over 100 wiki platforms available. Some of them are free, but for corporate use there are many commercial platforms. Commercial platforms include some features that are not included in free platforms and they suites company use better. For example Socialtext, Traction Software, Confluence and Microsoft Office Sharepoint Server 2007 are suitable wiki platform. (Otala, 2008)

University of Helsinki has used Confluence wiki for their helpdesk KM. Their main idea is that an open wiki offers all the essential information for the first line support. Everyone using Helpdesk wiki is allowed to contribute, update and edit articles in it. (Eväsoja, 2009)

5.2.2 Blog

A blog is a web platform where a person or sometimes small groups can write articles. Blogs are not edited like wikis. The articles added to the blog stay as they were put there. Usually users do not have rights to modify writings, but they are able to ad comments underneath each article. Blogs are widely used in companies by the managers for distributing their ideas to the staff and for collecting their opinions in a comment form. Through blogging the newest information can be distributed rapidly before the official channels. (Otala, 2008)

5.2.3 Corporate Portal

A corporate portal is a framework for building a web portal to corporate information and services. It enables content aggregation and delivery of information, collaboration and community services, and application access for the target audience. A good example of a corporate portal platform is Microsoft Office SharePoint server 2007. (Otala, 2008; Benbya, et al, 2004)

5.2.4 Discussion Forum

Discussion forums have developed based on "newsgroups" in the mid-1970s. A discussion forum is a web page where people can discuss asynchronously and freely on different subjects primarily used as a forum to communicate with members of a group or an online community and to seek assistance and support from a group or an online community. Discussions can be categorised under different subjects and any user can start a new thread or write answers to existing ones. It is also possible to search old messages. Because of the asynchronous interaction it a discussion forum is archival in nature. (Otala, 2008; Harman and Koohang, 2005)

5.2.5 Mashup

Mashup is a technology for integrating multiple information sources under one user interface for creating an integrated experience. New mashup tools are easy to use and by using them the user can add information of his or her interest to the website. The information is updated automatically when it is changed in the external site. According to Gartner this technology is moving from consumer to enterprise and it is lead by vendors such as Google. Microsoft gives an interesting example of corporate mashups on their website. The example is a site for

customer service use that integrates all the necessary customer information (contact information, local time, subscribed products and top service issues) under one site. The same site also shows local talking points, local weather, local news and a map of local service centers for customer servant. This helps the customer servant to fill the silent gaps in the conversation and makes the service experience more pleasant for the customer. (Otala, 2008; Casonato, 2007; Clarkin and Holmes, 2010)

5.3 Tools Used in the Case Organisation

Solution tool is a part of Tieto Oyj's internal Operation Management Tool called OMT mentioned in passing in the chapter 4.1. From the viewpoint of Tieto Oyj OMT is the most important software of ITSM. Solution Tool (ST) is tightly integrated to OMT and therefore it is appropriate to first take a closer look at OMT and after that to the ST.

5.3.1 Introduction to Operation Management Tool

Operation Management Tool (OMT) is Tieto's internal ITIL and ISO 20000 standard compatible tool for registering incidents and service requests and for managing service support processes defined by ITIL. These kinds of systems are generally also called ERP (Enterprise Resource Planning) or ITSM (IT Service Management) systems. OMT's role in service production is very central (Figure 18). It is in some sense a hub between internal and external third parties systems. It also has connections with monitoring, reporting, automated service portals. OMT is built on Remedy ARS platform and an example screenshot of this kind of system is shown in Figure 21.

OMT is divided to the following sections:

- Incident Management
- Problems
- Change request
- Advanced
- Service Comments
- Notifications
- Continuous Feedback Collection(Sarno and Westerlund, 2009)

In terms of the SD the most important sections are incident, problems and change management sections.

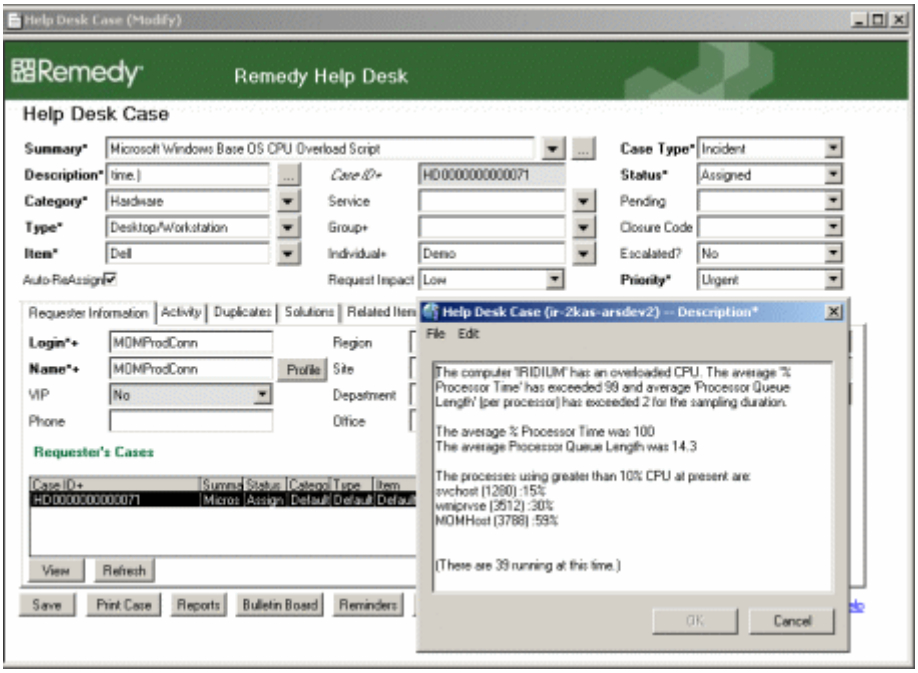

Figure 21. A screenshot of a system built on Remedy ARS platform (Engyro, 2010)

Incident Management section is used for managing incidents and service requests defined in ITIL. Whenever a user contacts SD a record is created. This records include useful information of the user like name, organisation, contact information, services that s/he has and so on. The ticket also includes fields problem description, ticket history, services that the ticket is related to and so on. With these information SD agents can monitor the processes and scan the incident history.

Problems section is used for starting and managing ITIL compatible problem management process. After creating a problem ticket all incidents that are related to a particular problem are connected to this problem ticket. This enables SD specialists at the higher levels to get access to all the information about that is available of this problem and it's also easy to control the problem solving process.

ITIL compatible change management process is managed through change management section. By usage of change management for example orders for new servers and new software installations can be managed.

5.3.2 Solution Tool (ST)

ST is an OMT integrated tool, that is also tightly integrated with incident, problem and change management processes. It is used for searching solutions and workarounds from KB and matching Incidents against open problems. OMT users can access ST when they are working with incidents by clicking solution tool button. Basically ST can be seen as interface for searching KB and problem records.

Solution tool has many useful properties:

- Tickets can be matched against KB or open problem records by free text keywords or by different classifications based on configuration items. User can also define the fields used for searching.
- KB entries can be general or customer specific.
- When a solution is found it can easily be copied to the ticket and used by SD agent by pressing “re-use” button.
- When re-using a ticket a link between the incident and problem ticket is automatically made. This enables one to find incidents related to particular problems from the problem ticket. Also when problems’ root cause is solved the solutions can be automatically found from incident ticket. Because of this functionality the problem manager has so much information of the problem as possible.
- Possibility to define specific solution text (different from the one shown to the SD agent) that is send to user.
- KB records can be made in problem management process based on problem tickets or in standalone mode when they are not related to any particular case.
- KB entries can be added by any people working with particular case, but it must always be approved by predefined problem manager before it is added to the KB. When KB entry is done based on problem ticket the classification and description fields are automatically copied from the problem ticket. The workflow is similar to the one shown in figure 19.
- KB entries can include attachment files

If no solution is found from KB or open problems one can try finding similar incident tickets. This is however a very heavy procedure because of the amount of incident records. Problem tickets may be solved also at level two and three. This enables knowledge sharing between different support levels.

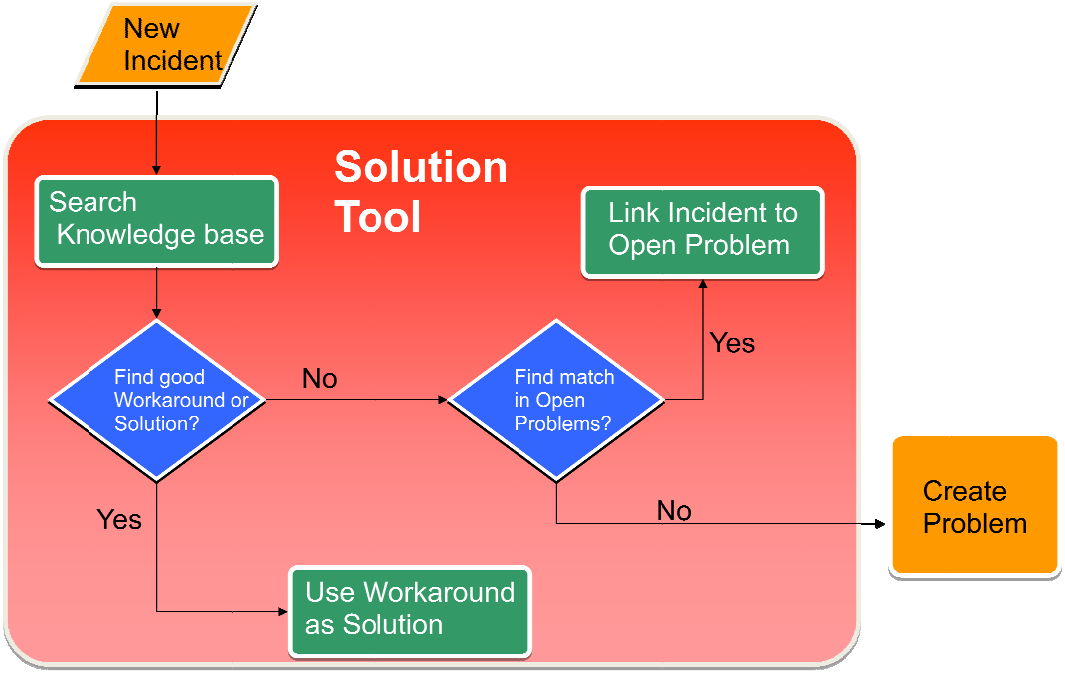

Figure 22. Solution tool work flow

5.3.3 Support Instructions Portal (SIP)

SIP is a portal for Tieto Oyj's internal use which collects all documents and information in one place. Its purpose is to standardize the management of documents by offering a central, standardized document repository with a unified library structure for all customer sites which makes document creation, updating, versioning and sharing more efficient.

SIP is built on Microsoft SharePoint server technology. The solution consists of two SharePoint servers, two SQL servers and one load balancer. Servers are placed so that there exists two identical sets of servers in two different locations. This enables high reliability in fault situations.

SIP is straight forward realization of the Centralized Knowledge Management process defined by ITIL, but this model is a little bit modified to suit better for Tieto Oyj's usage. The biggest difference is the absence of second review step. When a document has passed the review process it is straight published in SIP. No

further review processes are done. The document publication steps are shown in Figure 23.

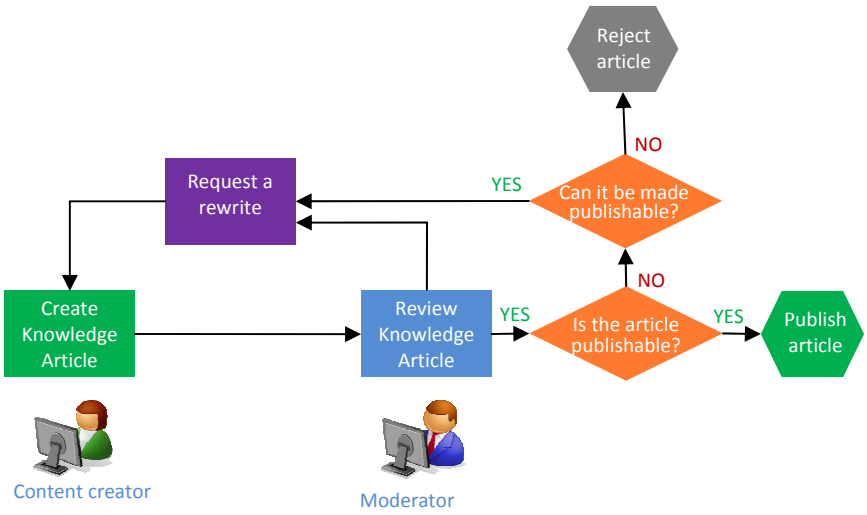

Figure 23. Simplified SIP document publication process

The main properties of SIP are:

- Effective search based on MOSS search engine which can search also keywords in the documents.
- Support for Microsoft Word, Excel, PowerPoint, Adobe PDF and for all common document file formats.
- Sophisticated role based user rights, which ensures that s/he has access just to those parts that is needed to perform the work.
- Document approval workflow
- Ability to define document responsibilities and document expedition date.
- Effective integration with Microsoft Office tools enabling e.g. document approval and checking to be done by one click.
- Predefined document templates.

SIP is divided in five sections; SIP home page, customer area, IT service groups area, general instructions area and service concepts. The most important section for SD is customer site. It includes customer-specific instructions and information needed for daily support operations. Each document is placed in a folder named after the customer. Every customer section is further divided to contact information, service information, infrastructure information, installation

instructions, support instructions and operational instructions. SD uses mostly support instruction section. Inside this section there can be more hierarchical folder structures based on for example the supported environment structure. However, the folder structure varies between the customers and thus places challenges for finding material in SIP. A big difference between OMT and SIP is that linking documents to incidents or service requests is not supported by SIP. (Microsoft, 2008; Westerlund, et al, 2008; Westerlund, 2008)

6 RESEARCH METHODS

In the research framework of this thesis, the elements of two different approaches, which can be used for designing a KB, are combined. This thesis will employ a *User-Centred Design* (UCD) as a philosophy for the research, and ITIL ver. 3 process flow, originally developed for ITSM tool evaluation, as a process flow model (Figure 24). One should note that the model is not developed directly for KB evaluation purposes, but it can easily be generalised for suiting it.

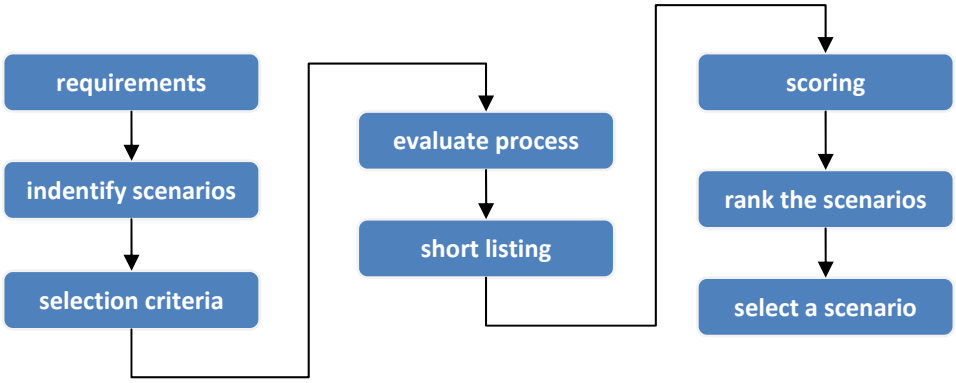

Figure 24. scenario selection workflow (modified from ITIL tool evaluation process)

The model starts with requirement identification. This is done by using the user research methods of the UCD. The UCD philosophy is introduced in more detail in chapter 6.1. In the following process steps, UCD appears as a way of doing the research; the users are kept involved in the process flow in every step. Chapter 6.2 and its' four subchapters deal with the research and information gathering methods used in this thesis process. All of these tools originates from the UCD, except the SWOT analysis method, that is used in this thesis for evaluating pros and cons of the future scenarios.

6.1 User-Centered Design (UCD)

During the last decades product usability has continuously become a more important aspect of product design and development. Nielsen (1993) has defined usability as:

- *Learnability*: The systems should be easy to learn, so that the user can rapidly start getting some work done with the system.

- *Efficiency*: After learning the system, a high productivity should be enabled.
- *Memorability*: The system should be so easy to remember, that the users are able to return to the system after some period without a need to relearn all over again.
- *Errors*: The system should have a low error rate and the users should be able to recover from errors easily.
- *Satisfaction*: The system should be so pleasant, that users like it.

Patrick W. Jordan (2000) states that the usability is vital, but it is not the whole story. He has introduced a bottom-up model for designing pleasurable products. The lowest level of this model is *functionality*. A product will be useless if it does not contain the functions necessary to perform the tasks for which it is intended. The second level is the *usability*. Once the appropriated functionality is included, products that are easy to use are the most wanted. The third and the highest level is *pleasure*. After people are used to usable products it seems that people will soon want some more; products offer something extra; products that are not just tools but "living objects" that people can relate to; products that bring not only functional benefits but also emotional ones.(Jordan, 2000)

UCD is a design philosophy that is created to best address the user's needs and tasks. In UCD one may sacrifice some system efficiency to better address needs of the users in the interaction and the interface is built. (Leventhal and Barnes, 2008) Nielsen reminds that users and human factors should be taken into account at an early stage of the planning. Even if you skip the usability testing, your customers will do it for you as they struggle to use the system. Change requests at this stage will be about 100 times more expensive to implement than changes discovered in the early phases of the project.(Nielsen, 2010)

6.2 Research and information gathering methods

For defining the current state of knowledge tools and for discovering the requirements for the KB, specific information about users' perception, attitudes, feelings and ideas are needed. Multiple tools and methods are available, for example interview, user survey, contextual inquiry, user observation, brainstorming, focus groups, and many more (Bevan, 2010). In the following

chapter, we are going to take a closer look at the methods chosen for this thesis; user survey, focus group, brainstorming, and SWOT analysis. As mentioned earlier the first three methods originates from the UCD, but the SWOT analysis originates from economic literature.

6.2.1 User survey

A user survey is a practical method for collecting information that is important for defining requirements and special issues of a particular solution. It can also be used for acquiring information of existing solutions and past experiences. Nowadays Internet is usually used for conducting user surveys, and because it does not require a personal contact with the respondents, a bigger respondent group can be gained faster and cheaper, than with other methods.

It is important to tell the user what the matter of the user survey is and what kind of information one is trying to gather. It is also important to construct questions so that they are not biased by creator's personal opinions.(Bevan, 2010; Couper, et al, 2005)

For determine the current state of the KB tools in the case organisation, a web based survey was established. Multiple drivers for a web based survey colud be found. First, because there is no personal contact with the respondents and survey was online 24/7, no difficult scheduling was required and a large respondent group was achieved easily. Secondly, questionnaire results can be analyzed statistically, which according to Nielsen gives moderately hard, objective data (Bevan, 2010).

The survey form was grouped into four sections (Attachment 3). The object of the first section was to identify, how users acquire information and what internal tools are used for it in daily work. The second part addressed the usage of external knowledge channels. Third part collected person's opinions of SIP and the fourth question part opinions of the ST. At the end of each section there was a free text form in order to enable respondents to express their opinions and ideas in their own words. The answers were saved to a database from which they were easily transferable to Excel for further processing and analyzing.

Based on this survey it became possible to calculate numerical values for user satisfaction and other properties. The questionnaire is also easy to repeat. This may be useful for measuring how changes in the tools affect in users opinions.

6.2.2 Focus Group

Focus group is a group section lasting between 1 to 2 hours, and normally involve from six to nine users to participate in it. It is used for capturing participants perceptions, feelings, attitudes, and ideas of the topic. The session is run by a moderator, whose task is to maintain the focus of the group by following a pre planned script. The moderator must ensure that all participants take part in the discussion and avoid to let the opinions of one participant to dominate. For the participants, the group session should feel free and unstructured flow of ideas. One should notice that the results should not be generalized to a larger group. (Nielsen, 2010; Bevan, 2010)

The web questionnaire discovered some demands for the KB, but for defining all the requirements and desired features a focus group session was organised. One SD department manager, one SD team leader, one SD specialist, and of two people designing and implementing internal tools and processes for Tieto Oyj, took part in the focus group session. The author of this thesis acted as a moderator and was also the sixth participant. To increase the efficiency, some background information and questions to be thought in advance, were provided to the group members a couple of days before the session.

The focus group was organised in a quite small conference room, which was equipped with a video projector. In a focus group session, the discussion can flow sometimes very rapidly, and it can be hard to make notes simultaneously. This was overcome by using an electronic mind mapping software. After the focus group this kind of documentation can be easily processed further and analyzed. Screenshot of the mind map that was produced in the focus group session can be seen in attachment 5.

6.2.3 Brainstorming

Brainstorming is a method for creating group creativity in groups of two to 12 people. The idea is that a group of people come together and focuses on a problem or a proposal. Brainstorming session can be divided to two sections; idea phase

and analytic phase. In the first phase every participant can present ideas about the subject. After the group has come up with a sufficient amount of ideas they may shift to the analytic phase. in the analytical phase the ideas are processed. Similar ideas are brought together, and ideas which are impractical or incorrect are modified or discarded. Also new ideas can be generated in this phase. (Nielsen, 2010; Bevan, 2010) In this thesis brainstorming was used for processing the requirements for the future scenarios with the supervisor of this thesis and with the case organisation leader.

6.2.4 SWOT Analysis

The abbreviation SWOT comes from the words *Strengths*, *Weaknesses*, *Opportunities* and *Threats*. It is a simple tool for structuring and analysing ideas, originally developed for the company directors, and first mentioned in economic literature in the 1970's.

The model is often used as a square model, where a big square is divided into four sub squares that are titled according to the parts of the SWOT (Figure 25). This squares are filled with the ideas according to the title, and thus the ideas are almost automatically grouped. The SWOT analysis can be used either in a group session, or when working alone.

Strength	**Weaknesses**
Opportunities	**Threats**

Figure 25. The table used for the SWOT analysis (Piercy and Giles, 1989)

In this thesis SWOT is used to identify the key issues and advantages of the future scenarios and to ease the selection of the scenario to be proposed. It will also help the thesis readers to infer why a particular scenario was chosen. (Piercy and Giles, 1989)

7 RESULTS

7.1 The State of the Knowledge Base Tools in the SDFSF

The survey was conducted in February 2010, and overall 44 employees from six different SDs of Tieto Oyj, took part in it. All of these SDs are quite similar to SDSFS, but they serve different customers. In addition to normal SDs, employees of 24h control desk was also included in the respondent group. The control desk serves over 100 separate customers, outside office hours, and is fully dependent on the instructions found in the SIP, made by other teams. The age of the respondents was from 20 to 60 years, and the average age was about 40.

According to the survey the most popular knowledge tools were Internet search, archived OMT tickets, own notes, archived emails and the SIP. The usages most popular tools are shown in Figure 26.

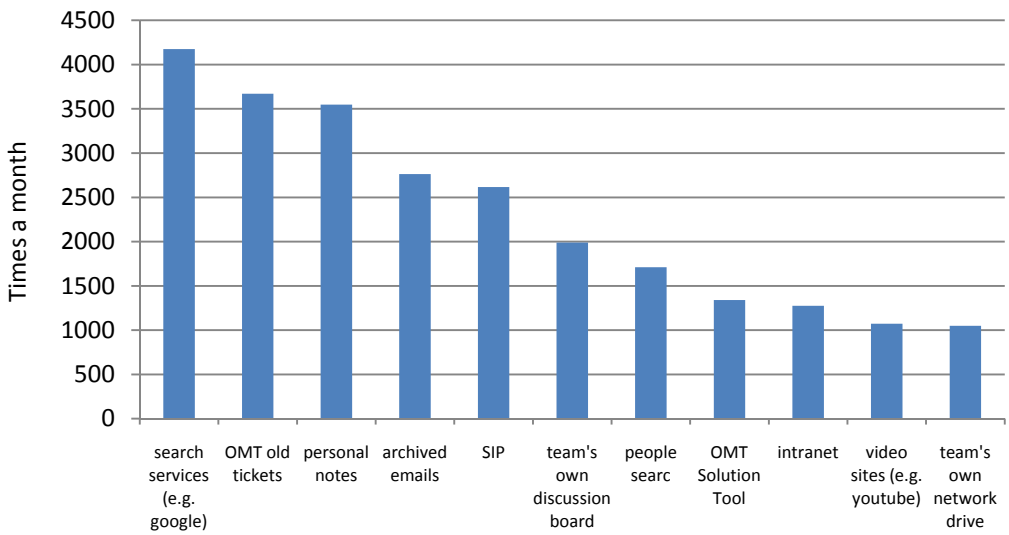

Figure 26. Tools used for searching information or knowledge in the daily work

Based on the survey, over 75% of the respondents used Google daily or more than ten times a day. This should be taken into account by including Google search to the KB user interface. This kind of a function was discussed in the focus group. It was suggested, that the systems could present Google search results, when there is no articles with a good match in the KB. Although Google is very effective tool, it should be used only after all the internal information sources are searched. There is no guarantee, that the tips and instructions found in Google really work. For

example Microsoft Technet was mentioned in the focus group session as a more reliable information source, that could be integrated into the KB.

According to Pöysti referred by Otala (2008) 90% of group work is performed via email and 75% of companies' knowledge lies in these emails. Based on the survey, archived emails were also widely used in the case organisation. OMT enables users to send email through a ticket and archives these messages into the system. This ensures that the information included in the emails is not lost. Old incident tickets are preserved for the period of two years, and after this period the tickets are deleted. Simultaneously important information may be lost, if no new KB articles based on the tickets to be deleted articles are created. For example the group ware Lotus Notes, that has been developed from 1980s, allows one to search and exploit the information included in the emails (Stephen Hardison, et al).

Employee's own notes were also widely used, but these were not supported by currently used tools. This should be taken into account when designing the new system.

Following conclusions about the knowledge tools can be made based on the numeric answers of the survey.

- over 75% of SD agents used old tickets of OMT daily or more than ten times a day
- Intranet is quite commonly used, but not for the knowledge sharing purposes
- some teams have established own discussion boards, but those were not widely used
- over 65% of the employees used their own notes and archived emails daily or more than ten times a day
- other information sources were not significantly popular

Based on the survey OMT ST was used very seldom, and it did not score very well. It was found hard to use and impractical. Some users found it easier to search the old incidents of OMT, than search a solution by the ST. Support instructions found by ST were found unclear and outdated. Also the number of instructions was found too low.

According to free text answers the main problems of the ST arise from:

1. Unsuccessful roll out

   Many SD agents told that the ST is not in use or they doubted if it is in use.
2. Insufficient instructions and/or training

   People wanted a better education for the ST, and some people told they could not find any instructions for the ST.
3. Limited search functionality

   Based on the survey a sophisticated and effective search is the key functionality in the KB. People were unsatisfied with the search of the ST, and told that they have great difficulties in finding particular instructions.
4. Speed issues

   In terms of usability, speed is one of the key factors. The survey revealed that the OMT ST freezes too often and therefore makes it difficult to use.

The numeral questions concerning the ST, addressed people's opinions of the instructions found in the tool, and the practicality and usability of the tool (Figure 27). The results were mapped so that *-2 = totally disagree, -1 = disagree, 0 = without opinion, 1 = agree and 2 = totally disagree*. Because of the high amount of the *without opinion* answers the results are presented with and without the influence of these answers. Based on the numeral questions the amount and the quality of instructions is the biggest problem in the ST. The second biggest problems are the usability issues.

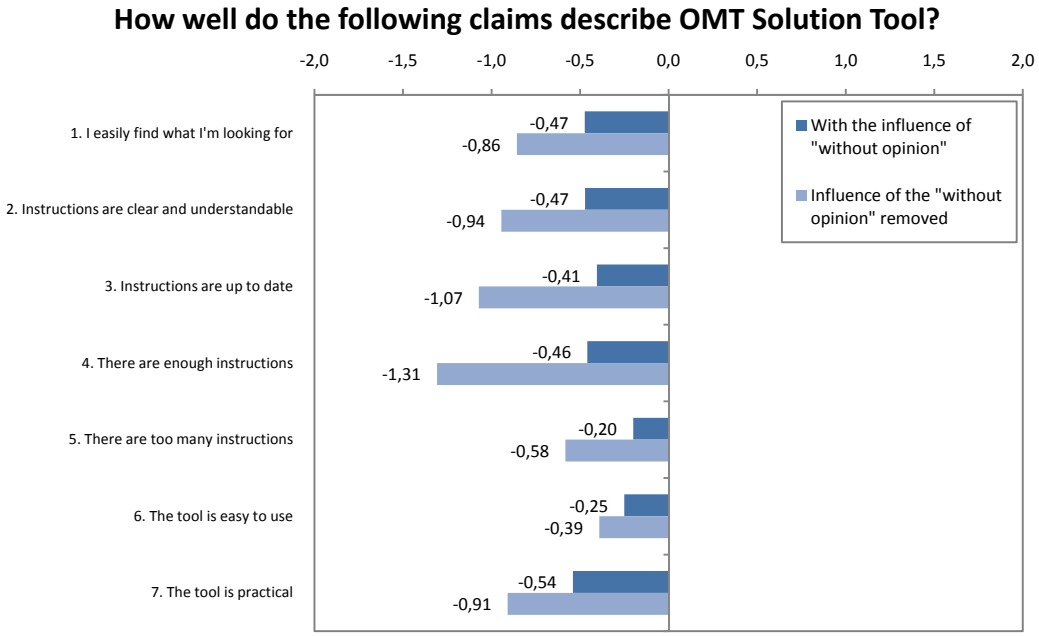

Figure 27. Results of the user survey concerning the OMT Solution Tool

Most of the problems mentioned above were valid a few years ago when ST was introduced, but there have been significant improvements since then. According to the measurement data from OMT (February 2010) there were overall over 3500 KB entries in the ST. Over 140 entries were added and over 160 were modified or updated monthly. These entries were made by the problem managers, and thus the articles should be of the top quality. Nevertheless user opinions of the ST are negative and reversing them to positive can be seen as a huge challenge.

SIP scored better than the ST almost in all areas (Figure 28), and was also much more used (75% used SIP daily or more than ten times a day). Based on the survey about 50% of the SD agents had some problems in finding solutions in the SIP, but about 50% managed to find certain articles quite easily. The majority of the employees found instruction articles of the SIP understandable, but some people had problems in understanding them. Over 50% of the respondents thought that some improvements to the SIP usability should be made. Opinions on practicality were quite neutral. The results were mapped similarly, as the results of the ST.

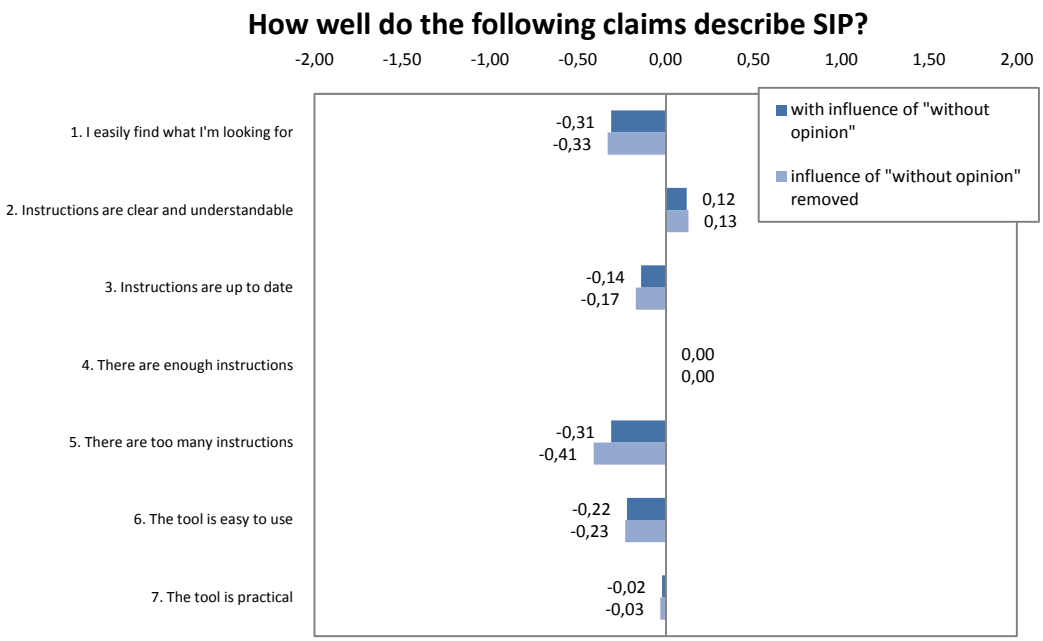

Figure 28. The user survey result concerning the SIP

Based on free text answers there are four major factors failed in the SIP:

1. Roll out

   There was not enough education for the use. In the beginning new material was inserted rapidly to the SIP without any formal instructions or folder structure, and without thinking the consequences of this.

2. Practices and instructions

   There are no clear rules for creating and adding documents. Folder structures and practices for naming documents are non-uniform.

3. Content

   Some instructions are outdated, content can be unclear or inaccurate, documentation style is not uniformed add titles are not always describing documents.

4. Program and user interface

   Search should be better, easier and more flexible with more search options.

In the focus group session it was also discussed, that is it necessary to have two parallel KB tools. According to Gartner redundant technology can be a candidate

for consolidation. Gartner also reminds that the lack of usage is the main cause of failure, not the redundant products. (Casonato, 2007) Although SIP and ST are quite similar, there is a little difference in the documents that are saved to them. When the ST includes solutions to incidents and problems, SIP also includes agreements, contact information and other documents. Nevertheless it was discussed that ST should be connected to SIP, and thus allow accessing SIP documents through the ST interface.

During the thesis project many discussions with Tieto Oyj's SD agents where had. Based on these discussions there is much so called *temporal information* born in the daily operations. SD agents have a lot of know-how and tacit knowledge of the system they are supporting, and often can find a workaround to an incident before the incident based on the root cause is even escalated to the higher expert levels. Typical to this information is that when it is discovered it must be rapidly distributed to other agents working in the SD, where it is used for some time and then leaved behind. This information can be a workaround for solving a problem that occurred after a particular software update and at this moment it is often verbally distributed. This leaves an option that there is an agent or group of agents which do not know that this solution exists. The verbal distribution process also takes a lot of time and resources, when the agents have to teach each other how the particular case is solved. This problem can be overcome by allow adding temporary instructions to the database. These instructions must be somehow marked to be temporary and have expiration date. If the SD personnel find an temporary instruction useful they can propose it to be qualified as a normal article.

7.2 SDFSF Requirements for the New Knowledge Base Solution

Based on the literature, the user survey and on the focus group session a large mind map of requirements was constructed. The requirements were then classified to four groups; culture and practice issues, functionalities, User Interface (UI) and costs. For benchmarking the requirements must have weights, that define how critical the requirement is. Each SD agent was asked for his or her opinions of how critical a requirement is found. Final criticality weights were assigned in co-operation with the case organisation team leader and the thesis supervisor, using the results obtained from the SD agents were as a base. Some new requirements

were also discovered at this stage and added to the list. The requirements can be seen in attachment 6.

Culture and practice issues include requirements that are dependent for example on successful roll-out, management and reward. These requirements are mostly human problems; a good software can ease fulfilling these requirements, but cannot fully meet them. If obligatory requirements of this part are not met the introduction of a new solution will probably fail. The functionalities part includes requirements, that affect on what can be done with the software. Most of these requirements are functionalities that can be already found in the ST or SIP. When choosing the future scenario none of these functionalities should be lost. The usability part includes requirements that must be fulfilled for the software to be user friendly. Most of these requirements originates from Nielsen (1993), but also a few extra requirements were discovered. Although most of these requirements are not marked obligatory, one should note that if the software does not meet these requirements at all, it will lead to poor user satisfaction, that will effect on the usage of the tool. The final part deals with the cost issues. With infinite amount of time and resources almost all software introduced in this thesis could be modified to be suitable for the case organisation, but because resources are limited, we have to also explore the cost issues. This may also be the hardest part of the benchmarking, because we have to assess costs before the project plan for software implementation is done. It could have been possible to use *Total Cost of Ownership* (TCO) (David, et al, 2002) method for calculating the costs, but we decided not to use this method, because it is impossible to estimate the expenses related to it accurate enough.

7.3 Benchmarking

The primary aim of the benchmarking is to explore how well the KB solutions available at the markets suits for the case organisation. The secondary aim is to compare KB tools currently used in the case organisation against these tools. By using benchmarking, we can include a large variety of KB systems in this thesis. Currently used solutions (chapter 5.3), BMC Remedy Knowledge Management Module (chapter 5.1.1), a few solutions from each category of the social media tools (chapter 5.2) and a few other KB tools are included in the benchmarking.

For the benchmarking the requirements were grouped to *compulsory*, *normal* and *nice to have* requirements. The benchmarking was done in three phases. In the first phase it was checked that the solution meets all the compulsory requirements. Solutions that did not met all these requirements were dropped out. The solutions that passed the first phase were then matched against the requirements classified to *normal.* After calculating the points four best solutions were chosen to proceed to the third phase. In the third phase the solutions were matched against *nice to have* requirements. The three step benchmarking process ensures that a solution with many nice to have, but lacking many compulsory requirements are not chosen.

7.4 Future Scenarios

While working with this thesis it has all the time became clearer that the knowledge base cannot be handled separately from KM and the issues related to it. It has also became clear that there is no superior KB solution that could solve all the problems discovered in this study. Many of the problems in currently used solutions arise from unsuccessful roll out and education, unclear processes and from culture and people behaviour.

In the following chapters we are going to take a look at the three logical paths that could be chosen for the future. In the beginning of each chapter the particular scenario is introduced in detail, and after that a SWOT analysis of each scenario is presented.

7.4.1 No changes to the Existing Tools

Based on the survey, it is clear that the currently used KB tools are not optimal solutions, although they seem to function from a technical perspective. The biggest problems arise from nontechnical issues, and can be overcome without changes to the actual tools. There is a possibility to affect on people's attitudes, processes, the data found in the system and possibility to educate people. These problems are not just problems of existing tools; need for these actions remain even if a new software is introduced.

The user survey discovered that users have especially negative attitudes for the ST, and many users have difficulties using it or do not even use it. The ST has developed much in past two years, but people still have the same opinions they

formed a long time ago based on the early versions of the ST. Shifting these opinions by promoting and educating could be a good starting point. An open culture for knowledge sharing should be established. SD agents should be reminded that the cases are not solved before a solution instructions concerning the problem can be found in the KB (Figure 15). Also the division of the data put to ST or SIP should be made clear. This can in any case be very challenging, because it is hard to change processes, practices and habits that have been in use for a long time and people are used to. In any case the users are already somewhat familiar with these tools, so educating should be easier, than with a completely new tool.

Based on the user survey people the documents saved in the ST are of poor quality, the folder structure of SIP is unclear, and the documents found in the systems are not properly titled. These problems can be overcome by reorganizing the documents and by defining better templates for the documents and for folder structures. One should note that in some cases so called "*re roll-out*"; taking all documents out of the system, recreating them and then saving them back to the system with right folder structure can be the most effective way. A good template for instruction document structure can be found in KCS documentation (George, et al, 2006).

The pros and cons of proceeding with the current systems are shown in table 3. In the benchmark part current versions of SIP and OMT ST are compared against the requirements to get clear view of how they perform compared to other solutions.

Table 3. SWOT analysis of proceeding with current systems

	+	-
Internal	**Strengths** • Minor costs • No production breaks • No need to transport data from system to system • Tools already customized and proved to work • People are already somewhat familiar with the tools	**Weaknesses** • Strong opinions hard to change • Hard to change practices that has been in use for a long time • Two substitute system remain • Discovered limitations and problems not removed

External	**Opportunities** • No dependency on an external provider	**Threats**

7.4.2 Modification of Existing Tool

Two substitute KB tools are used in the case organisation currently; SIP and ST. If it is decided, that the case organisation will proceed with modifications to the current system(s), one of these systems should be picked up and the other system combined to it. The new solution should be taken into a more social media like direction. This means that it should enable more interaction and communication between the users. This can be done by adding possibility to comment and rank the documents added by other users. The SD agents should also have more possibilities to customize the system to better suit them; possibility to add documents to favourites or customise the starting page. The new solution could also adopt characters of the mash-up systems; it should combine data from multiple sources, for example from MS Technet and Google search.

Both of the currently used systems have their own reasons, why the particular system. ST is built on BMC Remedy platform that is a way more closed platform than MOSS, which makes it harder to customise than the SIP. Because ST is tightly integrated with the OMT, the KB articles are tied with the incident, problem and change management processes, which enables vertical information sharing and ensures that the articles are created by the persons, who have the highest knowledge of the particular issue. The integration with the OMT also enables fast searches, which can be automatically done, for example based on the text in the ticket description. It also enables resolution copying from a KB item by one click of a button, and allows one to link tickets to the corresponding KB items. The best thing in choosing ST, is its integration with the ITSM tool and with the work processes. If the ST is chosen to be the platform for the new solution, the SIP functionalities should be integrated into it. This can also be done by adding a connection to SIP, that enables users to explore and use SIP documents through the ST user interface.

Although most of the properties introduced above cannot be built into the SIP it still stands as a possible building platform, because of its flexibility. SIP is built on the MOSS, which means that many of the social media functions can be easily added to it. The MOSS also enables easy integration with the Intranet. For example user profiles and other data can be automatically imported to the SIP. Also multiple ready build modules and "building blocks" can be found on the Internet, even for free. The strongest reason for not choosing the SIP, is the lack of connection with the OMT. Building these connections can be very challenging and time consuming.

One should note that, although a new system is established, the actions introduced in chapter 7.3.1. should be carried out.

Depending on the amount of modifications, modificating existing tool(s) can be cost effective. However, if there is already a tool with all the required properties, purchasing it can be a cheaper alternative compared to customisation. One of the biggest benefits of making modifications to existing tools is, that all the properties found good can be preserved. Current processes also support the use of current tools, thus no big changes, but rather some refinements to processes are needed. SWOT of making modifications to currently used tools is presented in Table 4.

Table 4. SWOT of modifications to the currently used tools

	+	-
Internal	**Strengths** • People are already familiar with the currently used tools • Cost effective (depending on the amount of modifications) • No useful features lost • Compatibility with processes guaranteed • No need for transform or transport documents	**Weaknesses** • Can be very expensive and time consuming (depending on the amount of customization) • Changing people's attitudes can be difficult
External	**Opportunities** • No dependency of external provider • Possibility to market the developed system?	**Threats** • Wheel re-invention - someone may have already developed the same system

7.4.3 A New Tool

A new tool can be purchased *out of the box*, it can be built on a ready platform by using commercial or open source building blocks, or it can be completely made in house from a scratch. A new tool can be of form any of the KB solutions introduced in chapters 5.2 and 5.3. If a new solution is purchased for the case organisation, the SD agents are once again introduced to a new tool, and this may cause great resistance to change. The problem can however be eased by using the methods mentioned in chapter 7.3.1.

The best aspect of introducing a new tool is, that all the discovered requirements can be met. When the tool is functional and the processes are well defined, the outcome can be better, than in any scenarios introduced above. It may also be easier to affect on people's opinions and behaviour when a tool, that is really new and better, than the earlier tools, is introduced.

The fastest way to obtain a new KB tool is probably to buy a ready built solution from the market. The system should meet the requirements as well as possible and it should requires only a few modifications to deploy. Multiple commercial KB solutions for corporate exist at the markets. They differ in operational logic, platform, and in functionalities. Selection of the platform affects highly on, how the system can be integrated in the Intranet or other tools.

Building a system on a readymade platform gives the organisation more options for customisation. After choosing a suitable platform, the system can built by using ready modules. These modules are often already used by other companies and proved to work. The company can then customise these modules and combine the best properties of them. Also products of different suppliers can be combined. For example a company can use MOSS as the platform, a ready template named *Bamboo* for the knowledge management, and *Google Search Appliance* or *MS Fast* for search purposes.

Building a new solution from a scratch by the company itself is a hard option, but it enables the highest level of customisation. This ensures, that the system complies fully with the case organisations requirements and with the other tools used in the organisation. Building a system by company itself consumes much time and resources, and the company may also lack of the sufficient knowledge.

In that case the company can acquire the essential knowledge from outside. Company should also avoid re-inventing the wheel when building a new system.

In the benchmarking multiple tools of all these three categories were examined.

Table 5. SWOT of obtaining a new tool

	+	-
Internal	**Strengths** • The discovered technical problems can be overcome and the requirements met • Easier to change opinions when something really new is introduced • Ready solution; No need for heavy customization and time consuming coding work • Compliant with the best practices • Possibility to combine SIP and ST functionalities (in some cases)	**Weasnesses** • Resistance to change; people are once again introduced a new tool • Costs? • Need for change processes • The actions mentioned in 7.4.1. needs still to be carried out • Compatibility issues • The development is not anymore in the case organizations hands • The possibilities to modify the solution to suit better for the case organisations demands can be very limited • Drawbacks; there can always occur issues that could not be taken into account beforehand
External	**Opportunities** • The organisation gets access to the providers knowledge • Avoid the *wheel re-invention* • Solutions proved to function in many case organisations	**Threats** • Dependency of the external provider • If bought with SAAS model the safety issues must be managed

7.5 Proposed Actions for the SDFSF

Knowledge management is a very broad and difficult concept. The closed and tightly controlled centralized knowledge management model is more or less history, and a more open and interactive knowledge management is gaining

popularity. In chapter 3.3. Huysman's classification to first and second wave knowledge management was introduced. Currently the case organisations KM is at the first wave. Knowledge is more human capital than social capital and it is shared more in operational level than organisational wide. Current systems and KM initiatives focuses highly on codified knowledge. This knowledge represents only 20% of all knowledge and thus the KM should focus on both; the explicit and tacit knowledge. This thesis focused on the knowledgebase and thus the tacit part of knowledge is mostly ignored.

In the open KM model of second wave, every user of the KB is a simultaneously a content producer. The same kind of development can be seen in websites; web 2.0 concept has opened up websites and for example in the Wikipedia every registered user is also a content producer. Adopting this kind of a process model for corporate use introduces many opportunities and challenges. Unfortunately the ITIL gives very few instructions for KM. Thus, the *Knowledge Centred Support* (KCS) should be taken into the company as a complementary best practice library to the ITIL. It is a ready framework that gives an approach for KM and introduces best practices that are already proven to work in many organisations..

KCS has four basic concepts (KCS, 2010):

1. Create content as a by-product of solving problems
2. Evolve content based on demand and usage
3. Develop a knowledge base of your collective experience to date
4. Reward learning, collaboration, sharing, and improving

In the benchmarking a variety of KM tools developed by external providers were examined. Based on the literature it is obvious that the KB must be integrated to the problem solving workflow so, that the usage it is a natural part of daily work. The integration with ITSM tool is essential, because it enables the SD agents to work with the KB without leaving the ITSM tool and the IM and PM processes. A few solutions examined in the benchmarking section met almost all the defined requirements, but in the end neither of these tools would work better than the existing tools, because cannot be integrated with the ITSM system. This basically rules out the scenario of obtaining a new tool from the market.

We have two possible scenarios left; making no changes to the existing tools, and modification of the existing tool. The proposed action is some sort of a combination of these two scenarios. The main idea of the new tool (Figure 29) is that it is tightly integrated to the ITSM system, and thus ST should be selected as a base. The integration with the ITSM tool has the following advantages:

- Users do not have to leave the incident process or ITSM tool in order to use KB, and thus KB is better integrated with the processes.
- Keywords and classification data from the ITSM system can be used as search strings for the KB. This also enables the search to be fully automatic. For example different pattern recognition techniques can be used for matching the KB articles against free text ticket data.
- A solution from the KB article can be copied to the ticket by one click of a button.
- A ticket can be linked to a KB article. This enables the SD agents to take a look at what kind of problems have been solved with the particular article, and also the data stored in the archived tickets can be exploited later.

Collaboration and knowledge sharing is an important part of knowledge management. Currently used tools usually do not have functionalities needed to support these activities. By adding interactivity to the system, by using components, that are already used in social media and web 2.0 applications the company can support collaboration and knowledge sharing. The following advantages are gained by adding interactivity:

- The information will be transferred and shared in the vertical direction between the KB authors and the users. It will also boost the horizontal knowledge sharing between adjacent SDs. The openness will allow different teams to work with the same article, and thus support collaboration. This also allows the problem managers to ask a group of specialists to work with a single issue, although they are located at different SDs.
- The KCS will decentralise the responsibility of the knowledge management among all KB users. The functionalities like article commenting, rating and free editing will ensure that the knowledge is accurate and up to date. This will also ensure that the knowledge will be acquired more efficiently.

- Users will be rewarded for knowledge sharing for example by establishing top lists. Also positive comments and ratings will be one part of the rewarding.

Based on the survey, SD agents are searching for knowledge in many different tools and knowledge sources. For removing the need for multiple tools these information sources should be integrated to the new tool. This will have the following advantages:

- All needed knowledge is available in one tool, and the SD agents do not have to deal with multiple different user interfaces.
- This allows also the integration of the SIP to the ST. The administration of SIP articles can still be made via SIP interface.
- A big hype is related to the cloud computing today. This solution is in some sense exploiting it.

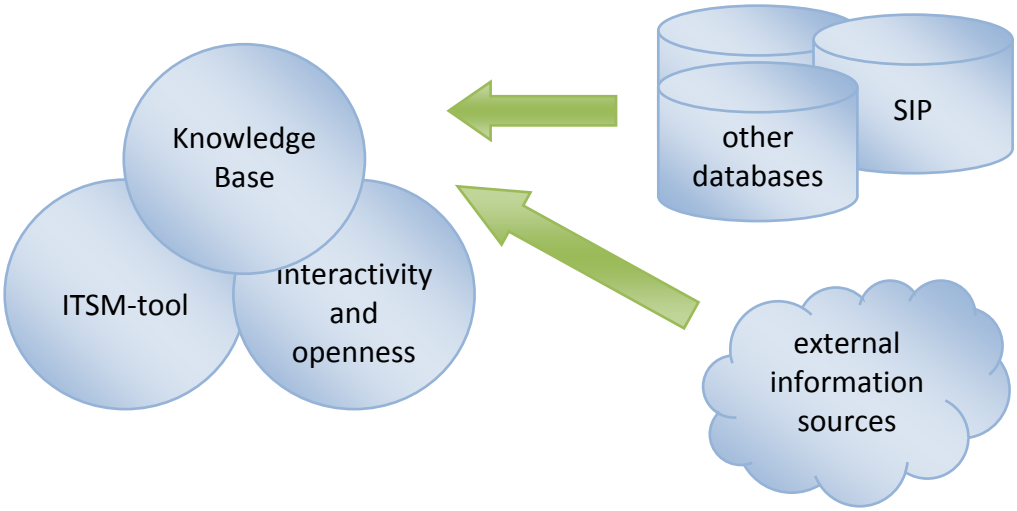

Figure 29. The idea of the new KB tool

The benefits mentioned above will have a high impact on the SD service quality. Because the SD agents are able to find instructions to the problems, the service will be more expert, the solution times will be smaller and also a higher rate of incidents can be solved at the first level. Well functioning KB will also affect on the other quality meters mentioned in chapter 4.4.

There is also many challenges faced when the new KB tool is built. These challenges are:

- It is difficult to predict the costs of the program development. These costs can also be too high for the organisation.
- Development of the new system takes much more time than taking one out of the box. The new functionalities can be slowly added to the current tool, and hence take advantage of them immediately.
- The article quality can drop, because of the openness. This can be managed by appointing persons that are responsible for specific article areas. KCS also advices, that the KB articles do not have to be the best quality, they just have to be good and accurate enough.(George, et al, 2006; KCS, 2010)
- The technical challenges cannot be overcome. The new tool is technically challenging and the organisation should consider if it is necessary to involve an external provider or partner into the development process. The management of the external partners can also be challenging.
- Innovativeness is an important part of software development. If the persons who have developed the current systems, are also responsible for the new solution, there is a risk that the new solution it is too similar to the existing systems, and thus the discovered pitfalls are not fully removed.
- The new tool is dependent on external information sources. The accuracy and reliability of these sources must be examined and managed.

Chapter 2.4. addressed future trends for SDs. Based on the literature the main issues are: cost savings, quality improvements and automated services. The cost savings are gained by exploiting better the available knowledge, automating the services or by off shoring SDs. By better knowledge re-use and better knowledge availability the SD can solve incidents faster, and more issues can be handled at the cheaper first level. Machines cannot solve problems, at least not yet, and that is why automated services always need some kind of knowledge base as an information source. If the SD is already using some KB it can be connected to the automated self services and thus the service users will have more solutions, that are up to date, available through the system. This will save costs and at the same time improve the quality of the service. The third way for cutting costs is to off shore the SD to a country where labour is cheaper. This underscores the importance of good guidance and the importance of a well functioning knowledge base even further. In such SD, there may be dozens of customers served and no

one can handle all problems without instructions. The second level support may be located at the different country with a significant difference in time. Because of that, the first level support must solve the cases by using the knowledge base. If they are unable to solve a case, it may take from eight to 16 hours before the second level support will start solving the same case.

8 DISCUSSIONS

Prusak (1997) stated, that despite the KM has been under study since second World War we still do not have thorough and robust models and approaches to make our knowledge bases more effective and efficient. Based on the study made in this thesis this still holds true. The work discovered that many firms have truckled with KM and KB issues. The market is full of solutions for KB and KM, but still nothing new, revolutionary and suitable for the case organisation was found during the study.

During the thesis work the existing theory, that the technical tool is just one part of successful KM was proved. Establishing a well functioning KB is as much, or even more, depending on organisational and people issues than on technology. The companies must also agree that only a small part of knowledge can be saved to KBs, and managed through technical tools. The study defined the state of currently used KB tools, and based on the study, it can be seen that the group developing these tools, had very different views of the tools than the SD agents using the tool. There is much work to be done with the currently used tools and with the organisational and people issues. This study brought those issues to daylight and provides essential background information for solving those issues.

One of the objectives of this thesis was to suggest a development scenario for the future. The study managed to define the requirements to the KB, and based on that defined three possible future scenarios. The final proposition was a combination on two scenarios; make no changes to currently used tools and make changes to currently used tools. Many reasons for choosing this particular proposition were given and also the challenges where discussed.

The last part of the objectives dealt with quality. The quality was explored in detail and some definitions and the most important meters used in SD organisations were introduced. The study discovered that successful KB and KM have a high impact on these meters.

During the thesis research process many discussions with SD agents, team leaders and people developing the tools and processes were had. Almost 50 people took part in the user survey, and before the benchmarking a deep search for solution candidates was conducted. The researcher also visited Helsinki ICT fares and

contacted different software providers for finding new candidates and necessary information. This proves that the research has been broadminded, and it has taken into account the viewpoints of all parties, and also their opinions and needs have been considered.

Future readings

The following publications are recommended for reading to people who will continue to work with the KB or KM process development.

As an additional best practice library to ITIL KM, the company should consider adopting Knowledge Centred Support model ver. 4 (KCS). A comprehensive documentation of KCS can be found in the Internet. (KCS, 2010)

The usability issues are gaining more and more attention. The next version of knowledge tool must be much more user friendly and it must suit the user needs much better than the current solutions do. For ensuring, that the future software scores better in usability, a human centred design process should be adopted. There exists a standard, ISO 13407 Human centred design processes for interactive systems, for implementing this processes that should be adopted into the development process. (Suomen standardoimisliitto (SFS), 2010)

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ATTACHMENTS

Attachment 1: Customer Satisfaction Survey (CSS)

IM[redacted]

Customer Feedback

Your feedback is very important for us to be able improve our support.
Please let Us know what You think about the quality of Our service.

Total score for Your service in this case

Very good	Good	Poor	Very poor
4	3	2	1

Free Comments

SEND

Attachment 2: BMC Remedy Knowledge Management features

Searching

- Support for Over 200 Unstructured Data Formats
- Support for Database Sources
- Natural Language Processing
- Multiple Source Searching
- Integrated Hit List
- Relevancy Ranking
- Boolean Searches
- Approximate Searching (Fuzzy Searching)
- Fuzzy Boolean Searches
- Phrase Searching
- Intuitive Searching
- Wildcard Searching
- Proximity Searching
- Customizable Thesaurus Function
- Search Refinement
- Adaptive Learning (Usage Metrics)
- Term Weighting

Integration

- Developed on BMC Remedy AR System
- Authoring Integration
- Searching Integration
- Ticket Completion
- Notifications
- BMC Remedy Web Interface – Mid-Tier
- Self-Service Integration
- Email Integration

Scalability

- Enterprise
- Central Server
- Distributed Servers
- Authoring
- Searching

Reporting

- Reports Inside Remedy
- Canned Reports
- Flexible Report Creation
- Integration with Third- Party Reporting Tools

Architecture

- BMC Remedy Application
- HTML XML
- Windows
- UNIX
- Browser Support

Customer Access

- Dynamic Frequently Asked Questions
- News Flashes
- Watch Lists
- Table of Contents Browsing
- Natural Language Processing
- Customer Web Surveys
- Research Session Audit Trails
- Email

Authoring

- Best Practice Templates
- Rich Text Authoring
- Local Attachments
- Global Attachments
- MS Word/ HTML Compatible Editor
- Spell Checking
- Authoring Process Workflow
- Dynamic Indexing
- Notifications
- Promote or Demote Options
- Online Authoring Process Report
- Document History
- Comment Fields
- Version Control

Security

- Utilizes Existing BMC Remedy Security Groups
- Utilizes Existing Web Security Models
- Knowledge Base Security
- Document Security
- Sub-document Security

Administration

- Leverages Remedy Admin Tools
- Admin Reports
- Easy Configurable Changes
- News Flashes
- Automated Routines
- Architecture

Attachment 3: Questionnaire form

Perustiedot

Organisaatio

SD FSF

Ikä

1. Kuinka usein käytät seuraavia Tiedon sisäisiä työkaluja tiedon hakuun?

5 = yli 10 kertaa päivässä
4 = päivittäin
3 = noin kerran viikossa
2 = noin kerran kuussa
1 = en koskaan

	1	2	3	4	5
1. OMT Solution Tool					
2. OMT vanhat tiketit					
3. SIP					
4. intra					
5. teamer					
6. ryhmän oma keskustelufoorumi					
7. ryhmän oma verkkolevy					
8. omat muistiinpanot					
9. arkistoidut sähköpostit					
10. muu / muut					

Mikä / mitkä?

Jos vastasit kohtaan 1.4 kaksi (2) tai suuremman, vastaa seuraavaan kenttään.

	1	2	3	4	5
1. knowledge sharing / blogit	☐	☐	☐	☐	☐
2. knowledge sharing / wikit	☐	☐	☐	☐	☐
3. henkilöhaku	☐	☐	☐	☐	☐
4. muu osio/ muut osiot	☐	☐	☐	☐	☐

Mikä / mitkä? [ ]

2. Kuinka usein käytät seuraavia ulkoisia tietolähteitä työssäsi?

5 = yli 10 kertaa päivässä

4 = päivittäin

3 = noin kerran viikossa

2 = noin kerran kuussa

1 = en koskaan

	1	2	3	4	5
1. hakupalvelut (esim. google)	☐	☐	☐	☐	☐
2. videosivustot (esim. youtube)	☐	☐	☐	☐	☐
3. sosiaaliset mediat (esim. facebook)	☐	☐	☐	☐	☐
4. keskustelupalstat	☐	☐	☐	☐	☐
5. blogit	☐	☐	☐	☐	☐
6. encyclopediat (esim. wikipedia)	☐	☐	☐	☐	☐
7. toimittajien tietokannat (esim. Microsoft)	☐	☐	☐	☐	☐
8. muu / muut	☐	☐	☐	☐	☐

Mikä / mitkä? [ ]

3. Miten hyvin seuraavat väittämät mielestäsi kuvaavat OMT Solution Toolia

5 = täysin samaa mieltä

4 = osittain samaa mieltä

3 = en osaa sanoa

2 = osittain eri mieltä

1 = täysin eri mieltä

	1	2	3	4	5
1. Löydän helposti etsimäni tiedon					
2. Ohjeet ovat selkeitä ja ymmärrettäviä					
3. Ohjeet ovat ajan tasalla					
4. Ohjeita on riittävästi					
5. Ohjeita on liikaa					
6. Työkalu on helppokäyttöinen					
7. Työkalu on käytännöllinen					

parannusehdotuksia / ominaisuuksia, joita toivoisin:

4. Miten hyvin seuraavat väittämät mielestäsi kuvaavat SIP:a (Service Instruction Portal)

5 = täysin samaa mieltä

4 = osittain samaa mieltä

3 = en osaa sanoa

2 = osittain eri mieltä

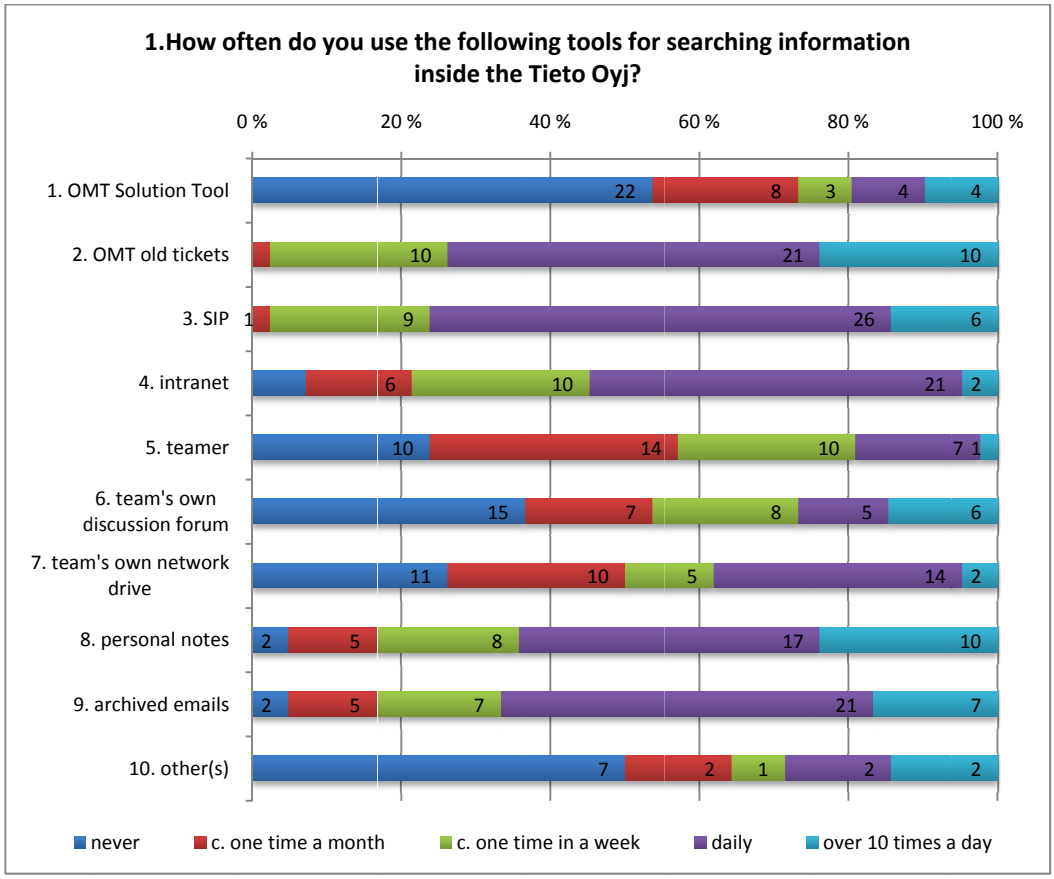
1 = täysin eri mieltä

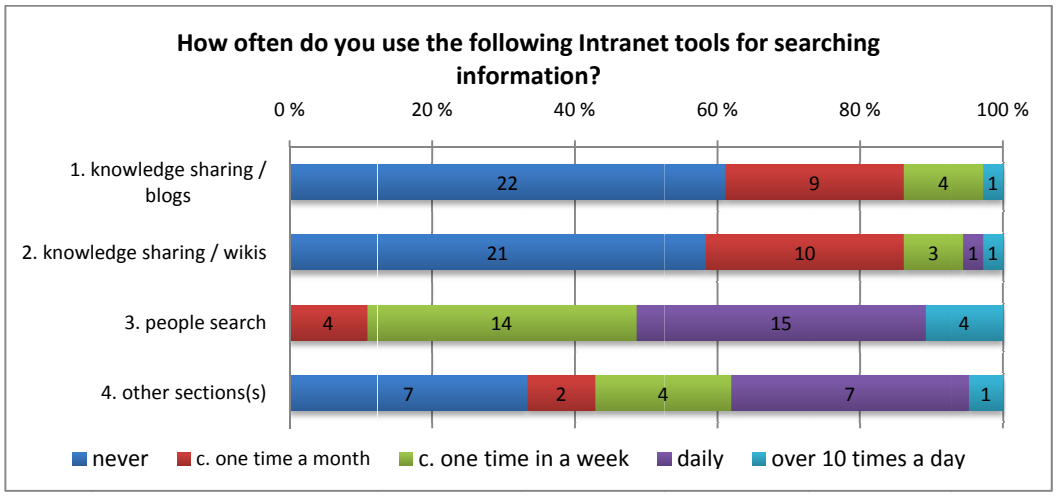
	1	2	3	4	5
1. Löydän helposti etsimäni tiedon					
2. Ohjeet ovat selkeitä ja ymmärrettäviä					
3. Ohjeet ovat ajan tasalla					
4. Ohjeita on riittävästi					
5. Ohjeita on liikaa					
6. Työkalu on helppokäyttöinen					
7. Työkalu on käytännöllinen					

parannusehdotuksia / ominaisuuksia, joita toivoisin:

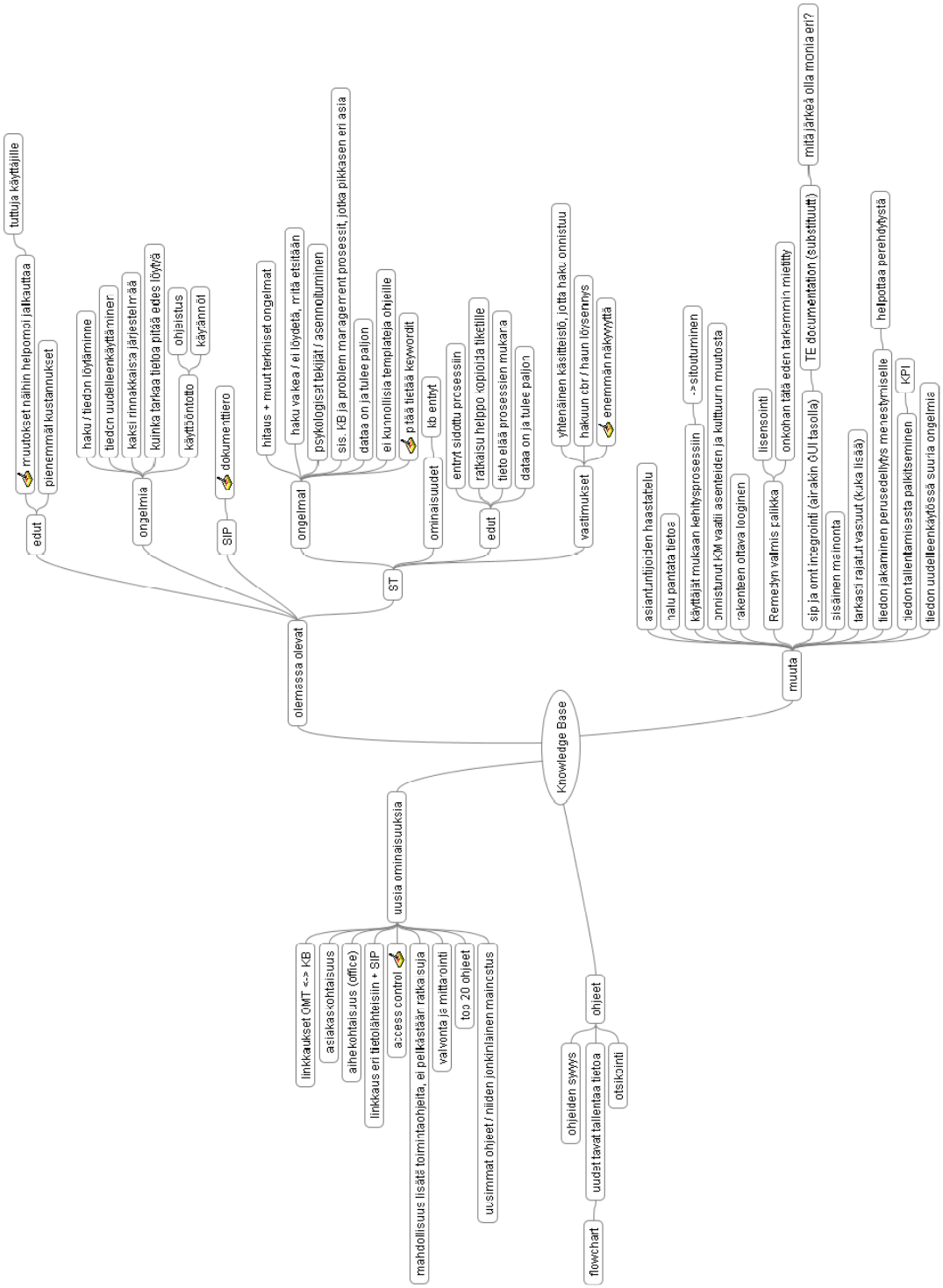
Tallenna vastaus

Attachment 4: Questionnaire results





Attachment 5: Focus Group Mind Map



Attachment 6: Knowledge Base requirements

Criticality: 1 = low 2 = medium 3 = high 4 = critical	Class C = Compulsory N = "*Nice to have*"

Culture / practice issues

Demand / problem	More specific description / solution	Criticality	Class
Open Culture	The solution must support an open knowledge sharing culture that motivates people to share, save and reuse knowledge.	4	C
Combined tools	It should be possible to integrate the functionalities of SIP and OMT to one tool. This removes e.g. confusion of which of the tools is used.	3	
Drives for publishing own notes	Adding a new article must be so easy that people continuously creates new articles and do not use their own notes any more.	4	
Reward for knowledge sharing	There must be a possibility to reward users for knowledge sharing. This does not mean just money (e.g. some kind of top KB user lists).	2	
Unified heading practices	Documents must be titled clearly and uniformly so that it is easy to know what the article is about based on the title.	4	
Roll out	The roll out must be successful so that users know when the new system is taken into use and required training for the system must be organized. The system must also be carefully tested to avoid the arising of the negative opinions.	4	C
Management support	The new solution must have leaders support behind.	4	C
User's	Users should be involved in the	3	

involvement in the planning	planning and implementation process. This ensures that the new solution suits their purposes and they commit to the use of the tool.		

Functionalities

ITIL support	The solution must be ITIL compliant.	4	C
Documents tied to processes	Documents must be tied to IM, PM and CM processes so that the instructions are updated and added according to the process progression.	3	
Connections with OMT and SIP	The new solution must be connected with the OMT and SIP so that it can take an advantage of the information that is already in these systems.	3	
Connections to information sources	KB should allow connections to other databases and be able to exploit them (e.g. Google search).	3	
Sophisticated access control	Possibility to restrict user access to the documents and possibility to define specific roles for the users.	4	C
Data Security	It is essential that the system is not vulnerable to intrusions and no information is leaked outside the system.	4	C
Multiuser support	The system must support multiple simultaneous users.	4	C
Customer-specific instructions	There should be possibility to add customer specific instructions	4	C
Topic-specific instructions	There should be possibility to add instructions concerning on a particular topic (e.g. instructions related to MS office)	3	
Possibility to add directives, not just solutions	Much of important knowledge discovered in daily operations is lost, because the current solutions support just formal instructions.	3	
Administration and meters	Possibility to control and meter the usage of the tool. E.g. how many articles a person has used / added / updated	2	
Effective search	Free text search must be effective and easy to use. This can be implemented	4	C

	by using modern search algorithms.		
Most popular key words	The search automatically completes the search key words based on the most popular search strings.	2	N
Templates	There must be good templates for the folder structures and for the article structures.	4	C
Mark document for review / propose corrections	Users can mark documents that they find outdated or erroneous to be reviewed. Users can also propose corrections to existing documents.	3	N
Document edit	Users can freely edit documents, but the document owner / creator are informed of the changes.	2	N
Document ranking	Users can rank documents with e.g. thumb up/thumb down method. There can also be a list of the best documents (this can be a part of rewarding)	2	N
Document commenting	Users can comment documents (cf. blogs).	1	N
Expiration date	Documents must have some kind of best before date. After that date the documents must be reviewed.	4	
Add favorites	Users can add articles to favorites (cf. web browsers)	1	N
Copying a resolution	The user should be able to copy the resolution from a solution document to the ticket that s/he is working with.	3	
Latest documents and promotion	Some kind of a list of the newly added documents and possibility to promote those documents.	2	N
Top lists	Possibility to have e.g. Top 20 list of the mostly used / liked instructions or documents.	2	N

User Interface

Learnability	The system should be so easy to learn that the user can rapidly start getting some work done with the system.	3	
Efficiency	After learning the system a high productivity should be enabled.	3	C
Memorability	The system should be so easy to remember, that the users are able to return to the system after some period	3	

	without need to relearn all over again.		
Errors	The system should have a low error rate and the users should be able to recover from errors easily.	3	
Satisfaction	The system should be so pleasant to use so that users like it.	3	C
Appearance	The system must look modern and pleasant	2	
Single sign on	Possibility to get login credentials from external source e.g. AD or other source. If the knowledge tool is integrated to another tool no login should be required.	3	C

Costs

Software costs	Preferring single purchase and no user based fee.		
Hardware costs	Not taken into account in this thesis.		
Maintenance / support costs	Work amount for maintenance purposes must be considered. Is there need for dedicated maintenance role?		
Roll out / Education costs	Not taken into account in this thesis. The easier the product is to learn and to roll out the lower these costs are.		

Attachment 7: KnowledgeBase Manager Pro

KnowledgeBase Manager Pro is a very simple solution for KB. It meets almost all the case organization requirements, but the user interface still looks very simple. The biggest problem with the KnowledgeBase Manager Pro is that it does not support integration with MOSS or with any external tools used by the case organization. This means that if this solution is implemented it will automatically be stand alone tool. The tool is shown in Figures 7.1 and 7.2. (Website Scripts, 2010)

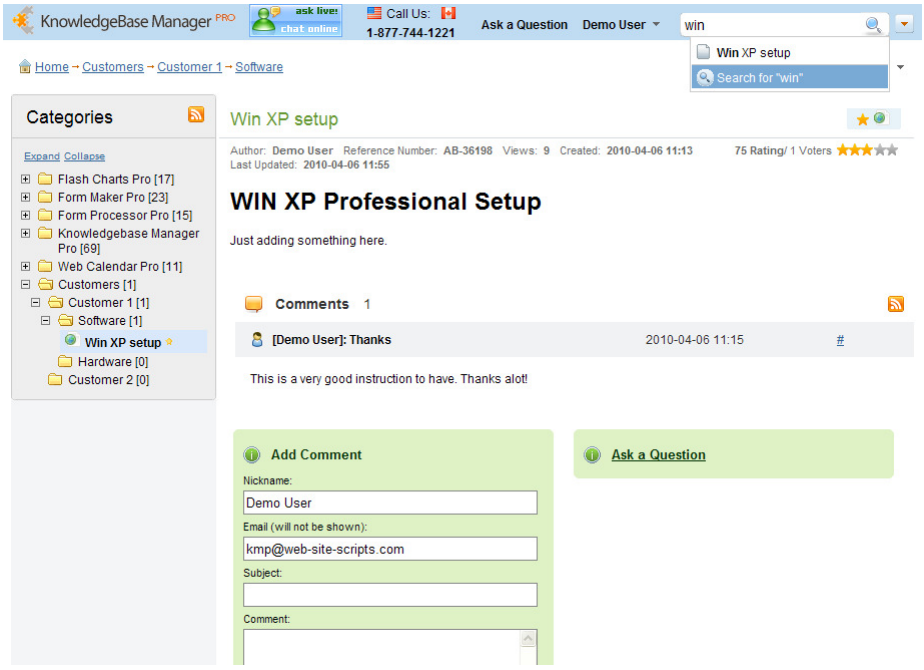


Figure 7.1. A screenshot of KBMP document frontend interface

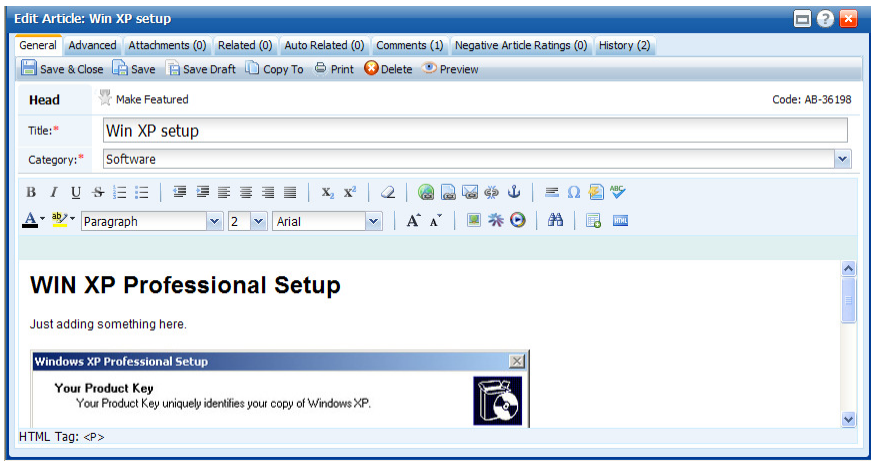


Figure 7.2. A screenshot of KBMP document edit window

Attachment 8: Confluence

Confluence is a wiki based collaboration platform for organizations and enterprises, which can be integrated with MS SharePoint and MS Office tools. One key ideas of confluence is to take KM for everyone. Anyone with proper permissions can easily contribute formatted text, insert images, attach documents and embed multimedia content. It can be modified and extended by using over 200 existing plug-ins. Confluence is very broad social media and KM platforms. It allows users to write blogs, comment and rank documents, host own sites, update own status etc. Many of these functionalities are already included in Tieto Oyj's Intranet, thus there are many functionalities that are not needed by the case organization.

Confluence allows one to build a powerful, navigable store for your knowledge, through page hierarchy, labels and links. It also includes a search that instantaneously shows results below the search form (Figure 8.1). Confluence also includes a customizable dashboard page where the users can see recently updated documents, favourite pages and other information related to the KB. Confluence has received many awards and it has over 8100 customers in 94 countries. (Atlassian Pty Ltd, 2010)

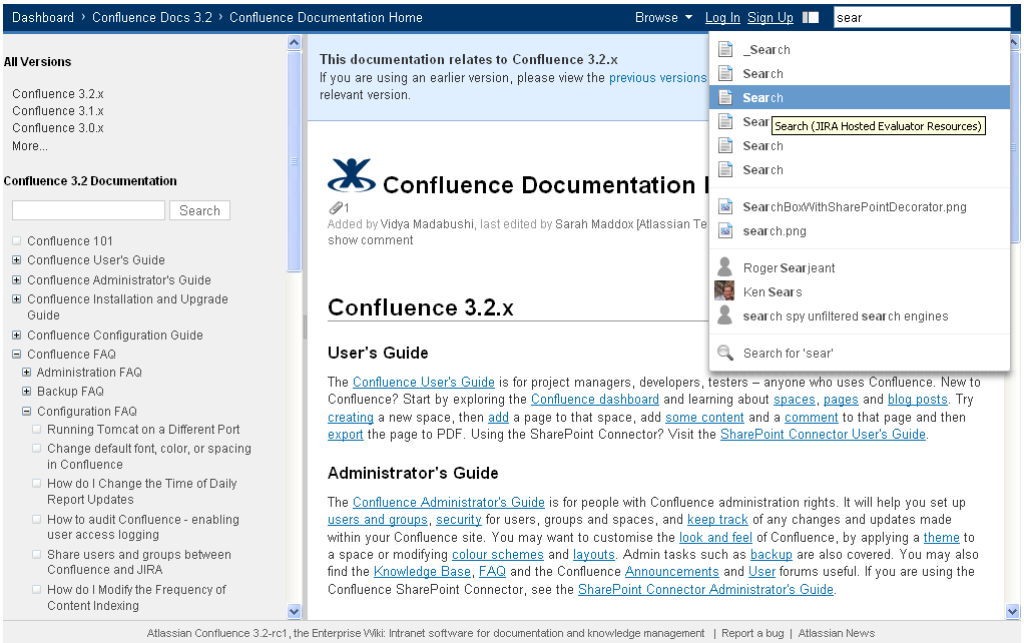


Figure 8.1. Confluence Knowledge Base

Attachment 9: Benchmarking

	Current tools		Wiki			Disscussion Forum			Commercial standalone KM tool					Integrated tool	Home made customized tool		
	SIP	OMT ST	Protege	Social text	Confluence	MOSS	PHPBB	Simple Machine Forum	manager pro	Knowledge base	Youncycle	Zylab	Lotus Notes / IBM quikr	Bamboo (MOSS)	Management Module BMC Remedy Knowledge	Mach Up	OMT ST based tool	SIP Based Tool
Obligatory demand																		
Open Culture	?	?	x	x	x	x	x	x	x	x	x	x	-	x	x	x	x
Successfull Roll out	x	-	x	x	x	x	x	x	x	?	x	x	x	x	x	?	?
Management support	?	?	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
ITIL support	x	x	-	?	x	?	?	?	x	-	x	?	x	x	x	x	x
Sophisticated access control	x	x	?	?	x	x	x	x	x	x	?	x	x	x	x	x	x
Data Security	x	x	x	?	x	x	x	x	x	x	x	x	x	x	x	x	x
Multiuser support	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Customer-specific instructions	x	x	-	?	x	x	x	x	x	?	?	?	x	?	x	x	x
Effective search	-	-	x	?	x	?	?	?	x	?	x	?	?	x	x	x	x
Templates (document)	x	-	?	?	x	-	-	?	x	x	?	?	?	x	x	x	x
Efficiency	-	-	-	?	x	-	-	-	x	?	?	?	?	x	x	x	x
Satisfaction	x	-	-	x	x	x	x	x	x	?	x	?	?	x	x	x	x
Single sign on	x	x	x	?	x	x	x	x	x	?	x	?	?	x	x	x	x
PASS	NO	NO	NO	NO	OK	NO	NO	NO	OK	NO	NO	NO	NO	OK	OK	OK	OK
Requirements																	
Combined tools	-	-			?				?					?	?	?	?
Drives for publishing own notes	-	-			x				x					x	x	x	x
Rewards for knowledge sharing	-	-			x				x					-	x	x	x
Unified heading practices	x	-			x				x					x	x	x	x
User's involvement in the planning	-	-			x				x					-	x	x	x
Documents tied to processes	-	x			-				-					x	x	x	-
Connections with OMT and SIP	-	-			x				x					x	x	x	x
Connections to other information sources	-	-			x				x					?	x	x	x
Topic-specific instructions	x	x			x				x					?	x	x	x
Possibility to add directives, not just solutions	x	x			x				x					?	x	x	x
Administration and meters	?	?			x				x					x	x	x	x
Expiration date	x	x			?				x					x	x	x	x
Copying a resolution	-	x			-				x					x	x	x	-
Learnability	x	x			x				x					x	x	x	x
Memorability	x	x			x				x					x	x	x	x
Errors	x	x			x				x					x	x	x	x
Appearance	x	-			x				x					x	x	-	x
SECTION POINTS	25	25	0	0	38	0	0	0	45	0	0	0	0	34	48	46	42
***"Nice to have"* requirements**																	
Most popular key words search	-	-			x				x					?	x	x	x
Mark document for review / propose corrections	?	-			x				x					x	x	x	x
Document edit	x	-			x				?					-	x	x	x
Document ranking	-	-			?				x					-	x	x	x
Document commenting	-	-			x				x					-	x	x	x
Add favorites	x	-			x				x					x	x	x	x
Latest documents and promotion	-	-			x				x					x	x	x	x
Top lists	-	-			?				x					-	x	x	x
SECTION POINTS	3	0	0	0	11	0	0	0	13	0	0	0	0	6	15	15	15