Creating Knowledge Landscapes

A Service Oriented Approach to the Implementation of Knowledge Management in the Aviation Industry

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Preface

Knowledge management has undergone several paradigm shifts in the last decades. At first a strong focus was put on the codification of knowledge mostly by means of IT applications. Then new anthropocentric concepts evolved particularly the personalization strategy and socialization strategy which focus on human interaction and social networks. In many cases a reasonable combination of these strategies was neglected in the past, thus impairing the effectiveness of knowledge management. In addition, a common agreement on scientific terminology and technical vocabulary with regard to knowledge management still needs to be developed. Implementation failures due to a false understanding of knowledge management and exaggerated expectations have led to disillusionment in some cases. As a consequence knowledge management may face acceptance problems. The goal of this work is to provide knowledge managers with arguments in favor of knowledge management and respective systems. Both management and employees of a company need to be convinced of the manifold benefits and added values of knowledge management for a successful implementation. In order to achieve this, the following main theses have been postulated:

1. Service management, and in particular IT service management concepts as found, for instance, in ITIL (Information Technology Infrastructure Library), have the potential to increase the acceptance of knowledge management measures significantly, especially when applied from the beginning of the implementation process.
2. Especially in larger organizations with many different applications and complex processes a so-called knowledge landscape, as has been developed in the first case study of this work, can serve as an orientation guide and help with the directing of knowledge flows and the identification of appropriate tools for specific types of knowledge. A knowledge landscape provides orientation and, thus, helps to improve acceptance of knowledge management tools.

The theses are proved in two case studies, both in the aviation industry. First, however, general concepts are explained. In chapter two the terminology is defined. Data, information and knowledge are defined according to a business studies approach and according to the information science approach. A distinction is made between individual and collective knowledge and between explicit and implict knowledge. Further dimensions of knowledge are introduced such as criticality or confidentiality, for example. Chapter three is about different concepts, methods and strategies of knowledge management. A widely renowed concept is that of Probst, Raub and Romhardt who have defined eight building blocks of successful knowledge management (Probst et al. 2006). Nonaka and Takeuchi have developed another concept of a so-called knowledge spirale that explains the generation of knowledge (Nonaka & Takeuchi, 1997). Among the strategies that are introduced there are the aforementioned codification strategy, the personalization strategy, the socialization strategy and process based knowledge management.

Chapter four introduces a number of different knowledge management tools, distinguishing between technical and social tools. Further supporting tools are project management and change management. Besides, the concept of Web 2.0 is explained in detail. The focus in this context is on wikis because the first case study is about the implementation of a wiki as knowledge management tool. (IT) Service management is explained in chapter five. The focus is on ITIL, a collection of best practices. These include concepts such as demand management, access management, event, incident and problem management, change management, first level support and other measures of IT service management which have been applied in the first case study. This case study is about the implementation of knowledge management and of a wiki as the core of the knowledge management IT landscape. From this IT landscape a knowledge landscape has been developed, which is a guideline to determine the handling of knowledge and the appropriate tools for specific types of knowledge. Furthermore, a survey was made with regard to the effects of service measures on the acceptance and the use of the wiki. User statistics are related to measures of IT service management. Thus, it is shown that the application of service management can have a significant positive impact on the acceptance of knowledge management tools. Another case study is about the cooperation of two different airlines. A knowledge manager was established as an interface between the cabin managements of both companies in the context of a service provider contract. The transfer of knowledge and expertise and the building of knowledge networks was considered as a service from one company to the other. In the respective chapter an extension of the knowledge landscape is developed. It deals with knowledge flows between departments and people. In this context a knowledge landscape includes signposts that help to determine how knowledge is transferred or shared. In the end a general guideline is presented how knowledge management can be implemented successfully beginning with an information needs and requirements analysis, continuing with an evaluation of knowledge types and knowledge management tools which then are matched ending with a monitoring of the actions taken. All these actions are preferably accompanied by a knowledge manager as service provider.

I sincerely hope that you will enjoy reading this work and that you may find it useful for the implementation of knowledge management tools and activities in your organization or company.

Sascha Rohmen

Düsseldorf, Germany · April 2019

Nonaka, I. & Takeuchi, H. (1997). *Die Organisation des Wissens: Wie japanische Unternehmen eine brachliegende Ressource nutzbar machen.* Frankfurt New York: Campus Verlag

Probst, G., Raub, S. & Romhardt, K. (2006). *Wissen managen: Wie Unternehmen ihre wertvollste Ressource optimal nutzen.* (5. Auflage). Wiesbaden: Gabler

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1 Introduction

> An investment in knowledge pays the best interest (Benjamin Franklin, 18th century).

The famous library of Alexandria, founded around the third century B.C. was said to include about 490.000 (Johannes Tzetzes, 12th century A.D) scrolls in the middle of the third century B.C. and at least 700.000 scrolls in Ceasar´s time when a fire was said to have destroyed about 700.000 scrolls (Aulus Gellius, 2nd century). 490.000 scrolls are estimated to equal 80.000 to 100.000 modern books. Although these numbers cannot be confirmed for the history of the library is somewhat legendary one conclusion can be drawn: two millennia ago the accumulation of knowledge was already seen as an important matter.
In modern times knowledge has increased enormously. And especially in the past decades large amounts of money have been spent in order to generate, distribute and save knowledge. In order to quantify the increase of knowledge various scientific methods have been developed.

The first attempts to measure the increase of knowledge were made in the 1950´s. According to the calculations of de Solla Price knowledge has been growing exponentially around every 15 years since the 17th century. His calculations were based on the number of publications in scientific journals. According to him there would be an increase of seven percent in new papers per year in any scientific field (1986, 135ff). Nowadays it is supposed that the amount of knowledge is growing at an even faster rate. Especially due to the internet and electronic mass media information is distributed faster, more widespread and more efficiently. According to a study from 2003 the amount of virtual information had grown by 30 per cent per annum from 1999 to 2002. In 2002 alone 5 Exabyte of new information was produced 92% of which were saved on electronic data processing mediums. At the same time the World Wide Web contained roundabout 170 Terabyte of information (Lyman et al., 2003)

The historian Franz Graf-Stuhlhofer doubts that the increase of scientific information can be estimated by the number of publications. He distinguishes between:

- an increase of scientific information

- and the increase of knowledge

thus differentiating information from knowledge. He has developed his own method to calculate the increase of knowledge by taking into consideration the volume of scientific books, the number of renowned scientists and important scientific findings from 1500 to 1900 AD. According to these calculations scientific knowledge had doubled every 100 years (Stuhlhofer: 1983, 6, 169-193).

According to Linde and Stock information and knowledge have become part of the foundations of modern society which they call information society because of the widespread use of communication and information technology on the one hand and knowledge society on the other hand because of a strong emphasis on scientific and technical knowledge making life-long learning essential. As knowledge is usually transferred via information and communication technologies knowledge societies are also information societies at the same time (Linde & Stock, 2011, 81ff).

Whatever the case may be: this shows how important it is to manage knowledge in order to separate relevant knowledge from ballast and to prevent an information overload.

Nowadays knowledge is said to be a fourth production factor in enterprises (Stewart, 1998, 1).
As a precious resource knowledge requires an effective management (Hoff, 2005, 26). Very often IT applications are being used to support the management of knowledge. However the use of IT applications has often proved insufficient (Berg, 2001, 20). A positive cost benefit ratio for knowledge management and respectively a supporting knowledge management system requires a detailed plan and design of the implementation process and all involved persons must be informed in due time.
A major challenge arises from the fact that the complexity of existing knowledge management systems sometimes overburdens employees who are busy enough with their actual workload. The implementation of a new knowledge management system often requires the instruction of the employees in the use of the system. In the beginning errors and hence resulting extra work can become a major impediment for the motivation to use an application. Breaking down knowledge management to singular processes may be a promising approach. Instead of implementing finished complex and cumbersome information systems which are at risk of being rejected by the employees

the focus of knowledge management activities on processes has the advantage that knowledge management systems can be customized according to the needs deriving from work processes. Furthermore an overview of the processes in an organization supports the decision on the degree of knowledge management activities required to create a true added value. This is a fundamental requirement for all activities in an enterprise. As the motivation of the employees to participate in knowledge management activities is essential for their successful implementation change management may play an important role.

The following statement concerning Web 2.0, a collection of web tools that have become important and widely used for knowledge management, shows why concepts for improving acceptance are extremely important:

> Web 2.0 läuft nicht (CIO 10, 2009)

This statement would translate as: „Web 2.0 isn´t working“. It can be found as the headline on the cover of a renowned German magazine for IT strategy in enterprises. The thesis is postulated that blogs and wikis are not fit for business. In an inquiry concerning the satisfaction with the intern IT in enterprises it was found out that e-mail services are by far the most popular and most widely used tools for collaboration in companies. They are followed by document management systems leaving wikis, blogs and RSS Feeds far behind.

56 percent of the interviewed employees said that they either did not know wikis at all or did not know of their existence in their own companies. With blogs and feeds this number mounted up to even 63 percent. 18 percent of the interviewed refused web 2.0-tools in general. (CIO 10, 2009, 18f)

In the very same edition however CIO´s of various enterprises are cited who put emphasis on the value of web 2.0. Rick Meuser, head of the IT compartment at Silgan Plastics for instance says:

> We snuck social networking into our enterprise…it took only a few months for almost half of our business users to embrace the technology for keeping in touch with their teams. Since they discovered the benefits of their own, people were enthusiastic about sharing their success, and those who weren´t using it yet, saw the advantages in daily use all around them (CIO 10, 2009, 46).

Athlene Gieseman, CIO at Stinson Morrison Hecker is of the following opinion:

> Web 2.0 requires that you turn over the experience to the end user. That´s not normal, nor is it comfortable, for IT departments. Even with confidentiality at top of mind, many of our attorneys were excited to use these tools for business (CIO 10, 2009, 47).

She admits that it is necessary to customize the use of applications to the needs of the enterprise and to develop best practices or even to find out first to what extend Web 2.0-applications are suitable for an enterprise. Nevertheless she is convinced that this is easily done with Web 2.0.

The use of Web 2.0 applications is obviously a controversial matter. Whereas some are enthusiastic others conjure a complete failure. It can be said, however, that, since the publication of this article, Web 2.0 has become more popular with companies.

Götz (2002, 5) was wondering in the year 2002 whether knowledge management would be another “fashion trend” or if it would be able to catch on in both theory and practice. Wesoly and Schnalzer illustrate the development of the acceptance of knowledge management since the early 1990´s when the internet boom began and new technologies promised unforeseen possibilities for the management of knowledge. Their illustration is based on Gartner´s theory that technical innovations and concepts follow a so-called hype cycle. In this hype cycle a peak of inflated expectations is followed by disillusionment which then leads to an increasing realism finally reaching a plateau of productivity. Illustration 1.1 shows how Wesoly and Schnalzer use this cycle for the varying acceptance of knowledge management.

They consider the development of the internet and new media as the technological trigger that led to an enormous boom due to great expectations. The end of the dotcom bubble was followed by a phase of disillusionment in the year 2000. In the mid 2000´s the ideas and the understanding of what knowledge management is capable of became clearer.

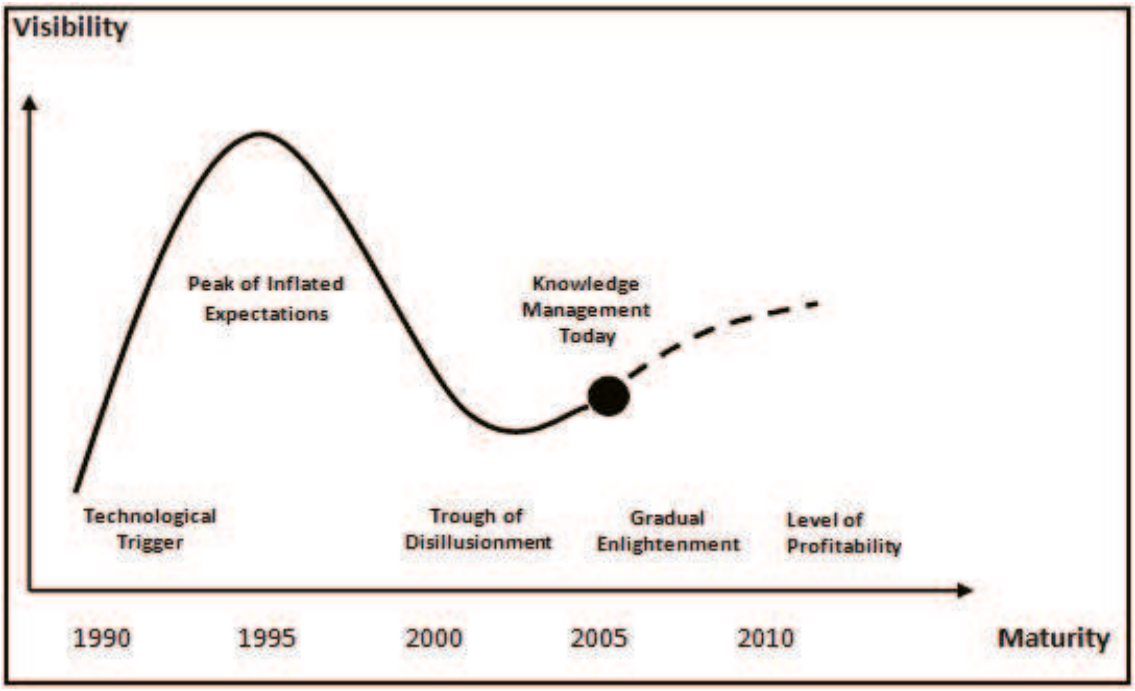


Illustration 1.1: The Hype Cycle of Knowledge Management (source: based on Wesoly & Schnalzer, 2005, 11; Gartner, 2004)

Wesoly and Schnalzer suggest that around the year 2010 the level of profitability might be reached, a condition which, according to Gartner, means that 30% of all enterprises use at least one knowledge management tool (Gartner 2004 in Wesoly and Schnalzer, 2005, 11). However, in 2005, the year the survey was made, knowledge management was still in a phase of disillusionment developing towards a gradual reconnaissance. Only 24% of the participants of the survey considered the use of knowledge in their companies as good or very good. Nevertheless the high number of 540 companies who have joined the study and their readiness to spend more money in knowledge management in the following years lead Wesoly and Schnalzer to the assumption that there was a tendency towards leaving the bottom of the curve.

With the emergence of Web 2.0 technologies knowledge management has experienced a new, yet more realistic hype. Companies have started to implement wikis, blogs and other collaboration tools for internal documentation and the exchange of information. Applications such as Facebook, Twitter or Yammer have become more popular and are being used for sharing knowledge and exchanging experience. Nevertheless knowledge management sometimes still needs advocacy in companies. Frost mentions several failure factors (Frost, 2014, 4ff). First of all a lack of performance indicators and measurable benefits makes it difficult to justify knowledge management towards management and controlling departments. This may result in inadequate management

support. Another failure factor is improper planning, design, coordination and evaluation. This sometimes results from inadequate skills of knowledge managers and/or employees. Organizational failure factors are culture and structure of a company. Technical failure factors result from improper implementations. Relevance, quality and usability are essential for success as will be seen in chapter six. Frost also mentions lack of widespread contribution, an overemphasis on formal learning, systematization, and determinant needs, lack of responsibility and ownership and poor budgeting resulting in excessive costs. All these failure factors must be avoided during the process of implementation.

A case study at the information management department of the financial department of a large airline has helped to develop an approach with regard to convincing both management and employees of the usefulness of knowledge management. Knowledge management activities were connected to business processes and methods of service management were used which proved to be a great help with improving acceptance.

The core of the knowledge management activities was the implementation of a wiki as the storing application for all relevant knowledge of the respective department. Around this core a so-called knowledge landscape was developed in order to determine which one of a variety of applications would be the appropriate one for specific types of knowledge. The intention was to match knowledge with required functionalities. Chapter six will show how this was achieved. Furthermore the working space in the group intranet was redesigned with regard to the needs of both company and employees that had been surveyed against the background of knowledge management. A second case study in the aviation industry has showed that knowledge management can even be a legal requirement. It is about the implementation of a knowledge manager as an interface between two companies that cooperated in order to operate flights with mixed crews from both companies. This case study will be dealt with in chapter seven. First the basics of knowledge management will be explained in chapter two. This will include an explanation of what knowledge is in contrast with, for example, data or information. Then approaches to the management of knowledge will be introduced as well as a number of different strategies of knowledge management which reflect the current state of research in chapter three. Special focus will be on process based knowledge management as well as on IT service management. The latter will be explained in chapter five. Derived from the case studies a guide line for successful knowledge

management will be developed including a knowledge landscape that gives an orientation on how to apply the variety of knowledge management tools successfully.
The term knowledge landscape does exist already but is usually used for either the sum of knowledge assets or the existing tools in general. In the context of this paper, however it describes a guideline for efficient and successful knowledge management.

Current state of research

Among the best known approaches to knowledge management there are “Wissen Managen” by Probst, Raub and Romhardt and “Die Organization des Wissens” by Nonaka and Takeuchi in “Die Organization des Wissens”.
Probst et al. (2006) describe a pragmatic business approach with eight building blocks of knowledge management. They are part of a cycle starting with knowledge goals and further consisting of knowledge identification, knowledge acquisition, knowledge development, knowledge distribution, knowledge preservation, knowledge use and knowledge measurement which then may lead to new or changed knowledge goals etc. Their approach is popular in companies of the western hemisphere which can be seen often by the way western companies deal with knowledge management. The focus is on explicit knowledge and implicit knowledge is often neglected. The approach of Nonaka and Takeuchi puts emphasis on implicit knowledge as is common in Japanese companies. They have developed a knowledge spiral where implicit knowledge is transformed into explicit knowledge and vice versa (Nonaka & Takeuchi, 1997).

Gust von Loh has introduced the concept of evidence based knowledge management the intention of which is the filling of the gap between theory and practice. She has identified a gap between knowledge manager and user which is filled by empiric information need analyses and user analyses and another gap between knowledge management and research and development which can be filled by research and academic literature (Gust von Loh, 2009).

Furthermore various knowledge management strategies have been developed. The most popular strategies are the codification strategy with a focus on managing explicit knowledge by means of technological applications, the personalization strategy, which puts emphasis on the exchange of knowledge between people, the socialization strategy which focuses on organizational expertise and a process oriented approach as described by the *Fraunhofer IPK Referenzmodell.* This last approach is rather new becoming more popular as it brings knowledge management and business processes together.

The BITCOM Trend Report gives an overview of trends in knowledge management. (Schütt et al. BITCOM 2007). The scope encompasses the years 2007 to 2011. Beside the transformation of enterprises into Web 2.0 enterprises that promote a culture of participation they see the following trends:

- **Innovation management:** Due to the rising of countries such as China and India etc. the world becomes more competitive and innovations will become essential for maintaining the current life standard in Europe. An approach called collaborative innovation is suggested which means that by means of Web 2.0 solutions idea management is combined with discussion forums. Idea and innovation management, knowledge management, intellectual property management, standardization and regulation are to be combined.
- **Knowledge management as an answer to demographic challenges:** The main challenge lies in the prevention of a loss of expertise and knowledge due to the fact that society ages rapidly and a large number of employees will retire in the near future. The transfer of knowledge between older and younger employees needs to be ensured and improved. At the same time with employees getting older in average enterprises must maintain their innovation dynamics. Among the possible solutions there are mentoring schemes or collaboration groups consisting of current and former employees.
- **Green computing:** The goal is an environmental friendly IT. It is suggested to evaluate and anticipate the amount of data that is really needed and to delete whatever is not needed any longer.
- **International expert networks:** In order to solve global problems international knowledge networks are built. The solutions are then implemented by transnational organizations and NGOs. Communication and collaboration tools are used.
- **Real time collaboration and communication:** Technologies such as instant messaging and web- video- and telephone conferences are becoming more popular.
- **Service-oriented architectures:** Instead of working with mere documents the focus is shifted towards tasks and processes of knowledge workers. Via metadata processes are connected with the respective knowledge repositories. At

the same time the execution of a process can be documented. Thus templates are created that can be used whenever the same process is started again. Tools can be integrated into service-oriented architectures as required.

- **New retrieval methods:** Meta data, semantic search and social tagging are expected to improve the quality of search results.
- **Decentralized and self-organized learning:** E-learning is expected to be combined with social software services and user generated content.
- **New strategy and management instruments for knowledge management:** Experience has brought forward new approaches to the implementation of knowledge management including planning and controlling processes. Knowledge management activities are aligned with business objectives and the introduction of the concept of a knowledge balance improves the measurability of knowledge management activities thus improving acceptance in the management, too. Management and controlling of knowledge and knowledge management are standardized.

IT service management, another important aspect of this thesis, has become an important and widely used framework for the implementation of IT systems. A standard that has become quite popular is ITIL. It comes in very useful especially for the implementation of technical knowledge management solutions because it helps to anticipate and solve problems that may occur during the process of implementation and takes into consideration the requirements and needs of potential users.

Novelty value of this paper

The final goal of this paper is to provide arguments in favor of knowledge management activities that may help to convince the management in companies or organizations of their benefits on one side and to help motivate employees to live knowledge management and use the respective tools on the other. In order to achieve this goal various methods of a wide range have been suggested from balance scorecards to change management and others. Some of these methods will be explained in detail in this paper. Adding to these methods this paper will introduce two new concepts which have proved successful with reaching the aforementioned goals. The two main theses are:

1. In addition to frequently used management concepts such as project management and change management, (IT) service management can be a strong contributing factor to a successful implementation of knowledge management.

2. In complex organizations with a large variety of applications and complex processes a knowledge landscape, i.e. a guideline for directing knowledge flows and for the use of appropriate applications for specific types of knowledge, provides orientation, reduces barriers against knowledge management and enhances the acceptance of knowledge management activities. It is recommended that this guideline is designed intellectually by a knowledge manager with sufficient expertise. A virtual tool for creating a knowledge landscape is to be preferred due to the complexity. Users of this tool could enter information about the knowledge they would like to store according to certain predefined parameters and the tool would suggest the appropriate knowledge management application or concept. In a non-virtual environment a list might serve as a guideline.

Based on these theses it will be showed that a **service oriented approach** to the implementation of knowledge management combined with a guideline which will henceforward be called **knowledge landscape** reduces the risk of failure of knowledge management activities significantly. The theses are proved by two different case studies. In the first case study an empirical survey of user acceptance related to service measures and the establishing of a knowledge landscape shows clearly the effectiveness of these measures. The second case study shows that a knowledge manager can be considered as a service provider right from the beginning and extends the concept of a knowledge landscape by the aspect of human interaction. The term knowledge landscape itself is used for different concepts in different contexts. In the context of this paper it describes the entirety of knowledge management applications, methods and knowledge objects as well as the people involved in knowledge intensive processes, in a closed environment such as organizations or companies. A knowledge landscape would, for example, consist of the different types of knowledge, technical applications, social methods and interrelations between the people of a company as described in the case studies. This concept of a knowledge landscape is not to be confused with a concept that includes all existing knowledge and knowledge management activities in general. This paper is not about describing knowledge landscapes; in fact it is about how to **create** a knowledge landscape and about developing a guideline that helps to identify appropriate methods

and applications for specific types of knowledge. It is demonstrated how that can be done intellectually in two case studies. Companies, for instance, may have several technical applications for storing and processing information and knowledge. For employees it comes in very useful to have an understanding of the functionalities, the purposes, risks and benefits of these applications when they are to decide where and how to save their knowledge. Therefore this paper develops a concept which will be introduced in the respective chapters demonstrating the usefulness of a knowledge landscape in a business environment on both the department level and for cross company collaboration.

Another essential aspect of this paper is service orientation. In the case studies aspects of IT service management were applied in order to promote acceptance of knowledge management activities. Furthermore in the second case study an interface or knowledge manager was implemented as a provider of various services. The main tasks of a service oriented knowledge manager are the explanation of knowledge management in general and of strategies, concepts, tools, applications, risks and, above all, benefits as well as the matching of services with requirements and user support in cases of the implementation of applications. A survey in chapter six, which is about the first case study, will show that all these measures proved to be successful.

2 Data, Information and Knowledge

In an enterprise individuals with varying backgrounds work together. To grant a smooth and well functioning collaboration it is important to share a common understanding when it comes to terminology. Therefore it comes in useful to define some of the most important terms of both information management and knowledge management. The challenge here lies in the fact that there are varying definitions of information and knowledge. For many both terms seem to have the same meaning. Others do not distinguish between data and information. In the aforementioned case study which can be found in further detail in chapter six, interviews concerning the comprehension of knowledge and information have revealed that even in an information management department these terms are used in a quite “liberal” way. The very same case study also shows which difficulties can arise from an unspecific understanding and use of the terms information and knowledge.

A thorough understanding of the methods of knowledge management requires an idea of what knowledge is. There are various different approaches and concepts. For example in business studies knowledge is seen differently from the idea of knowledge that has been developed in the field of information science. Having a clear comprehension of the terms data, information and knowledge is important in a business environment so that information is not only produced and saved in data banks but also can be transformed into knowledge that is relevant for work processes.

According to Probst et al. (2006) data or information management is useless if employees are not enabled to use the provided information. In many companies the IT department is responsible for data and information management, the human resources department takes care of the development and education of the employees and the research and development department is responsible for innovations. The reason given for this separation is a lack of understanding of the differences between data, information and knowledge on the one hand and their interdependency on the other (Probst et al. 2006, 17). This is not surprising for in common speech they are often used as synonyms, especially information and knowledge are not distinguished by many people. Even in dictionaries information is given as a synonym of knowledge. Data is described as information and information as:

> 3 knowledge acquired in any manner; facts; data; learning; lore (Webster´s New World College Dictionary, 1997, 693).

The same dictionary gives another interesting definition of information:

> a person or agency answering questions as a service to others (1997, 693).

Especially the idea of putting information into a service context will be of great interest in following chapters of this paper. Knowledge itself is defined as both:

> 2 acquaintance with facts; range of information, awareness , or understanding 3 all that has been perceived or grasped by the mind; learning; enlightenment (1997, 748)

and:

> 4 the body of facts, principles, etc. accumulated by mankind (1997, 748)

Here knowledge is both information that is perceived by a (human) mind on a personal level and facts that exist and have been accumulated not necessarily requiring an intellectual context nor a perceiving mind.

In business studies information and knowledge are distinguished by the dependency of knowledge on people. (Gust von Loh, 2009, 11) Information becomes knowledge when it is processed by a human mind. Gust von Loh describes a hierarchy of (alphanumeric) characters, data, information and knowledge. Characters can be letters of any alphabet, numbers, punctuation marks or pictograms. They are combined according to certain rules by which data is generated. The rules are subsumed under the term *syntax*. Data is separated from spoken words by the fact that it requires a data storage medium, a piece of paper or a disc, for example. Data which is put into a context becomes information. In the next step information is explained as:

> eine immaterielle und dynamische Qualität von Daten, die erst entsteht, wenn ein Subjekt die Daten verwertet. Benötigt wird dafür ein erkennender Empfänger (Gust von Loh, 2009, 12).

This can be translated as:

> an immaterial and dynamic quality of data that developes only when the data is utilized by a subject. A recognizing recipient is required for this (own translation of Gust von Loh, 2009, 12).

Information is described as the immaterial and dynamic quality of data that comes to exist when data is processed by a subject. A recognizing recipient is required. This recipient can be a human being but also a computer which is able to process data and generate information by putting it into a context. Eventually a logical interconnection of information generates knowledge.

The following illustration shows the "development" of characters into knowledge:

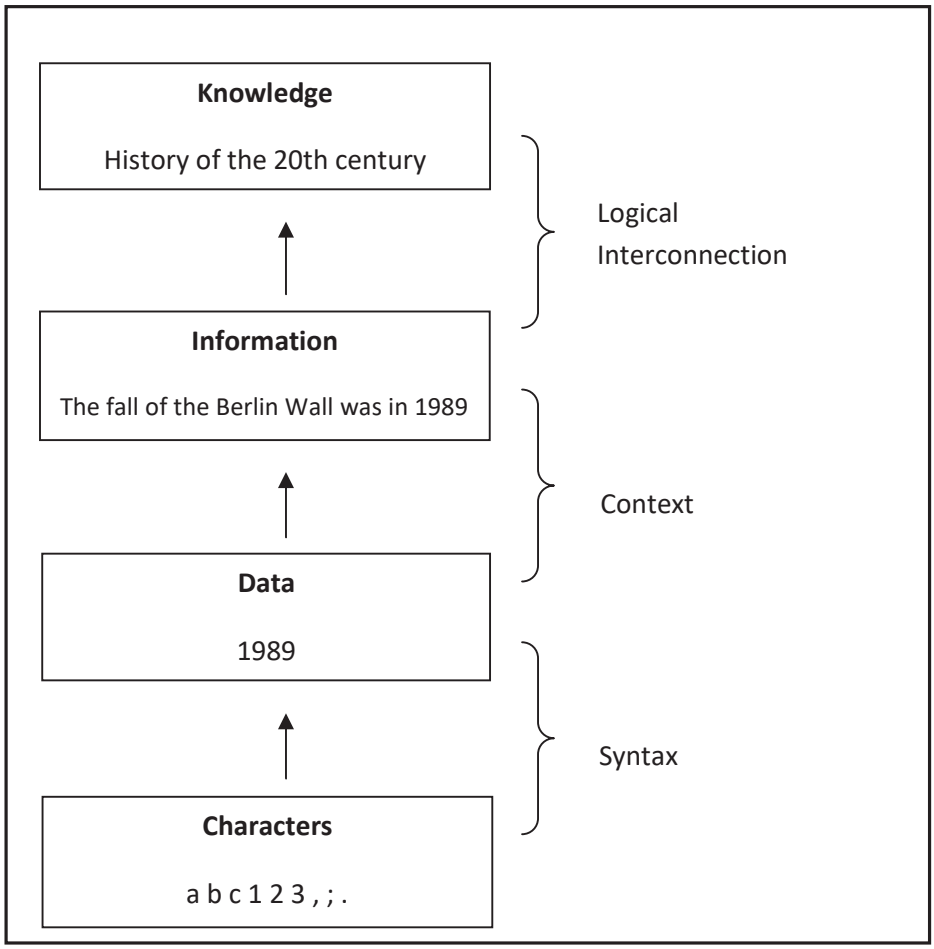


Illustration 2.1: Characters-Data-Information-Knowledge (source: based on Probst, et al., 2006, 16; Rehäuser & Krcmar, 1996, 6)

The interdependency of the various levels can be illustrated as a process of enrichment beginning with isolated characters developing into knowledge that has the ability to influence people´s behavior. There is no strict separation. (Probst et al., 2006, 16ff)

In the illustration above for example, the fall of the Berlin wall is embedded into a historical context on the highest, the knowledge level. A recipient of this information might consider it a part of the history of the 20th century. From a political point of view though it might be considered prove for the failure of socialism. This requires a political and cultural background and, to a certain degree opinion, as well as information about different economic and political systems which shows that the simple information that the Berlin wall fell in 1989 does not mean the same to everyone. It all depends on the intellectual context of the recipients of that information. The border between knowledge and opinion is vague in this case but as Probst et al. state knowledge is acquired over a period of time by combining and interpreting information. This may lead to the conclusion that knowledge is much more subjective than information. For others the mentioning of the number 1989 alone, which is found on the data level can be information enough to conjure memories and knowledge that concerns the year 1989. Does this mean that data read (aloud) and thus perceived is information already? The pronunciation of "1989" alone can make a difference. Saying nineteen hundred eighty nine moves it further up the hierarchy, for it is common knowledge that it is a year, than saying one thousand nine hundred and eighty nine which would not make much sense to most people without a context.

Rather than setting the individual terms strictly apart Probst et al. outline a continuum from data to knowledge:

Data……..	Information…….....	Knowledge
Unstructured…….....	……	Structured
Isolated…….....……		Anchored
Context-independent…….....		Context-dependent
Low behaviour control……..…..……		High behaviour control
Characters…… ……		Cognitive behaviour patterns
Distinction……		Mastery/capability

Illustration 2.2: Continuum from Data to Knowledge (Probst et al.2006, 17)

There is a constant change in quality by enriching data with structure, context and relevance. The shift is from objectivity to subjectivity. Knowledge is at the subjective end. Objective knowledge does not exist in this concept.

Another perspective of information and knowledge has been defined by Kuhlen:

> Information ist Wissen in Aktion (Kuhlen, 1995, 34)

This statement can be translated as:

> Information is knowledge in action (own translation of Kuhlen, 1995, 34).

Knowledge and information are of the same nature but distinguished by the term *action.* Only when knowledge is transferred it becomes information. According to Stock (Stock, 2007, 21) knowledge is static and information is dynamic. The process of enrichment differs from the illustration according to Probst et al. (2006) in so far as knowledge is enriched and becomes information. Kuhlen explains:

> Der Prozess der Erarbeitung von Information belässt Wissen nicht in seinem *Rohzustand*, vielmehr ist er als Transformations- oder, mit einer gewissen Bewertung, als Veredelungsprozess anzusehen(…). Diese Umwandlung von Wissen in Information nennen wir die Erzeugung informationeller Mehrwerte. (Kuhlen, 1995, 34)

Translated into English the quotation above means the following:

> The process of developing information does not leave knowledge in a raw state. In fact it is to be considered as a transformation process, or with a certain evaluation as a refinement process (…). We call this transformation of knowledge into information the creation of informational additional value (own translation of Kuhlen, 1995, 34).

Stock (2007, 20f) distinguishes subjective and objective knowledge. Subjective knowledge is the knowledge that exists in people´s minds and is thus inseparably connected to a person. Objective knowledge is all knowledge that is stored in databanks, saved on a data storage medium or any other device or is written down in books, magazines, etc., it is independent from people and static. There is a permanent interaction between subjective and objective knowledge. Subjective knowledge is transformed into objective knowledge when it is written down. Objective knowledge on the other hand can be consumed and thus influence both the already existing subjective knowledge and the recipients behavior who is now able to generate new or enriched knowledge from a combination of the old and the newly acquired knowledge. When this new knowledge is written down it becomes objective knowledge. While in business

studies knowledge is necessarily connected to people in information science this applies to subjective knowledge only. Exclusively objective knowledge is represented by information technology. The latter approach to knowledge was made in the first case study as the core of the project was a wiki where most of the subjective knowledge of the department was to be stored and categorized as objective knowledge. Therefore whenever the term "knowledge" henceforward is used in this paper it includes both subjective and objective knowledge unless otherwise stated.

2.1 Individual Knowledge vs. Collective Knowledge

In a business environment another distinction is often made between individual knowledge and collective knowledge which includes and combines the knowledge of several individuals.

> Kollektives Wissen, das mehr als die Summe des Wissens einer Anzahl von Individuen darstellt, ist von besonderer Bedeutung für das langfristige Überleben einer Organization. (Probst et al. 2006, 21)

The combination of the knowledge and the potential of several individuals creates an added value essential to long-term survival of an organization. Collective knowledge is generated over a longer stretch of time in a process of accumulation. Therefore collective knowledge cannot be "bought" on the market like other resources. The quotation above emphasizes the significance and can be translated as:

> Collective knowledge, which is more than just the sum of the knowledge of a certain number of individuals, is of particular importance for the long-term survival of an organization (own translation of Probst et al. 2006, 21).

2.2 Explicit Knowledge vs. Implicit Knowledge

As seen before there are different types of knowledge. Often a distinction between explicit and implicit knowledge is made. Each of these two requires a different approach when dealing with it. The following example is meant to help understand the differences.

Someone who has learnt to play the piano may still remember the first exercises: how to play with one hand first and with two hands independently from each other later. How to read music and how, in the course of time, it became easier to play. At first the learner had to think about every movement of the fingers but gradually focusing all

thoughts on the next movement became unnecessary. At a certain stage of the learning progress the playing seemed to just "happen" automatically. The capability of playing the piano had shifted from a conscious level to an unconscious level. This applies to many of our skills, be it driving a car, speaking a language or any kind of sport, to give some examples. After a certain time of practicing all these activities are carried out automatically. Explicit knowledge is transformed into implicit knowledge.

Gilbert Ryle (Ryle, 1946) was the first to distinguish between what he called Knowing That (explicit knowledge) and Knowing How (implicit knowledge). Later Polanyi spoke of tacit knowledge. According to Polanyi implicit knowledge is the knowledge that cannot be expressed by words but exists on a subconscious level. (Polanyi, 1985) Riding a bike, for example, requires certain skills, such as keeping the balance or riding at the right speed. Hardly anyone would be able to explain how to ride a bike precisely but yet the capability and the knowledge how to do it is there. Polanyi describes this knowledge as "part of our body" (Polanyi, 1985, 10). Therefore implicit knowledge can be described as practical knowledge while explicit knowledge is of a rather theoretical nature. Tsoukas is of the same opinion:

> We engage in tacit knowledge through virtually anything we do: we are normally unaware of the movement of our eye muscles when we observe, of the rules of language when we speak, of our bodily functions as we move around. Indeed to a large extent, our daily life consists of a huge number of small details of which we tend to be focally unaware (Tsoukas, 2006, 416).

The nature of implicit knowledge as knowledge that exists on a subconscious level is emphasized. Yet it is not limited to the physical dimension. In addition to being part of our body implicit knowledge is also based on experience, perspectives and values. Nonaka and Takeuchi distinguish between explicit and implicit knowledge as follows:

> Wir klassifizieren menschliches Wissen in zwei Kategorien: auf der einen Seite *explizites Wissen*, das sich formal, das heißt in grammatischen Sätzen, mathematischen Ausdrücken, technischen Daten, Handbüchern und dergleichen artikulieren läßt. Diese Form des Wissens kann problemlos von einem Menschen zum anderen weitergegeben werden…Demgegenüber steht jedoch ein wichtiger Wissenstyp, *implizites Wissen*, der sich dem formalen sprachlichen Ausdruck entzieht. Dieses Wissen baut auf die Erfahrung des einzelnen und betrifft schwer

> fassbare Faktoren wie persönliche Überzeugungen, Perspektiven und Wertsysteme (Nonaka, &Takeuchi, 1997, 8).

This statement of Nonaka and Takeuchi on the distinction between explicit and implicit knowledge can be translated as follows.

> We distinguish two categories of human knowledge: for one thing there is *explicit knowledge* that can be articulated formally, i.e. by grammatical sentences, mathematical expressions, technical data, manuals etc. This form of knowledge can be passed from one person to another without a problem…In contrast there is *implicit knowledge*, an important type of knowledge that cannot be expressed verbally. This type of knowledge is based on the experience of an individual and relates to elusive factors such as personal beliefs, perspectives and value systems (own translation of Nonaka & Takeuchi, 1997, 8).

According to Nonaka and Takeuchi explicit knowledge can be articulated formally by grammatical sentences, mathematical expressions technical data, handbooks, etc. it can be passed from one person to another. Implicit knowledge on the other side cannot be expressed by formal language. It is based on personal experience, opinions, perspectives and values. According to Stock implicit knowledge is a problem from an information science perspective (Stock, 2008, 25). In particular when it is assumed that implicit knowledge can be shared only by means of socialization, this has nothing to do with knowledge representation anymore. Especially in the case of interaction of humans with technology this results in difficulties. There are approaches however, to solve this problem such as knowledge warehouses which will be introduced in chapter four. Knowledge representation, however, deals without any restrictions with explicit knowledge according to Stock (2008, 31).

As the case studies have showed there was a vague understanding of these concepts of knowledge, however distinctions were often made incorrectly. Having a knowledge manager helped to gain a better understanding of the subject. With regard to the quality of what he calls information Eppler (2003) mentions various criteria as can be seen in table 2.1, distinguishing four levels of information quality. The infrastructure level is about the quality of knowledge management systems. The process level deals with knowledge processes and knowledge intensive business processes. Content is dealt with on the knowledge level and the community level is about knowledge receivers and how they handle information and knowledge. In the first case study the process level and the

infrastructure level were of particular importance because the employees had to evaluate accessibility and security (infrastructure level) as well as consistency, correctness and currency. Confidentiality, which could be sorted to the infrastructure or community level, reliability which could be at the infrastructure level, criticality of content (product level) , frequency of use (community level) and commitment (community level) are further criteria that have been added due to their importance in the case studies, in particular the first one. In the table these criteria have been added in brackets including their counterparts in the "opposite" column.

Level	Criterion	Opposite
Infrastructure Level	accessibility	inaccessibility
	maintainability	neglect
	security	exposure
	speed	slowness
	(confidentiality)	(openness)
	(reliability)	(unreliability)
Process Level	convenience	inconvenience
	interactivity	rigidity
	timeliness	lateness
	traceability	indeterminacy
Product Level (soundness)	conciseness	prolixity
	consistency	inconsistency
	correctness	falsity
	currency	obsolescence
	(criticality)	(uncritical content)
Community Level (relevance)	accuracy	inaccuracy
	applicability	uselessness
	clarity	obscurity
	comprehensiveness	incompleteness
	(confidentiality)	(openness)
	(frequent use)	(infrequent use)
	(commitment)	(indifference)

Table 2.1: Criteria of Information Quality (source: based on Eppler, 2003)

3 Knowledge Management – Models and Strategies

As knowledge is a valuable resource of an organization it has, over the years, become a management topic related to information management. However, while information management rather is about the management of information systems from a technical point of view knowledge management has a strong emphasis on the human factor. For information management the focus lies on developing, optimizing and customizing information and communication technology. Whole information architectures are designed and user support plays an important role, too. The lines between information management and knowledge management may sometimes be blurred and people do not always distinguish between them as can be seen in the first case study. In the following an up-to-date understanding of what knowledge management actually is will be introduced based on renowned publications and widely accepted theories.

3.1 Managing Knowledge

Knowledge management combines elements of business studies, business informatics, information sciences and organizational psychology (Gust von Loh, 2009, 21).

Management in general can be defined as activities of executive staff in all areas of a business , including acquisition, sale, administration, financing, human resources management etc. in compliance with their managerial functions. The main tasks of management are corporate planning, realization and controlling. Planning includes problem and task definition, entrepreneurial objectives, contingency planning and decision making. Realization involves organization, information, communication and motivation and coordination of employees. Controlling comprises feedback and target-performance comparison. (http://wirtschaftslexikon.gabler.de/Definition/management.html 03.09.2018).

In this context knowledge management can be defined as managing the resource knowledge. Core processes are the identification, the production, the storing, the distribution and the use of knowledge and experience. Knowledge management has a strategic and an operational dimension. The operational dimension includes the implementation of a supporting IT infrastructure and knowledge management systems and has an interface with information management at this point, as well as the establishing of methods and ways to share knowledge such as meetings, communities of

practice or lessons learned to give just a few examples. Liew emphasizes the strategic relevance as follows:

> Knowledge Management is one of the driving forces of organizational change and value creation since the early 1990s (Liew, 2008, 133).

This requires a business culture that promotes and supports the essential processes of knowledge management. Without the readiness to learn, to share knowledge and to use it the results of any effort to implement knowledge management will be poor. It can be promoted by flat hierarchies and a culture that allows and admits mistakes. Sivan (2000, 2) mentions nine keys of knowledge management: culture, technology, processes, users, switchboard, services, value, design and premises. The relevance of each key depends on the context of the organization. According to him these nine keys form the knowledge infrastructure of a business. They are further divided into three phases. The first three keys belong to the planning phase, the second three to the implementation phase and the last three to the evaluation phase. Services in this context represent tools that are used by users for knowledge management.

Knowledge management is often organized as part of either the IT department or the human resources department. All too often the integral aspect is neglected. According to Malhotra a too strong focus on information technology, artificial intelligence and machine learning has a negative impact on knowledge creation and utilization because the way people acquire, share and create knowledge and thus human psychology, is neglected (Malhotra, 2000, 41ff). This would lead to a negative impact on a company's capability to learn and adapt to ever faster changing circumstances and environments. Mere knowledge repositories are too static and impede the organizational adaptability and agility. Malhotra states that IT based knowledge management systems are good for "well-structured problem situations" but they see a great risk in "institutionalizing the status quo" thus suppressing any creative approach to solve a problem. He suggests combining information technologies with creative and innovative elements:

> Knowledge management caters to the critical issues of organizational adaptation, survival and competence in face of increasingly discontinuous environmental change. Essentially, it embodies organizational processes that seek a synergistic combination of data and information-processing capacity of information technologies, and the creative and innovative capacity of human beings (Malhotra, 1998 in Malhotra, 2000, 47).

Among the reasons for knowledge management there are:

- Knowledge is an important competitive factor.
- Knowledge intensive businesses become increasingly important (for example Google, Microsoft, Amazon etc.).
- Knowledge grows exponentially.
- Companies and organizations often do not even know all their knowledge assets such as patents or expertise for instance.
- Existing knowledge is not used in an optimal way or even remains completely unused, especially when it does not reach the right persons.
- The search for information and knowledge is often extensive and time-consuming.
- When employees leave a company valuable expertise is lost.

It is essential for companies that information and knowledge are practice-oriented. Activities are based on it. Therefore knowledge is considered as the intellectual capital of a business (Gust von Loh, 2009).

According to Pack the managerial functions in the context of managing knowledge are (Pack, 1976):

- the request for information
- the identification and enforcement of profitable objectives
- the provision of information
- decision-making
- delegating and coordinating
- motivating
- supervising/controlling
- representing

This leads to the logical conclusion that knowledge management should be a part of the internal general management.

Beside data banks people are important knowledge carriers. These are employees or project groups as well as any other stake holder, be it suppliers, subcontractors, customers, shareholders, the state or standards organizations.

3.2 Knowledge Management Models

With regard to the tasks of knowledge management various models exist. After introducing the most common models Laverde et al. list 17 different processes which they have extracted and suggest a reason why knowledge management is often difficult to implement:

> Although all the studied models use similar terminology, they do not share meanings. Inside this terminology the studied models present seventeen different processes, such as Socialization, Externalization, Combination, Internalization, Sharing, Accessibility, Assimilation, Application, Identification, Mapping, Development, Distribution, Knowledge goals, Knowledge assessment, Create, Codified knowledge claim, Knowledge claim evaluation. These processes must be interpreted according to the context given by each author. This situation generates confusion onto firms and slows the practical development of Knowledge Management projects and supposes an urgent need of lexical standardization (Laverde et al., 2003, 6).

The terminology in knowledge management has not been standardized yet. Even the terms knowledge and information are used in different ways depending on the theory applied as seen in chapter two. Therefore it is essential to create a common understanding of terminology at the beginning of every knowledge management project.

Among the most prominent objectives of knowledge management are a better competitive position and an increase in innovation. The adequate knowledge provides an advantage in competition. Special emphasis should be put on knowledge that is critical for economic success. The organizational knowledge base is evolved and the problem-solving-competence of both individual organization members and the organization as a whole are improved which can be subsumed under the term *organizational learning*.

The following knowledge management models emphasize the importance of including both people and technology.

3.2.1 TOM-Model:

Bullinger et al. (1998) have developed a model which depicts three main components of knowledge management. These components are technology, organization and people. The following illustration shows the interconnection of these three components and the respective role they play.

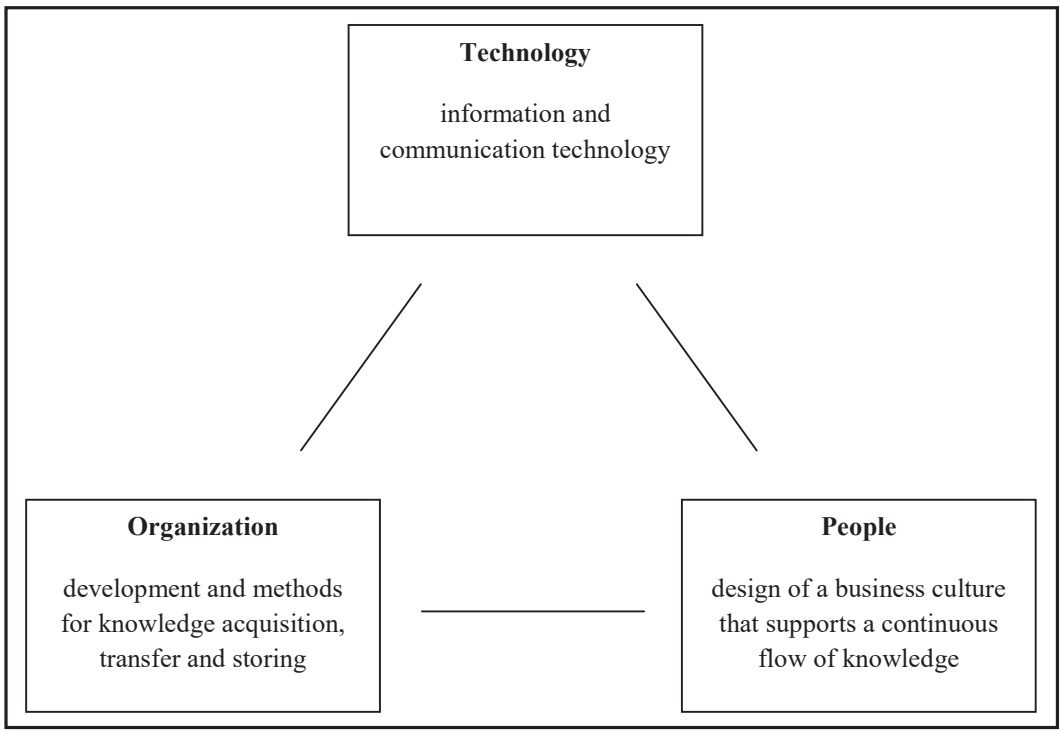


Illustration 3.1: TOM-Model (source: based on Lucko & Trauner. 2005, 24)

All three dimensions have to be considered for successful knowledge management. Adding the aspects "people" and "organization" sets knowledge management apart from information management (Nickelsburg, 2007, 40). In the following the terms will be explained.

Technology: This dimension contains the technological information architecture. In companies usually the IT department is responsible for providing appropriate hardware and software for handling information and knowledge. As hardware computers, smart phones, tablets and other devices come in useful. Software can be databanks or Web 2.0 applications for example. They can either be integrated into existing systems, be implemented separately or be complete e-business solutions which can be bought on the

market. Each possibility has its upsides and downsides. Complete solutions that are offered on the market just need to be implemented and, where applicable, be customized to the needs. However, they tend to be expensive and often face acceptance problems. Web 2.0 technology is rather low-priced. Wikis and blogs can be implemented at low cost or even for free but freeware often has issues which have to be dealt with and might cause a loss of motivation in the employees who are to use them. An advantageous solution would be the embedding of new technology into existing systems people are already familiar with. The downside is that compatibility is not always given.

Organization: Describes the entire enterprise, its values, objectives, strategies and processes. The organization is the framework responsible for creating the necessary conditions and for the actual implementation of knowledge management. Methods and processes are developed for the identification, acquisition, distribution, development, use and storing of knowledge. Without a "knowledge-friendly" culture within an organization knowledge management will fail. This includes the overcoming of barriers and incentives to share knowledge.

People: The third dimension focuses on the human factor. According to the definition of knowledge in business studies this dimension has a prominent position because knowledge is always connected to people according to this approach. But even if the information science approach is applied and the focus is on objective knowledge, the other two dimensions would not exist without people who invent technology and build organizations. It is people that own the resource knowledge. Earlier concepts of knowledge management often neglected this important factor.

> Most of the traditional Knowledge Management systems rely on the assumption that knowledge can be assimilated to objects that can be identified, separated from their initial context, and handled in information systems (Nabeth et al., 2002, 2).

This attitude still prevails in some organizations where the establishing of knowledge management is restricted to the implementation of technical tools and data banks. It can be doubted that this approach leads to an effective use of the organizational knowledge. Overall it is people who design and live a business culture that allows for the optimal dealing with knowledge. The employees must be willing to share their knowledge and to use knowledge they are provided with by the organization. Another challenge in

knowledge management is the preservation of knowledge when an employee leaves the company in a way that it can still be used by others.

3.2.2 TIMO-Model

Zhang and Benjamin (2007, 1936) add a fourth dimension to the Tom-model. Their model also includes information which must be managed as well. Illustration 3.2 shows the connection and the interaction of the four dimensions.

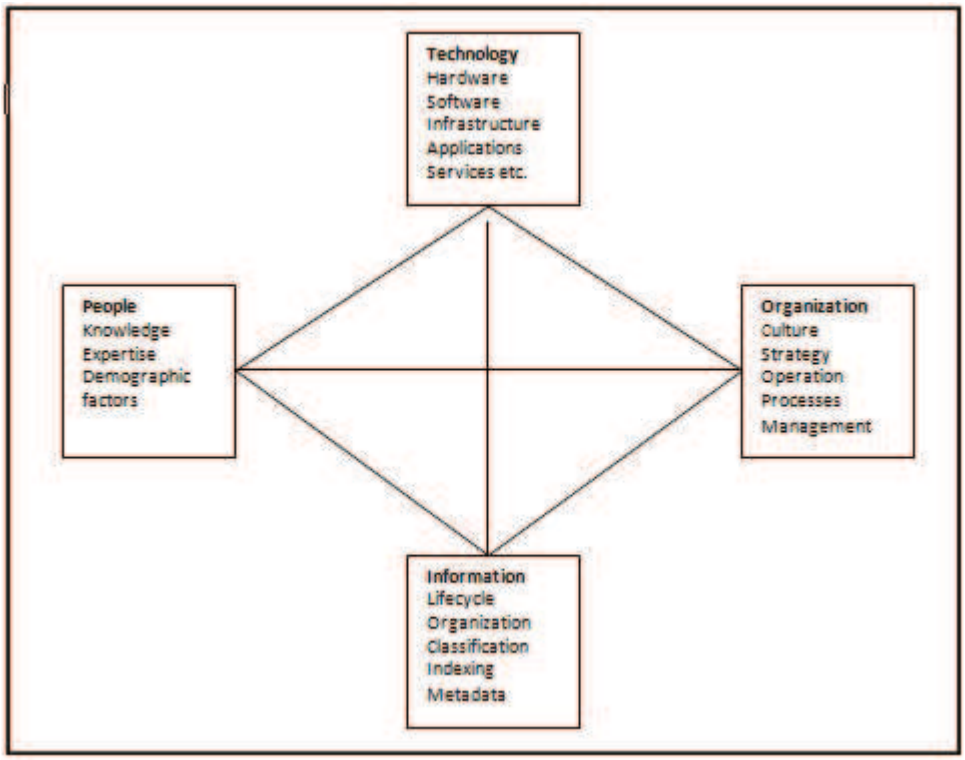


Illustration 3.2: TIMO-Model (source: based on Zhang and Benjamin, 2007, 1936)

According to this model information needs to be organized and categorized and has a lifecycle. The technology dimension also includes services and resources. Motivation is a factor of the people dimension. Huneke emphasizes the importance of taking human factors into consideration when he speaks of the treasures in their (people´s) minds (Huneke, 2008, 1). People are important knowledge carriers and it is people in particular who use knowledge. How important the use of knowledge is, is explained by Probst et al. (2006).

3.2.3 Building Blocks of Knowledge Management

The standard work “Wissen managen – Wie Unternehmen ihre wertvollste Ressource nutzen” (Probst et al., 2006) focusses on the handling of knowledge in business environments. The title itself reveals that they see knowledge as the most precious resource of an enterprise.

A systematic approach to knowledge and knowledge management is developed which is intended to optimize their benefits. There is a strong focus on explicit knowledge although it is assumed that an enterprise is based on both individual and collective knowledge and competence. It is the successful combination of competence which is seen as a fundamental basis for success. (Probst et al. 2006, 20f) In analogy to general management theories they emphasize the importance of goals, their realization and controlling. They see knowledge management as a dynamical cycle that is subject to permanent evolution. Their model involves eight building blocks divided into an outer and an inner circle which is shown in illustration 3.3.

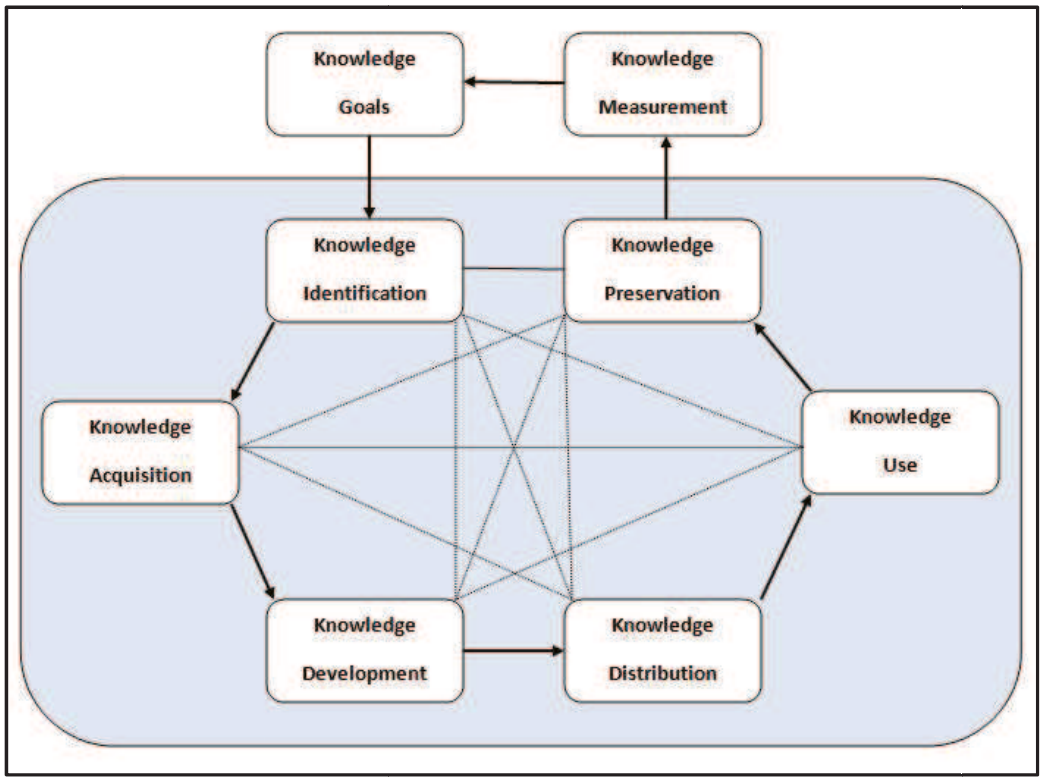


Illustration 3.3: Building Blocks of Knowledge Management (source: based on Probst et al., 2006, 32)

The outer circle consists of knowledge Goals and knowledge Measurement. While the goals define the direction of all knowledge management activities and determine which knowledge is to be developed an evaluation of knowledge ends the cycle and provides valuable data for further decisions on strategic questions concerning knowledge. A distinction is made between normative, strategic and operational goals. The normative level includes questions concerning company politics and culture. At this level decisions in favor of knowledge management are made. Judicial conditions and their effect on knowledge management are defined. An overall concept is designed and the

desired culture is developed which may include readiness for sharing knowledge or the increase in communication within a company. This requires the commitment of the management. It had best be a role model by living the idea of working with knowledge. At the strategic level there are goals concerning the structure of an organization. Decisions are made with regard to management systems in general or on the applications that are to be used for knowledge management. Desired core competences are defined resulting in the required competence portfolio. At the operative level the respective goals of the strategic level are realized. A knowledge infrastructure is built and processes are developed. Project management can be a helpful tool for the implementation of applications. After the knowledge goals have been determined the inner circle starts with the identification of knowledge which already exists within a company. Knowledge exists on various levels. It is stored in data banks, it can be patents owned by a company and it exists in the employees' minds. At the same time gaps in the knowledge portfolio can be detected. Knowledge identification creates transparency of knowledge and skills that exist within an organization. In the worst case knowledge remains undetected and unused. However, knowledge identification is not only about finding knowledge. It is furthermore about detecting the knowledge that is essential for the success of an organization. Probst et al. call it an "appropriate transparency of critical knowledge assets" (Probst et al., 2006, 63).

The next step is the acquisition of critical knowledge in order to fill the gaps which have been detected in the process of knowledge identification. There are numerous means to acquire knowledge. Probst et al. mention knowledge markets (2006, 93). Knowledge can be acquired by employing people. Mergers and acquisitions of companies lead to a large influx of new knowledge. Information can be purchased from information services. Knowledge can be acquired from other companies. Benchmarking is a useful means in order to learn from the best competitors in a specific business area. Stakeholders can be another valuable source of knowledge. A stakeholder is a person, group, or organization which affects (or can be affected by) an organization's actions, objectives and policies. Possible stakeholders are customers, suppliers, employees, governments, creditors, shareholders etc. (http://www.businessdictionary.com/definition/stakeholder.html, 21.01.2018)

The next building block is complementary to knowledge acquisition. (Probst et al., 2006, 113ff). The traditional way of knowledge development is the establishing of a development department/division. Car companies improve the engines of their cars in

their development departments. In the laboratories of the pharmaceutical industry new medication is developed. Some companies like Ratiopharm acquire knowledge by copying products which have been developed by other pharmaceutical companies after the patents have expired. Another possibility is cooperation with other companies, universities or other research institutes. But new knowledge can also be developed when employees get trainings or when they have a chance to exchange information and thus generate new knowledge (Gust von Loh, 2009, 39). Creativity and problem-solving skills are key competences for generating new knowledge. Probst et al. emphasize the importance of the right frame conditions to bring them forward (2006, 118ff). The key factors for generating knowledge between individuals are interaction, communication, transparency and integration.

This leads to the next building block, knowledge distribution. It includes two processes, that of distributing and that of sharing knowledge. Probst et al. describe the goals as:

> Die Aufgaben der Wissens(ver)teilung lassen sich schematisch in drei Gebiete einteilen. (1) Die Multiplikation von Wissen durch rasche Verteilung auf eine Vielzahl von Mitarbeitern. (2) Die Sicherung und Teilung vergangener Erfahrungen und (3) den simultanen Wissensaustausch, der in die Entwicklung neuen Wissens mündet (Probst et al. 2006, 170).

This quotation taken from Probst et al. translates as:

> The tasks of knowledge distribution can be arranged schematically in three categories. (1) The multiplication of knowledge by a quick distribution to a great number of employees. (2) The saving and sharing of past experience and (3) the simultaneous exchange of knowledge that results in the develeopment of new knowledge (own translation of Probst et al. 2006, 170).

It is essential that the right knowledge is at the right place at the right time. Therefore, a quick distribution is important. Experience is to be stored and shared and knowledge must be exchanged simultaneously. There are several methods used for knowledge sharing some of which will be introduced in the following chapters.

All these aforementioned building blocks remain useless if the knowledge that has been identified, acquired, created, distributed and shared is not used. Therefore it can be argued that the building block knowledge use is the most important one.

> Letztendlich müssen alle Bausteine des Wissensmanagements auf die effiziente Nutzung individuellen und organizationalen Wissens im Sinne der Zielsetzungen des Unternehmens ausgerichtet sein. Knowledge in Action ist somit das aussagekräftigste Kriterium eines erfolgreich implementierten Wissensmanagements (Probst et al. 2006, 175).

This can be translated as:

> Eventually all building blocks of knowledge management must aim at the efficient use of individual and organizational knowledge according to the goals of the company. Knowledge in action is therefore the most meaningful criterion of successfully implemented knowledge management (own translation of Probst et al. 2006, 175).

Every other building block of knowledge management should support the efficient use of knowledge which can also be characterized as the core component of knowledge management (Gust von Loh, 2009, 40). It is the criterion that leads to success. If knowledge is not used all other processes are in vain. An adequate work environment helps to bring forward knowledge use. This also means that applications for knowledge management have to be user friendly. Tools with a poor usability are often rejected. A knowledge landscape can help to understand how to use knowledge management systems, respectively to choose the appropriate applications. There might be sign posts that help those who consult it to find the right direction. Psychological barriers tend to prevent the acceptance of new knowledge. Routines allow for little innovation if they permit no flexibility. People tend to stick to what they are used to. Organizational blindness often has to be overcome first.

The last building block of the inner circle is about saving and storing knowledge. The main goals are the prevention of future knowledge gaps on the one hand and information overload on the other. This requires a repetitive selection process. The ideal outcome of knowledge saving would be a collective memory which remains unaffected in case individuals leave the organization. Probst et al. emphasize the importance when they write that many companies have realized that outsourcing and lean management have led to an irrevocable loss of expertise which then had to be bought on the knowledge market or from consulting agencies at high costs (2006, 190). In the case of explicit knowledge it is rather easy to save it in data banks. Implicit knowledge however, has to be shared by individuals in a continuous process.

At the end of the cycle the existing knowledge portfolio is revised and evaluated. The measures that have been taken are monitored with regard to their efficiency. As it is difficult to measure knowledge Probst et al. suggest further investigation on this particular problem (2006, 213ff). In process based knowledge management the improvement of single processes may be quantified. Does the supply of knowledge accelerate processes or reduce intermediate steps? Vice versa those processes which produce useful knowledge can be identified.

3.2.4 Harnessing Implicit Knowledge

Sharing implicit knowledge is more difficult than the transfer of explicit knowledge. Nonaka and Takeuchi (1997) consider implicit and explicit knowledge as complementary. New knowledge is generated by means of an interaction between the two types of knowledge. They suggest a knowledge spiral consisting of four main processes of knowledge conversion. Implicit knowledge is shared via socialization, which is an exchange of experience. It can create implicit knowledge such as common mental models or technical abilities, for example. According to Nonaka and Takeuchi the key to the acquisition of implicit knowledge is shared experience.

> Ein Mensch kann ohne Sprache unmittelbar implizites Wissen von anderen erwerben. Lehrlinge arbeiten zusammen mit ihrem Meister und erlernen dessen handwerkliches Wissen nicht durch Sprache, sondern durch Beobachtung, Nachahmung und Praxis. Im betrieblichen Umfeld geht die Ausbildung am Arbeitsplatz vom gleichen Prinzip aus…Der bloße Informationstransfer ohne den zugehörigen Erfahrungskontext ergibt oft nur wenig Sinn (Nonaka &Takeuchi, 1997, 75).

In English this would mean the following:

> A human being is capable of acquiring implicit knowledge from others directly without language. Apprentices work together with their foreman and learn his or her technical skills not by means of language but by observation, imitation and practical application. In a business context the vocational training on the job is based on the same principle…The mere transfer of information without the related experience often does not make much sense (own translation of Nonaka & Takeuchi, 1997, 75).

They give an example of how sharing implicit knowledge by means of socialization works. The company Matsushita intended to construct a bread baking machine. The challenge was the correct kneading of dough. In order to improve this process engineers were sent to the Osaka International Hotel in order to learn from the chef baker how to knead dough. The bread baked at the Osaka International Hotel was considered the best bread in the area. It took a while until the engineers found out that the baker stretched and twisted the dough. By means of observation, imitation and practising a solution for the optimized kneading of dough was hence found. (Nonaka & Takeuchi, 1997, 76) Even though it was one simple process only, that of stretching and twisting the dough, it took some time to acquire this knowledge.

In the 1990´s Giacomo Rizzolatti, Giuseppe Di Pellegrino, Luciano Fadiga, Leonardo Fogassi, and Vittorio Gallese of the University of Parma in Italy made a discovery which might help to understand how passing on implicit knowledge via socialization might work. They discovered a specific type of neuron in the brains of monkeys which fired both when the monkey picked up food himself and when the monkey observed a person picking up food. Those neurons "mirrored" the behavior that was observed in others and were, therefore, called mirror neurons. (Rizzolatti & Craighero, 2004, 27:169–92) Mirror neurons are triggered by visual stimuli and require an interaction between an effector i.e. either hand or mouth and an object whatever the nature or importance to the monkey may be. The prospect of a reward is not required.
Mirror neurons are classified as strictly congruent when goal and means to reach a goal correspond to what is being observed. They are classed as broadly congruent when they do not require the exact same action in order to be triggered. The latter seem to represent the majority of mirror neurons (p.170). Some mirror neurons are triggered specifically by "mouth action". There is even a distinction between those neurons which are triggered by ingestive actions and those which are triggered by communicative actions. Mirror neurons have been found in other areas of the brain which are responsible for all kinds of movements, too (p.171). The question arises what mirror neurons are good for. Rizzolatti and Craighero give an answer which is interesting when it comes to passing on knowledge:

> Two main hypotheses have been advanced on what might be the functional role of mirror neurons. The first is that mirror-neuron activity mediates imitation (see Jeannerod 1994); the second is that mirror neurons are at the basis of action

> understanding…(Rizzolatti & Craighero, 2004, 171)

Yet they admit that they are not the only reason for humans' ability to understand the actions of others:

> Both these hypotheses are most likely correct. However, two points should be specified. First, although we are fully convinced (for evidence see next section) that the mirror neuron mechanism is a mechanism of great evolutionary importance through which primates understand actions done by their conspecifics, we cannot claim that this is the only mechanism through which actions done by others may be understood…Second, as is shown below, the mirror neuron system is the system at the basis of imitation in humans. Although laymen are often convinced that imitation is a very primitive cognitive function, they are wrong. There is vast agreement among ethologists that imitation, the capacity to learn to do an action from seeing it done (Thorndyke 1898), is present among primates, only in humans, and (probably) in apes…How do mirror neurons mediate understanding of actions done by others? The proposed mechanism is rather simple. Each time an individual sees an action done by another individual, neurons that represent that action are activated in the observer's premotor cortex. This automatically induced, motor representation of the observed action corresponds to that which is spontaneously generated during active action and whose outcome is known to the acting individual. Thus, the mirror system transforms visual information into knowledge (Rizzolatti & Craighero, 2004, 171).

Experiments have showed that the activity of mirror neurons correlates with action understanding. A visual stimulus is only required when necessary to understand an action. If action understanding is already given other stimuli such as sounds are sufficient to trigger the neurons. It would be interesting to carry out further investigation on this subject in order to see if it helps to understand socialization better in the way Nonaka and Takeuchi understand it. Furthermore it would open new perspectives. For example virtual reality could be used to transfer implicit knowledge.

The next step is the transformation of implicit knowledge into explicit knowledge in a process Nonaka and Takeuchi call externalization. It means explaining implicit

knowledge with explicit concepts. As it is hardly possible to explain implicit knowledge they suggest using metaphors and analogies. Gust von Loh doubts that metaphors and analogies are appropriate means for the externalization of implicit knowledge and states that implicit knowledge cannot be converted into explicit knowledge but is only a part of the latter. (Gust von Loh, 2009, 37) With regard to the concept of Nonaka and Takeuchi she is skeptical, pointing at the differences between the Japanese and the western cultural background. Nonaka and Takeuchi explain some of the major differences. In contrast to western societies the Japanese prefer their own inner world of experience over abstract and metaphysical theories in their search for knowledge. Personal and physical experience is of a higher esteem than intellectual abstraction (Nonaka & Takeuchi, 1997, 42). Polanyi, too, is of the opinion that implicit knowledge cannot be articulated at all. This would also include the use of metaphors and analogies. Nevertheless, to a certain degree analogies might come in useful. Someone who already knows how to play the piano and who wants to learn typewriting may find the analogy between both skills useful as he already possesses a mental model of the finger movements required for both playing and typing. However, this is not a direct transformation of implicit knowledge into explicit knowledge which can only be acquired by those who already have the basic concept in their mind. It shows that externalization of implicit knowledge via analogies is possible to a certain degree with the restriction that a certain mental model and thus similar implicit knowledge must already be existent in a learners mind. For those who are able to interpret them, metaphors and analogies may serve as encrypted explicit knowledge all the more when it is considered that all kind of knowledge must be interpreted by a human mind, at least according to the business studies approach. This also shows that the borders between implicit and explicit knowledge are somewhat blurred which is supported by the fact that there is no sharp line between the conscious and the subconscious mind.

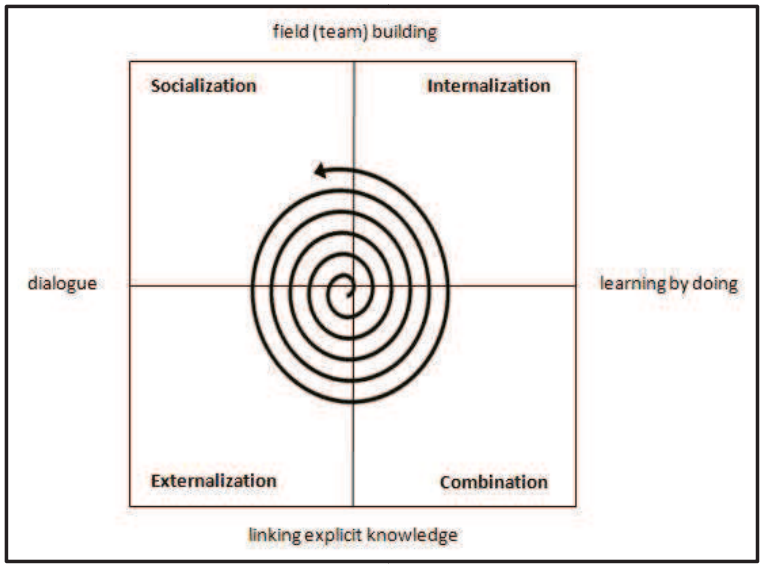
Probst et al. mention metaphors and analogies as an appropriate possibility for externalizing implicit knowledge, too (Probst et al. 2006, 123f).

Nevertheless, the objections of Gust von Loh imply that the use of metaphors and analogies does not provide a satisfying method to share knowledge. According to Polanyi implicit knowledge can only be shared via observation and Gust von Loh emphasizes the meaning of collaboration for sharing implicit knowledge. (p.34) In the future the research on mirror neurons may help to fully understand the neural processes that enable us to learn from observation and collaboration.

New knowledge is generated by combination of existing explicit knowledge. Exchange and combination of explicit knowledge takes place via media such as documents, internet, intranet, meetings, conferences, telephone etc. Information can be stored and organized. Categories in a databank are a good example of combining specific knowledge in a databank.

The fourth and last process is called internalization. Explicit knowledge is converted into implicit knowledge. Gaining experience is of great importance in this process. Nonaka and Takeuchi compare it to the "learning by doing concept". It does not only include the reception of knowledge but furthermore the internalization of mental models.

Nonaka's and Takeuchi's knowledge management model comes in useful especially when implicit knowledge needs to be shared or passed on. However, as it is based on Japanese mental models it might be difficult to fully understand and apply the concepts for companies of the western hemisphere that have a different way of thinking.



Illlustration 3.4: Knowledge Spiral (source: based on Nonaka & Takeuchi 1997, 84)

Nevertheless, it might be quite useful to at least consider their concepts especially when employees are about to leave a company and their implicit knowledge is to be transferred to new employees and mentoring, at least, has been introduced to many companies already.

3.2.5 Other Concepts

The model of Tannembaum and Alliger (2000) is not about an organizational knowledge creation process but rather about the effectiveness of knowledge management. Four different aspects are distinguished and examined.

- **Knowledge Sharing:** describes and measures the extent to which people share knowledge.
- **Knowledge Accessibility:** this aspect describes to what extent required knowledge is accessible in order to fulfill tasks, make decisions and solve problems.
- **Knowledge Assimilation:** is about how effectively people learn and assimilate the knowledge they are provided with and which they need for their work.
- **Knowledge Application:** deals with the question to what degree people use the knowledge they possess for performing in their job.

While the first three aspects contribute to it, knowledge application itself is the most important aspect. This is in accordance with Probst et al. according to whom knowledge utilization is the most important component to which all others have to contribute as seen before (Probst et al. 2006, 175).

Rastogi (2000) speaks of a set of operations that firms have to plan and implement:

- **Identification** of existing knowledge is essential for a competitively effective implementation of enterprise strategies.
- **Mapping** of the existing and available knowledge including expertise and skills.
- **Capturing** the existing knowledge through its formalized representation.
- **Acquisition** of knowledge and information including know-how.
- **Storing** the existing, acquired, and created knowledge in properly indexed and interlinked knowledge repositories.
- **Sharing** knowledge by means of automatic access for and distribution to users based on their needs and interests.

- **Application** of knowledge in order to support decisions, activities and problem-solving.

- **Creating,** generating or discovering new knowledge through research and development departments, lessons learned, creative thinking and innovation. This last step is considered as the most advanced stage of knowledge management.

Along with, or even before, choosing an appropriate model it is essential to spend some time thinking about the adequate knowledge management strategy as can be seen in the following subchapter. After introducing knowledge management models and concepts a closer look at knowledge management strategies will help to find a good starting point for the implementation of knowledge management in order to figure out suitable concepts, measures and tools.

3.3 Knowledge Management Strategies

According to the *St. Gallener Management Model* (management model of St. Gallen) which is nowadays one of the most prominent management models (Brauchlin, 2006,3), there are three management levels (Probst et al., 2006, 41). These are the normative, the strategic and the operative level. The normative level is the highest. At this level the philosophy of a business is determined as well as guidelines, standards etc. These create a framework for the two lower levels. Strategic management is responsible for developing business strategies that create and support the competitiveness of a business. Strategic goals are dictated which are to be achieved within a certain time period. On the lowest level, operative management deals with everyday business. Individual objectives are determined and individual decisions are made in order to achieve the strategic goals. A normative goal, for example, could be the creation of a knowledge-culture. On the strategic levels decisions would be made on the question of what types of knowledge might be relevant or what methods of knowledge management seem suitable for achieving the goal of living a knowledge culture, always considering which knowledge assets would strengthen competitiveness. The decision in favor of a specific knowledge management strategy would be located on the strategic level as well. On the operative level the decision in favor of specific software or the hiring of additional staff would be made. This chapter is about the strategic level. More on the actions on the operative level will be found in the case studies.

If a decision has been made in favor of knowledge management, the middle management of a company then needs to determine and define strategic goals that are to be achieved in order to add value to the business processes and strengthen the position on the market. Gust von Loh mentions three strategies of knowledge management. (Gust von Loh, 2009) The codification strategy extracts the knowledge of the employees which is stored in data banks and enriched with knowledge that is acquired externally. Solely explicit knowledge can be collected because implicit knowledge cannot be written down. The personalization strategy is about finding both internal and external expertise which is connected to people. Being implicit this kind of knowledge cannot be codified. However, the exchange of knowledge can be promoted. When applying the socialization strategy knowledge is seen as a common good. Communities are created which enable knowledge sharing. Gust von Loh mentions communities of practice in this context (Gust von Loh, 2009, 32). Another useful strategy would be process based or process oriented knowledge management.

Before going into detail a brief survey of the evolution of knowledge management will help to understand the different strategies that exist nowadays. In the course of time a variety of different knowledge management strategies has been developed. While knowledge management activities are probably as old as humanity, for knowledge has always been shared via activities such as communication, imitation of others or even mentoring etc., it was not before the twentieth century of the last millennium that knowledge management became subject of scientific research. Especially with the evolution of the information society the need to manage information and knowledge in a structured way arose (Linde & Stock, 2011, 81ff). Along with rapidly evolving new technologies the development of an information society has had an enormous impact on culture, society and economy which, on the one hand allowed for more mobility and flexibility, on the other hand however, has made it ever more important to react fast. The term knowledge society first came up in the 1960´s. Characteristic for a knowledge society is the systematic handling of knowledge supported by technology. The creation of new knowledge has accelerated. It has become widely available and is now a stimulating factor for wealth and prosperity. New knowledge based jobs have been created and information and communication technologies develop rapidly. The concept of knowledge management has undergone several changes in the course of the past decades. From a focus on IT based documentation the scope of knowledge management has widened. New strategies have evolved such as the aforementioned codification

strategy, personalization strategy, socialization strategy, process oriented strategy etc. In this context the codification strategy and the personalization strategy as the currently most common knowledge management strategies and process oriented knowledge management which is becoming more and more popular will be introduced briefly. A service oriented strategy is explained in chapter five.

According to Hansen et al. the applied knowledge management strategy should align with the general strategy and consider the structure of a company with regard to the nature of the business, clients and employees. With regard to pursuing either the codification or the personalization strategy Hansen et al. utter a warning:

> Emphasizing the wrong strategy or trying to pursue both at the same time can, as some consulting firms have found, quickly undermine a business (Hansen et al., 1999, 2).

Nevertheless, they suggest a division of 80% and 20% according to the general strategy and organization of a company considering its structures, clients and employees. Thus the prominent strategy is supported by the other. They have deduced both codification strategy and personalization strategy from observations of strategies used by consulting firms (Hansen et al.1999). The total neglect of the respective other strategy would result in failure of all knowledge management activities. They are of the opinion that the choice between codification and personalization strategies is being faced by all companies in the area of knowledge management (Hansen et al. 1999, 2).

3.3.1 Codification Strategy

The codification strategy reflects the concepts and activities of the first generation of knowledge management. The focus is on managing explicit and objective knowledge by means of technological applications, i.e. information and communication technology. A suitable technological infrastructure is designed according to the needs. Knowledge is codified which means it is extracted from people, stored by means of information technology and distributed to those who are in need of it. Thus at least explicit knowledge can be processed whereas this strategy neglects implicit knowledge. Common applications are intranets, databanks etc. The codification strategy is suitable especially for standardized products and processes. The activities of the codification strategy equal partly those of information management.

The goal of codification is the re-use of knowledge. The idea is to extract the knowledge from people and then store it. This approach is especially used by process-driven companies, which focus on documentation. One single investment into a knowledge asset is sufficient. The knowledge can be re-used over and over again. The extraction can be done by various means. Employees are sometimes asked to fill out forms or write reports about their work and the results. Debriefing can be used as well as lessons learned. Employees are interviewed and their knowledge is then stored. Combining the codification strategy with a process oriented approach the processes of an organization intend to codify the gained knowledge, to constantly build up a knowledge base with formalized content about specific tasks or problems. This knowledge base can then be used for the same process over and over again as well as for similar problems that may occur in future projects. The target is to learn from past events and approach current problems in similar ways. This acquired and stored knowledge requires some sort of classification in order to enable the retrieval of fitting knowledge according to the current needs. Furthermore the pursuit of more or less strict formalisms is important. The reported results can be difficult to find, if they do not follow the intended structure sufficiently. Templates for example, as seen in the case of the wiki in the first case study, help employees to understand where or how to enter their knowledge which simplifies its retrieval later. Hansen et al. (1999) explain that a competitive strategy, which would apply the codification knowledge management strategy, typically aims at providing high quality solutions that are reliable and specialized in a certain field. EY, formerly known as Ernst&Young used to pursue this strategy thus producing high-end solutions to a specific problem which could be used for different customers.

With regard to supporting IT systems it is essential that functions are provided that help to find the stored knowledge. This can be done by means of an effective search function or by categories, templates etc. Hansen et al. state that extensive investment in IT is essential as “the goal is to connect people with reusable codified knowledge” (Hansen et al. 1999, 4). As seen before the risk of this concept is a loss of creativity and innovation.

A knowledge management system that supports codification has to follow strict patterns with regard to usability and the way it deals with the involved knowledge. All employees are active users and access the system when the company’s processes expect them to. Guidelines define how to codify knowledge in order to simplify the access. It is

a challenge, however, to make sure that all users of a system understand and follow these guidelines. This may require monitoring of the activities to a certain degree.

3.3.2 Personalization Strategy

A second generation of knowledge management puts emphasis on a very different approach. People got into the center of attention. Applying the personalization strategy the exchange of knowledge between people is promoted on various levels. Knowledge is shared verbally, by collaboration or virtually with the support of information and communication technology which, however, has a supportive function only. Knowledge is communicated and passed on, not stored. The focus is on subjective knowledge which is bound to people. The advantage of this strategy is the possibility to manage both explicit and implicit knowledge. Particularly the expertise of highly qualified employees is externalized in order to keep it within the organization and render it usable for others. But the development of new knowledge is another important aspect. Communication structures, relations between people and networks are created and people are motivated to share their experience. Among the tools that are used there are meetings, teamwork, mentoring, communities of practice, yellow pages, knowledge maps or storytelling. The ultimate goal is the creation of a learning organization. The personalization strategy comes in useful especially for unique non-repetitive tasks. A challenge that derives from this strategy is the fact that knowledge is connected to people. Whenever someone leaves a company his knowledge is lost. Therefore countermeasures need to be taken in order to keep the knowledge in the organization. Auer recommends a model which he calls *Know How- Expertise- and Experience preservation (KEEP).* It is a method for preserving knowledge before an employee leaves the company (Auer, 2002). Experienced employees mentor junior employees which will benefit all persons involved as well as the organization.

> Erfahrene Mitarbeiter (Senior-KEEP-Mitglieder) stehen in einer Wechselbeziehung zu…ausgewählten Nachwuchskräften (Junior-KEEP-Mitgliedern). Durch den Austausch des menschengebundenen Wissens und aktuellstem Know How sowie einer zusätzlichen Arbeitsqualität profitieren alle Beteiligten, vor allem jedoch die Organization (Auer 2002).

Auers statement can be translated as:

> Experienced employees (Senior-KEEP-Members) interact with…selected junior employees (Junior-KEEP-Members). The exchange of knowledge that is

> connected to people and latest know-how as well as a higher work quality benefits everyone involved, above all the organization (own translation of Auer, 2002).

The method can be compared to mentoring programs. In this case, however, a mentor or senior member can act as a coach for several junior members from different branches of an organization. According to the degree of involvement in the program the operative workload of a senior member is reduced. Thus know-how and experience is passed on.

There is a close connection between the personalization strategy and the socialization strategy.

3.3.3 Socialization Strategy

The focus of the socialization strategy lies on the organizational expertise. Knowledge is considered a common good of a group of people that, by interacting, creates and develops knowledge. The main objective in this context is the construction and support of networks between people. Such networks can be communities of practice or communities of interest, for instance. An example of a consultancy that has shifted its focus from the codification strategy towards the socialization strategy is EY. A main task of their knowledge managers is the establishing and support of (virtual) networks between people. Especially the concept of virtual organizations is one of the latest strategies that have been developed in order to respond to the speed of information technology development (Larsen & Mclnerney, 2002). Virtual teams including knowledge workers are created. The challenge lies in the fact that a face to face interaction is not (always) possible. This might result in a poor performance. Members of virtual teams can be separated geographically. In fact they can even be located on different continents. In this case virtual teams face the challenge of distance and that of differences in time zones.

3.3.4 Process Oriented Knowledge Management

The process based approach embeds knowledge work into business processes. Basic assumption is that knowledge is already being used in every process yet not systematically. Therefore a systematic approach is the main objective.

Bodrow et al. describe processes as follows:

> Ein Geschäftsprozess ist eine Tätigkeit, die ein materielles oder immaterielles Produkt erzeugt. Er hat ein eindeutiges Ergebnis….Einem Zeitablauf, räumlicher Zuordnung, eindeutigen Inputs und Outputs: eine Struktur, die darstellt, wie Arbeit verrichtet wird….Verschiedene eingehende Informationen, Materialien oder sonstige Hilfsmittel werde benötigt und müssen einen Wert für den Kunden schaffen (Wertschöpfung)….Prozesse lassen sich durch das Hinzufügen von Wert an einem Produkt mittels Ressourcenverbrauch kennzeichnen. Man spricht erst dann von Geschäftsprozessen, wenn es sich um wiederholende und eindeutig abgrenzbare Abläufe oder Entscheidungen handelt (Bodrow, 2002, 13)

Bodrow´s definition of processes can be translated as follows:

> A business process is an activity that produces a material or an immaterial product. It has a clear result…a timing, spatial allocation, clear input and output: a structure that outlines how work is done…miscellaneous inbound information, materials or other tools are necessary and must create a value for the customer (value creation)…Processes can be characterized by adding value to a product by the required resources. They are referred to as business processes only if they are repetitive and unambiguously definable procedures or decisions (own translation of Bodrow, 2002, 13).

According to this definition processes meet certain criteria. They either create or add value to both tangible and intangible goods and products for potential customers. Processes consist of sequential activities that have an explicit input and a specific result. They structure work within a time, are iterative and can be distinguished clearly from other activities.

The *Fraunhofer IPK Referenzmodell* combines knowledge management activities with processes. Relevant knowledge is defined based on business processes. The existing knowledge is applied to the processes and new knowledge is created according to the needs of both internal and external clients. Knowledge intensive core processes are analyzed with regard to four of the core processes of knowledge management: knowledge creation, knowledge distribution, knowledge storing and knowledge application. According to Heisig et al. (2000, 4 ff) they form a closed process cycle and thus allow for a systematic handling of knowledge. The employee is at the center of all knowledge management activities and the potential for improvement results from gaps

in the cycle. Knowledge identification and acquisition play a less important role. In the following these core activities will be explained briefly:

Knowledge creation: includes both acquisition and creation of knowledge by oneself. Knowledge is acquired by means of counseling, recruiting, purchase of patents, cooperation and fusions, for example. Special focus is put on interdisciplinary project teams and lessons learned with regard to the integration of implicit knowledge.

Knowledge distribution: Heisig et al. emphasize the importance of developing a common language and common values that would enable and support the distribution of knowledge. Furthermore the distribution can be supported by information technology.

Knowledge preservation: Knowledge is stored in manuals, databanks reports, case studies etc. as well as in business processes and their respective descriptions.

Knowledge application: Several barriers need to be overcome in order to promote the application of knowledge such as the so-called “not invented here” attitude.

The frameset of Heisig et al. for knowledge management consists of the elements process organization, information technology, guidance systems, corporate culture, human resource management and controlling. Information technology needs to be adjusted to the knowledge intensive processes. Flat hierarchies and an open, cooperative style of leadership promote the readiness for sharing knowledge. This is part of the general corporate culture which has to encourage knowledge management activities.

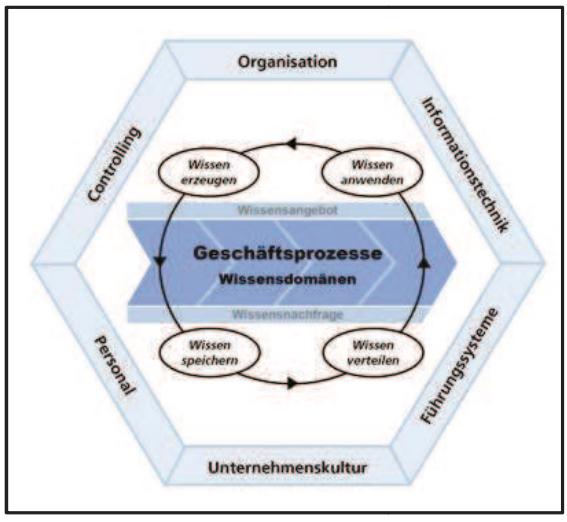


Illustration 3.5: Fraunhofer Reference Model of Process Oriented Knowledge Management (source: http://wissensmanagement.ipk.fraunhofer.de/leistungsangebot/prozessorientiertes-wm/ 07.12.2018)

Which tools can be used for process based knowledge management though? Practical solutions that add value are a powerful argument in favor of knowledge management activities. The execution of processes requires knowledge as seen. On the other hand knowledge can be derived from processes. A means of combining knowledge management activities with process descriptions is KMDL which stands for Knowledge Modeling and Description Language. It is based on process modeling. A simple example of process modeling can be seen in illustration 3.6.

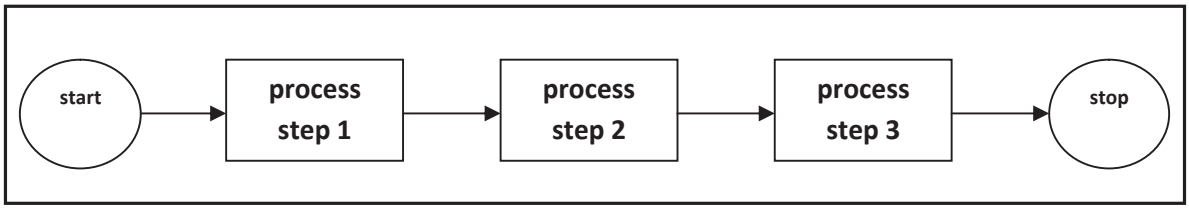


Illustration 3.6: Process Modelling (own representation)

KMDL

Gronau and Fröming (2006) extend process modeling by adding the four types of knowledge conversion as described by Nonaka and Takeuchi which are socialization, externalization, combination and internalization. The Illustrations 3.7-10 are based on their model to describe how knowledge conversion can add value to process modeling. They show how knowledge is processed and include people (Person A, Person B), knowledge objects, information objects, conversions and related actions.

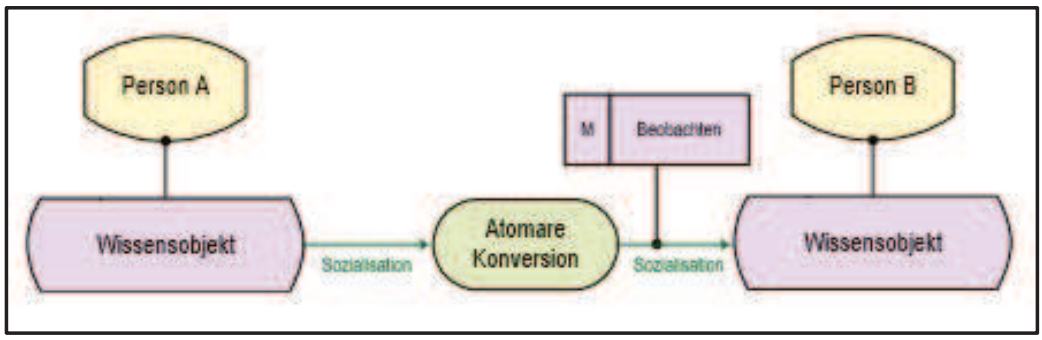


Illustration 3.7: KMDL - Socialization (source: based on Gronau & Fröming , 2006, 5)

The applied methods in illustration 3.7 are communication, observation, practicing and learning-by-doing. In illustration 3.8 the applied method is documentation. As knowledge is exernalized and documented it becomes an information object because it exists independent from people.

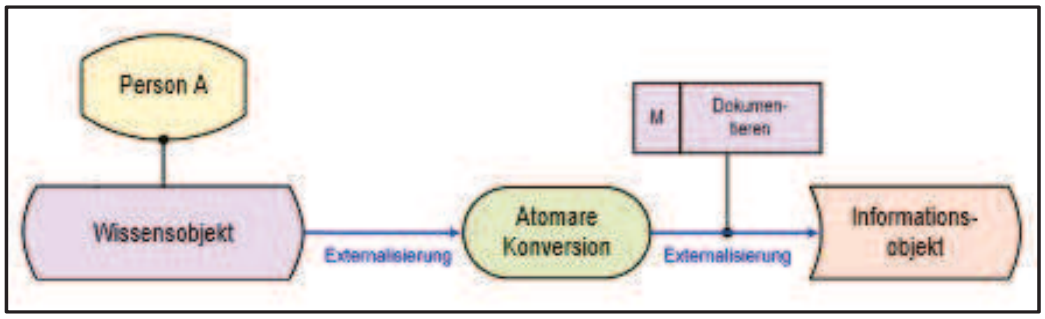


Illustration 3.8: KMDL - Externalization (source: based on Gronau & Fröming, 2006, 5)

The applied methods for combination are categorization, classification, aggregation, adding, deleting, exchange and integration. As knowledge remains independent from people information objects are converted into new information objects.

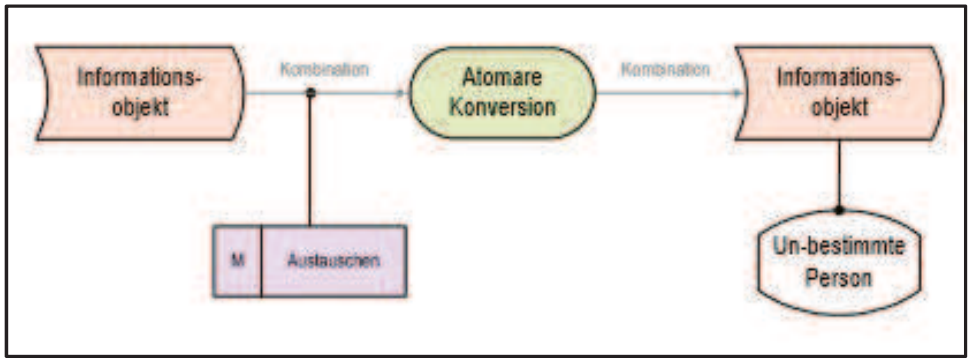


Illustration 3.9: KMDL - Combination (source: based on Gronau & Fröming, 2006, 5)

Illustration 3.10 shows how knowledge is internalized by reading, watching and listening in KMDL. In this process an information object is converted into a knowledge object.

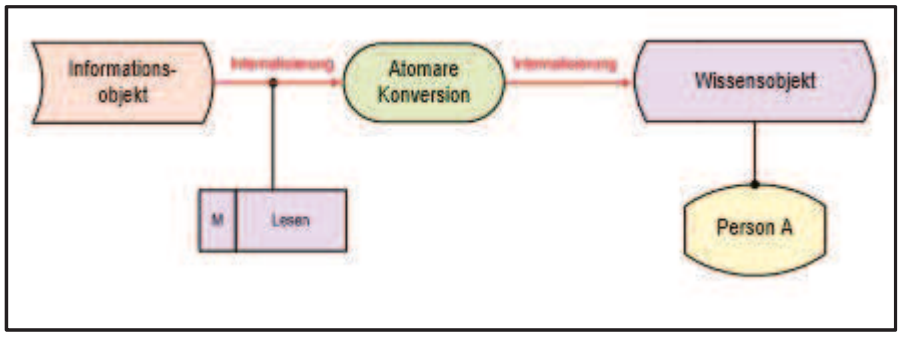


Illustration 3.10: KMDL - Internalization (source: based on Gronau & Fröming, 2006, 5)

In this context the distinction between knowledge and information is made according to the business studies approach. In the first example knowledge is passed on from one person to another by observation. In the second example Person A documents his or her knowledge thus creating an *Informationsobjekt* (information object) by means of externalization. In the third case information is combined and thus creates new

information which is available to any person (*Unbestimmte Person*). In the last example Person A reads information which thus becomes part of the knowledge of Person A. *Atomare Konversion* stands for exactly one input object and one output object.

In order to explain KMDL illustration 3.11 provides a helpful summary of all the objects and activities that are used.

In order to enable the modeling of knowledge intensive processes KMDL uses several perspectives. In this paper two of these perspectives will be presented. They are sufficient to understand what KMDL is about. These are called *Prozesssicht* (process view) and *Aktivitätssicht* (activity view). *Prozesssicht* illustrates the tasks, roles and tools. The tasks consist of activities and roles and tools that are used to fulfill the tasks are allocated to them. A task represents the processing of individual process steps. Every task has an agent that is responsible for it

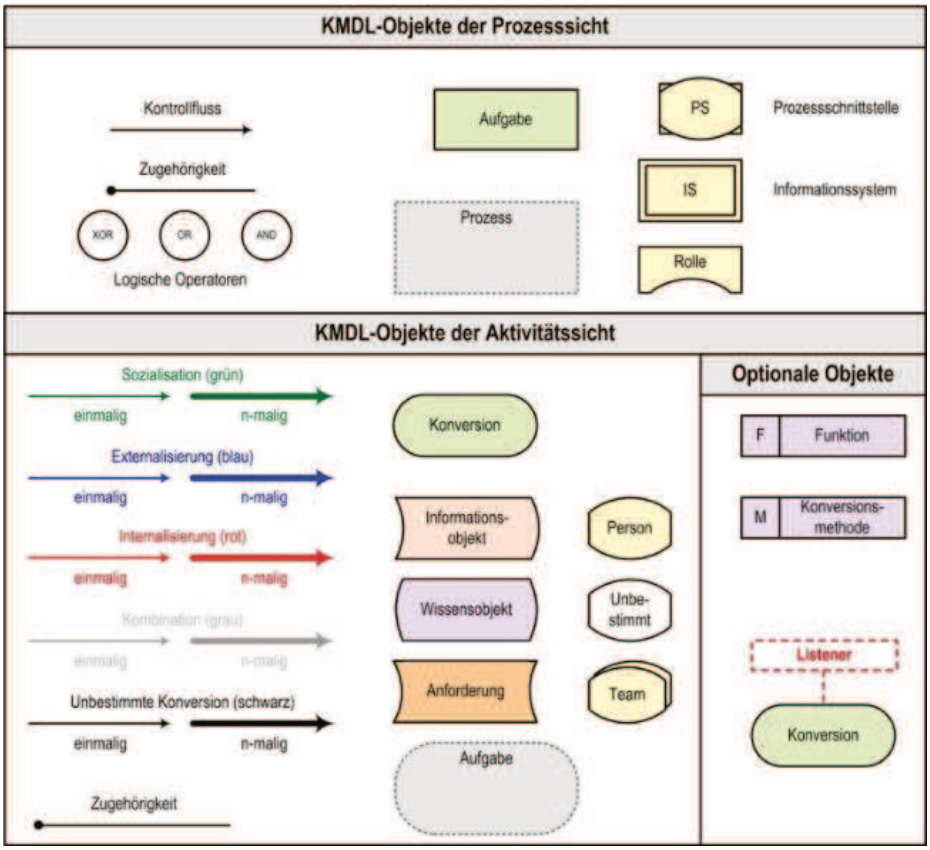


Illustration 3.11: Summary of KMDL Objects (source: http://www.enzyklopaedie-der-wirtschaftsinformatik.de/lexikon/daten-wissen/Wissensmanagement/Wissensmodellierung/Modellierungsmethoden/Knowledge-Modeling-and-Description-Language, 03.04.2018)

In illustration 3.12 “Klaus” and “Petra”, for example, are responsible for editing the article. The tool they are using is MS Word. “Sekretariat” is responsible for planning the journey (Reise planen) and “Professor” is responsible for review and approval (Review und Abnahme). The tools that are used for this task are MS Excel and Adobe. All kinds of information technology would qualify as a tool. Process interfaces (and) merge sub-processes to whole process chains. The focus lies on knowledge intensive processes. (Gronau & Fröming, 2006, 354f)

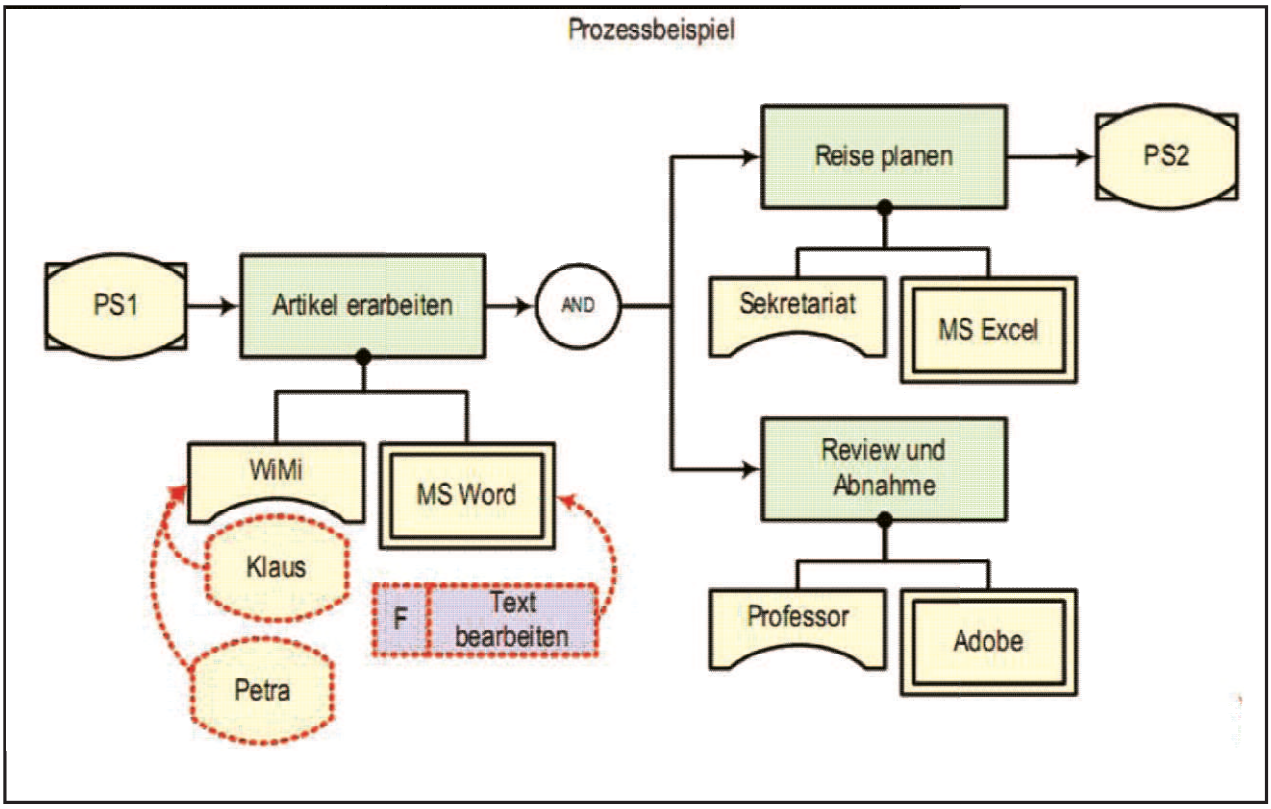


Illustration 3.12: KMDL *Prozesssicht* (source: Gronau & Fröming, 2006, 15)

The tasks of *Prozesssicht* are described in further detail by means of objects. These can be information objects, for example text, diagrams, electronic documents of all kinds etc. or knowledge objects that represent knowledge of one or several persons. This includes both explicit and implicit knowledge. Conversions require input and output. They describe the creation, application and distribution of information and knowledge objects. The requirements for realizing a conversion are defined by the graphic object *Anforderung* (see illustration 3.11). The type of conversion is clearly defined by input and output .*Anforderung* or requirements can be met by people, represented by the graphic object P*erson* and functionalities of information systems, represented by *Informationssystem*. Instead of *Person* (people), *Team* (team) or *unbestimmt* (undefined) can be used in cases where a whole team is responsible or when the object is still

unknown. People and teams are knowledge carriers to which knowledge objects are allocated. The graphic object *Konversion* (conversion) which becomes important at the *Aktivitätssicht* level defines how the conversion is executed. In illustration 3.13 that would be the generation of an idea for the article for example (Artikel generieren). Additional information is possible in KMDL. *Funktionen*, for instance, describes the functionalities of a tool that is used. So-called *Listener* (red dashed line) define additional requirements and restrictions of conversions. In the example of illustration 3.13 a condition defined by a *Listener* is that the idea has to be written down and separated into different paragraphs with MS Word. (Gronau & Fröming, 2006, 354f)

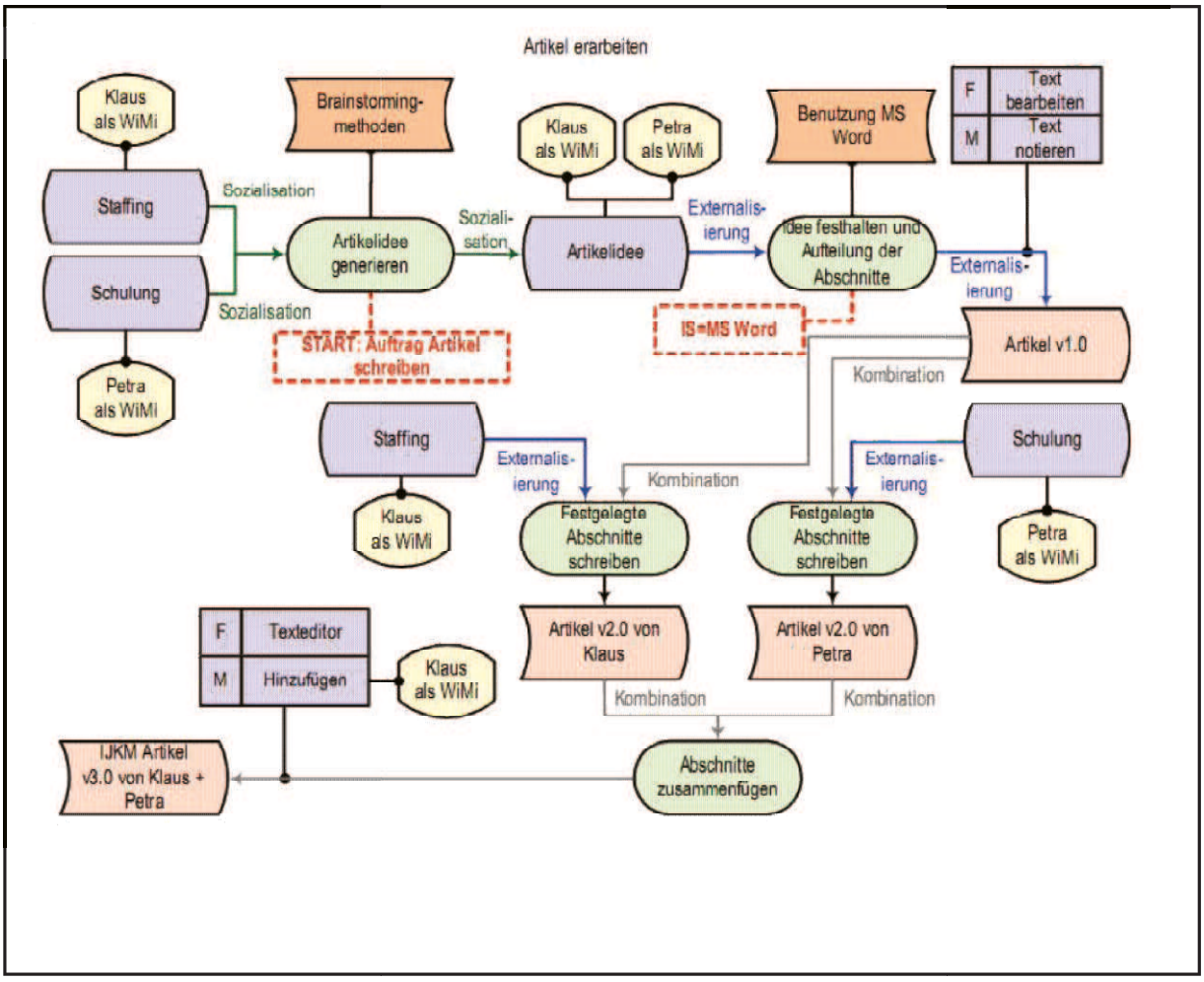


Illustration 3.13: KMDL *Aktivitätssicht* (source: Gronau & Fröming, 2006, 15)

Aktivitätssicht is the core of KMDL (Pogorzelska, 2009, 27) Knowledge conversions within business processes are described on a granular level (http://www.kmdl.de/de/node/94 25.04.2018). Pogorzelska recommends the use of the *Aktivitätssicht* only for knowledge intensive processes due to its complexity (Pogorzelska, 2009, 27 ff). There are various types of conversions. Conversion takes

place between information objects and knowledge objects. They have an input and an output. The types of conversions are defined by the numbers of input and output objects. As seen before *Atomare Konversion* has exactly one input and one output object. *Complex conversions* have either several input objects and one output object or one input and several output objects. This allows for the modeling of more complex activities. Generating the idea for an article could be the result of a combination of socialization as seen in illustration 3.11 and internalization by reading a book or paper on the topic, for example. In this case there would be two input objects. If there are several input and output objects conversions are referred to as *abstract conversions.* This is the case whenever used information and knowledge objects cannot be matched with the generated information and knowledge objects. Based on Nonakas and Takeuchis definition of knowledge conversion, KMDL uses socialization, internalization, externalization and combination depending on whether input or output is a knowledge object or an information object. KMDL also allows for further undefined types of conversion. With regard to methods of knowledge conversion Pogorzelska (2009, 34) describes the following systematization.

Conversion type	Methods
Socialization	• observation of the actions of others • practicing (learning by doing) • communication
Internalization	• perception of sensory impressions (seeing, reading, hearing etc.) which leads to learning
Externalization	• documentation
Combination	• classifying • adding • aggregating • categorizing • integrating etc.

Table 3.1: Conversion Types in KMDL (source: based on Pogorzelska, 2009, 34)

KMDL comes in useful whenever knowledge conversions are to be identified within complex processes. In both case studies KMDL was not used, however, it might have helped to increase awareness and understanding of what methods and tools of knowledge management would have been helpful based on the existing processes. Therefore KMDL can be a valuable tool in the process of creating a knowledge landscape. It helps to identify existing knowledge, knowledge conversions and appropriate methods for conversion types.

3.3.5 Reasons for a Process Oriented IT Organization

A process oriented IT organization is more than just an office routine organization. Among the main objectives customer satisfaction often plays an important role. Process orientation improves the flexibility of an IT organization with regard to the customer´s requirements. The focus lies on activities which generate an added value and are, therefore, honored by customers. Administration and coordination are facilitated. A precise assignment of responsibilities for specific processes is required as well as means to measure whether process objectives have been achieved (Kresse & Bause 2001, 62).

In order to optimize the benefits of knowledge management it needs to be integrated into the value creation chain of a business, according to Bodrow et al. Therefore, they suggest that the consideration of business processes is essential for a functional knowledge management.

> Um einen optimalen Nutzen zu erhalten, muss Wissensmanagement näher an die Wertschöpfungskette des jeweiligen Unternehmens gebracht werden. Deshalb haben die Geschäftsprozesse für Wissensmanagement eine so große Bedeutung. Nicht der Besitz von Wissen ist dabei entscheidend, sondern die Verwendung in den Prozessen (Bodrow et al., 2002, 13).

This argument can be translated as:

> In order to achieve an optimal benefit knowledge management must be connected closer to the value chain of the respective company. Therefore business processes are of great importance for knowledge management. It is not the possession of knowledge that is significant but its use in processes (own translation of Bodrow et al., 2002, 13).

This corresponds with the emphasis that Probst et al. put on the use of knowledge (Probst et al., 2006, 174ff).

For all these reasons it can be said that the process based or process oriented knowledge management approach can be of substantial value especially when trying to convince responsible decision makers in a company or organization in favor of knowledge management.

3.4. Learning Organization

As seen before the organizational aspect is of special importance for knowledge management. A learning organization develops by means of systematic learning and is more capable of responding to changes. According to Senge (1999, 11) a learning organization is characterized by peoples` readiness to continuously develop new abilities and to reach their goals. New ways of thinking are encouraged and people learn how to learn with each other. Probst et al. define organizational learning as a change in the organizational knowledge base (Probst et al. 2006, 23). The organizational problem-solving skills and general competence is improved. They distinguish organizational learning from knowledge management. While organizational learning is about learning processes, knowledge management is an intervening management tool. Corporate culture is an essential success factor for a learning organization as well as for knowledge management. It is one of the key contributing factors to the willingness to change in an organization (Best & Weth, 2003, 155f). As human behavior is often based on emotions and rather unreliable compared to technology, for instance, it is more difficult to manage. This needs to be considered and corporate culture must support more readiness to support organizational changes. This includes the overcoming and reduction of fears, for example.

Panhans mentions the following characteristics that members of an organization should have or develop (Panhans, 2004, 45):

- trust in both organization and colleagues
- strong communication skills
- self-confidence
- critical thinking and the certainty that critical thinking is allowed
- conflict resolution competence
- sense of belonging

- the ability to make decisions

For many airlines, for example, just culture is an important part of the corporate culture. Errors are not punished as long as they are not made intentionally or due to severe negligence. This encourages a reporting culture which allows an airline to evolve continuously, resulting in ever higher levels of safety and security.

The readiness to share knowledge must become an integral part of corporate culture. This would be the starting point of all other knowledge management activities and only then does it make sense to think about a strategy and the implementation of knowledge management tools which is, of course, based on requirements. The next chapter will introduce a variety of knowledge management tools the range of which will demonstrate how diverse knowledge management is.

4 Knowledge Management Tools

In the course of time a wide range of tools has been developed for knowledge management. At the same time already existing methods have been fitted to the needs of successful knowledge management such as change management, for example. Among these tools there are technical applications as well as social methods. With regard to the implementation of knowledge management tools and social software Gust von Loh and Peters express a warning when they write:

> Die Einführung von Wissensmanagements-(tools) im Allgemeinen oder von Social Software für das Wissensmanagement in Unternehmen kann bei Mitarbeitern und Unternehmensführung…auf große Skepsis stoßen [Fi09]. Diese Skepsis bzw. das Unverständnis für den Sinn und Zweck solcher Maßnahmen kann dazu führen, dass die Einführung von Wissensmanagement scheitert, da die von top-down eingesetzten und meistens technischen Werkzeuge intern und extern nicht angenommen und schlicht ignoriert werden [HV99] (Gust von Loh & Peters, 2011, 77).

In English this means the following:

> The implementation of knowledge management (tools) in general or of social software used for knowledge management in a company might encounter great scepticism among employees and company management [Fi09]. This scepticism or rather the incomprehension of the purpose of such measures can result in the failure of the implementation of knowledge management because the mostly technical tools that are implemented top down are not accepted, neither internally nor externally, but are simply ignored [HV99] (own translation of Gust von Loh & Peters, 2011, 77).

Knowledge management and respective tools should not be enforced upon employees top down. In the first case study people often spoke of *Zwangsbeglückung,* meaning that in the past applications had been enforced that had a poor usability and were rejected. This was to be prevented. While Gust von Loh and Peters suggest an evidence based approach to overcome resistance this thesis focuses on service management and the creation of a knowledge landscape.

In the following a survey of the tools will be given distinguishing between social tools and concepts that require human interaction on the one hand and technical tools on the

other. Sometimes a clear distinction is difficult, however, because in some cases social methods are supported by technology. Lessons learned, for example, are usually saved in a digital data bank and human interaction is an integral part of the use of Web 2.0 applications.

Before knowledge management is implemented it comes in very useful to get an idea of the needs of both company and employees. Therefore the survey will begin with a choice of methods to determine these needs or requirements.

4.1 Involving the Employees – Determination of Information Needs

All efforts to implement knowledge management are in vain if the employees do not support the process and refuse to use the provided knowledge. The motivation to support the necessary activities can be improved if they are involved in the development of the strategy and if the operational realization fits in with their needs and wishes. An analysis of the companies' information needs in general (objective information needs), and those of the employees in particular (subjective information needs) can be helpful. Employee attitude surveys are quite common. They have become a strategic management tool. The analysis of information needs focuses on people instead of applications. Employees usually want to be integrated and expect to have a say in work related matters (Domsch & Ladwig, 2006, 4; Hey, 2006, 62). If their opinion is taken into consideration and if that can be seen in the decisions of the management the satisfaction and identification with the company can be improved resulting in a higher motivation of the employees to perform well in their job. (Hey, 2006, 61)

The airlines of the case studies, too, have a so-called Employee Feedback Management. The employees are interviewed by means of a questionnaire concerning various aspects of their work and their attitude towards the company. This includes questions about the degree of identification with the company and satisfaction with the work situation. Other aspects deal with the satisfaction with the information employees get. The Employee Feedback Management is a standardized process according to an industrial standard and it is seen as a dialog between the management and the employees of the group. The intention is the consideration of the individual employees´ opinions, wishes and needs. The necessity to embed an internal feedback process on the strategic level along with accompanying communication of the process is emphasized. The questionnaires are evaluated by an external agency and the results are presented to and discussed with the employees. Thus changes can be initiated and their progress be

monitored by following surveys. Before a concept for knowledge management was developed the employees of the information management department in the first case study were interviewed about their understanding of knowledge management and their expectations. Their information needs were determined with the help of a questionnaire.

Gust von Loh is of the opinion that questions about the working atmosphere are to be integrated into questionnaires for analysing information needs. Especially the objective information need concerns all employees. The exchange of information can be promoted by a positive working atmosphere (Gust von Loh, 2009, 132).
Many big companies have standardized internal systems for employee feedback. Thus they can be conducted on a regular basis. Especially in smaller companies or single units of an affiliate group such as the information management department of the airline of the first case study, an analysis of the information needs helps to develop a customized solution for an effective knowledge management. Even when knowledge management is implemented group wide it is possible to determine which aspects of a knowledge management system may be relevant for specific departments. An analysis of information needs may include expectations in information systems, applications, processes such as distribution or storing of information and content. According to Gust von Loh an analysis of information needs is the empiric basis of the implementation of knowledge management (Gust von Loh, 2009, 133).
An important objective of an analysis of information needs is the revelation of the strengths and weaknesses of internal communication. On a normative level the corporate culture is to be developed towards enabling and promoting knowledge management. The importance of subjective information needs compared to objective needs must be understood. Ideally the subjective information needs are aligned with the objective information needs of the entire organization. A positive side effect will be the unification of subjective information needs.
Koreiman gives a general definition of the term *Informationsbedarf* (objective information need). According to his definition *Informationsbedarf* includes the type, the amount and the quality of information that a person needs to fulfil tasks in a given time frame, respectively the total of all information which is necessary for illustrating a process or a problem. The analysis of information needs includes all methods and means that are applicable for determining all the information which is necessary for the tasks and challenges in an organization (Koreimann, 1976, 65).

Concerning the information need in a business environment there are some expressions the meaning of which should be clarified first. They all describe different aspects that must be considered when speaking of the level of information in an organization. Among these there are objective information needs, subjective information needs, information supply, level of information, information demand and creation of information needs (Gust von Loh, 2009, 135ff.).

The objective information needs or information requirements derive from all the duties, responsibilities and tasks in an organization. Therefore, they are relative independent from people. They exist in the context of labour situations. The objective information needs depend on the character of an organization and its market environment. Examples are customer information, product information, cultural information, market information etc.

The subjective information needs on the other hand are connected to people. The individual employee needs information to be able to do his work according to his attitude and behaviour on the one hand (Szyperski, 1980, 907) and his experience and the way he becomes acquainted with new topics and procedures on the other (Mujan, 2006, 26). However, the borderline between objective information requirements and subjective information needs is somewhat blurred and information requirements are not completely independent from people. While subjective information needs are individual needs of every employee objective information requirements are defined by decisions made by the management concerning business culture and business strategy.

In order to be able to analyse information needs it is essential to look at the original conditions. An analysis of the information supply helps to uncover informational gaps. The information supply is the information that exists at a given point in time which can be used by the employees. It includes information held by the company and information that is available on the information market. A repeated variance analysis improves the awareness of actual and future information gaps and helps to overcome them.

According to Gust von Loh (2008) the level of information describes the part of the information supply where the subjective and the objective information needs overlap. It is the ideal situation and has to be brought forward.

The information demand is connected to the subjective information needs. Demand emerges from personal wishes and needs.

Mujan has introduced another aspect; the creation of information needs (Mujan, 2006, 33). Information marketing helps to generate subjective information needs in individuals. In the context of the first case study marketing measures were taken to promote a wiki in other departments. Other marketing measures were taken to motivate the employees to use the wiki when statistics were published that showed that wiki articles were read frequently by colleagues thus implying the usefulness of the contained information. This way a subjective need for the information found in the wiki was created and promoted.

Gust von Loh suggests that knowledge management has a positive effect on the level of information:

> ….Das Informationsangebot wird dem Bedarf, sowie – soweit mit dem Bedarf vereinbar – dem Bedürfnis angepasst, womit einhergeht, dass das Informationsbedürfnis besser befriedigt wird. Die Bedarfserzeugung nimmt durch ein besseres Informationsangebot ab. Sie ist nicht mehr notwendig. Der Informationsstand und auch die Informationsnachfrage erreichen ihr Optimum, wenn ein passendes Informationsangebot vorhanden ist (Gust von Loh, 2009, 137/138).

By this Gust von Loh means the following:

> The range of information is customized to the requirements and – provided that compatibility with the requirement is given – to the subjective needs which leads to a better satisfaction of the subjective information needs. The creation of requirements is reduced by a better range of information. It is not necessary anymore. Both level of information and demand of information reach their optimum if an appropriate range of information is in place (own translation of Gust von Loh, 2009, 137/138).

This shows that an essential goal of knowledge management activities should be the adjustment of the information supply to the information requirements.

Information needs should be surveyed before a knowledge management system is implemented or whenever major changes are being planned.

4.1.1 Approaches to the Analysis of Information Needs

The approach of Strauch and Winter (2002, 371ff) is about an information need analysis in a data warehouse. Current state and target state are compared thus deducting the information need. They distinguish at least three different approaches to the analysis of information needs.

- **Demand-oriented approach:** the subjective information need is identified. This approach focuses on the employees whose task it is to figure out what information they need. It is doubtful that they are capable of doing so let alone will they know about new developments. If information needs become too subjective it becomes all the more difficult to satisfy them and the desired congruence between subjective and objective information needs is impeded.

- **Supply-oriented approach:** the existing information systems are analysed. The users are excluded. This may result in problems with the acceptance of the system by the employees.

- **Process-oriented approach:** This approach is based on the data that is connected to the processes in an organization. Thus the objective information needs are taken into consideration yet not the subjective information needs.

Gust von Loh comes to the conclusion that each individual approach is insufficient and that only a combination of all three will provide satisfactory results (Gust von Loh, 2009, 139). This was validated in the first case study where information needs were determined based on both subjective information needs, an analysis of existing systems and existing tasks and processes.

4.1.2 Methods of Analysing Information Needs

In order to provide users with the desired functionalities and information in an information system an analysis of objective information needs, or requirements, and subjective information needs is essential as part of the process of designing a system. It must be distinguished between requirements regarding information and knowledge and requirements with regard to information systems. Requirement engineering is a practical method for collecting requirements for information systems. However it can also be applied to non-technical requirements regarding the desired knowledge base.

Requirement Engineering

Requirements can be defined as follows:

> 1. Constraints, demands, necessities, needs, or parameters that must be met or satisfied, usually within a certain timeframe.
>
> 2. Marketing: A standard of benefit, cost, timeliness, and value of a product or service as expressed or perceived by a customer. (http://www.businessdictionary.com/definition/requirements.html 01.12.2018)

Requirements are essential for a person or a system to reach an objective. The importance of requirement engineering is shown by a survey from 1995 made by the Standish Group. IT executive managers had been asked about the most important factors for successful projects. Among these there were user involvement with 15.9%, executive management support with 13.9% and a clear statement of requirements with 13%. On the other hand the managers considered incomplete requirements and specifications (12.3%) and changing requirements and specifications (11.8%) as major challenges for the success of a project. Asked for failure factors incomplete requirements even ranked first with 13.1% (Standish Group, 1995, 8ff).

Kotonya and Sommerville describe requirement engineering as the totality of all activities for retrieving, and managing all requirements for an information system and their documentation. The term also implies the systematic application of repetitive techniques which grant that requirements are relevant and determined completely and consistently (Kotonya & Sommerville, 1998, 6). A challenge lies in the frequent necessity to consider the technical features of an information system (Kotonya & Sommerville, 1998, 7).

Pohl has developed a framework for requirement engineering which can be seen in illustration 4.1. The German terminology that he uses is given in brackets. It includes the system context (Systemkontext), the core activities (Kernaktivitäten), requirement artifacts (Anforderungsartefakte), validation (Validierung) and management.
Validation and management are cross-cutting activities. The system context includes the general conditions of an information system and the gathering of requirements which can be divided into the work based object facet and utilization facet (Gegenstandsfacette, Nutzungsfacette) and technical requirements described by IT system facet and development facet (IT-System-Facette, Entwicklungsfacette), (Pohl 2008, 211ff). It describes the four software facets that are essential due to the complexity of software intensive systems.

The object facet describes that software intensive systems map objects and events from their context by saving and processing information about them. A wiki software for example can map the object „user“. The object facet includes all objects and events the system needs to take into consideration. The utilization facet includes all aspects that are relevant for the use of the system by people or other systems. Among these there are utilization processes or usability. The IT system facet is about the integration of IT systems that are to be designed into already existing systems and the interfaces that are necessary. The development facet describes all aspects that have an impact on the development of a system. An example would be the reliability (fit for use) and security of the system.

Among the core activities there are the retrieval of existing and possible future requirements, documentation and compliance between individual requirements in order to avoid inconsistencies. By *Anforderungsartefakte* (requirements artifacts) Pohl describes the results of the core activities i.e. documented requirements which have been transformed into objectives, scenarios and goal-oriented requirements (Pohl 2008, S. 39).

According to Pohl the management is responsible for the administration and categorization of all requirements and for their prioritizing. By the term *Validierung* Pohl means all activities that match the functionalities of an information system with the requirements that are made on it which helps to improve the usability of an information system. A better usability promotes the acceptance of a system. The first case study has revealed that the analysis of requirements can help to customize an information system according to the processes that are part of the everyday work. Requirement engineering hence comes in useful with systems that are used for managing knowledge. The focus of requirement engineering lies clearly on objective information needs respectively information requirements with regard to IT systems. The management monitors and steers the entire process. As seen before, subjective information needs need to be considered as well in order to increase the acceptance for an information system. Therefore, in the following methods for the analysis of subjective information needs will be presented and then combined with the rather technical method of requirement engineering.

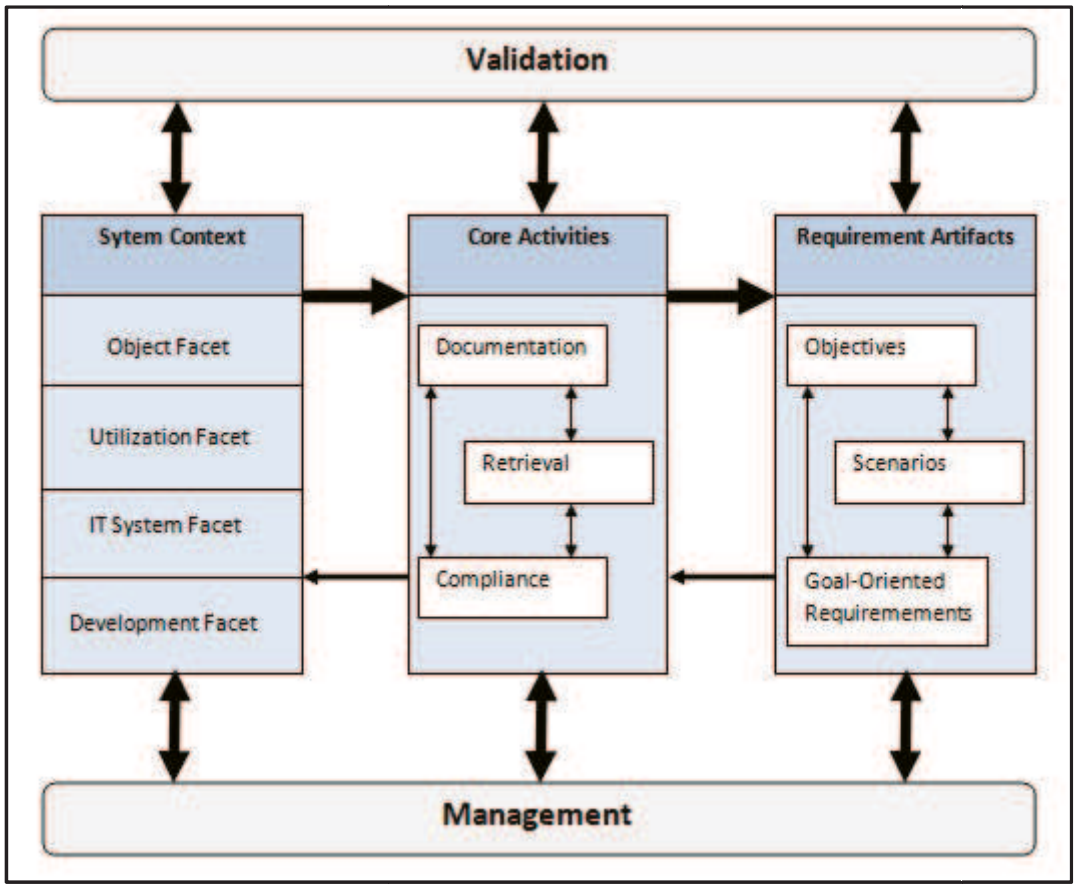


Illustration 4.1: Framework for Requirement Engineering (source: based on Pohl, 2008, 39)

How to Analyse Subjective Information Needs

If knowledge management activities are seen as services and the employee as a customer it is essential that the knowledge manager as the service provider surveys and considers individual subjective information needs. Only thus solutions can be customized to the degree that the employees fully accept them. Among the major challenges there are compliance between the individual information needs and the choice of the appropriate methods respectively applications to meet them. Furthermore subjective information needs need to be brought into agreement with the general information requirements of an organization. There are well established means to survey subjective information needs. Two of the most prominent and efficient methods are interviews and questionnaires respectively a mix of both.

An information need analysis can be described as a process that requires and produces knowledge, too. Illustration 4.2 shows the process as it was executed at the information management department of the first case study. At the end of the process the option is given to repeat it all over (Gust von Loh, 2009, 139) or end it depending on whether the results are satisfactory or not. In many cases the analysis of subjective information

needs is a repetitive process. In this special case the process ended with the realisation of the action plans however. The integration of further information needs became part of demand management and quality management.

First of all a sense of urgency for knowledge management activities was created. Thus the project team was able to influence the information needs of the employees in the department. By creating or promoting the awareness that knowledge management activities would facilitate work and solve existing problems. The actual state was communicated and objectives were defined. Then the individual teams were asked to think about and to identify existing knowledge management activities in their teams. A questionnaire was developed and sent to each individual via e-mail. In informal meetings the questionnaire was supplemented by interviews with chosen key players such as team leaders, for example. The response rate was high and the answers were analyzed and subsumed. At this point Gust von Loh recommends the deduction of need for action (Gust von Loh, 2009, 139). This was done in a meeting where the results were presented to the team leaders and the management. The last step of the information need analysis was the realisation phase (Gust von Loh, 2009, 139). The questions of the questionnaire concerned not only wishes and expectations with regard to knowledge and information systems but furthermore the general understanding of the importance of knowledge and knowledge management. On the one hand this enabled the project team to examine possible information systems and to determine whether or not those systems met the expectations of the future users. On the other hand decisions could be made about knowledge management activities and objectives based on the expectations towards knowledge management. Further meetings and workshops were organised where additional requirements could be made. This was necessary in the context of demand management whenever challenges during the process of implementing the knowledge management activities were encountered. It became clear that the analysis of information needs is an important aspect of quality management as well.

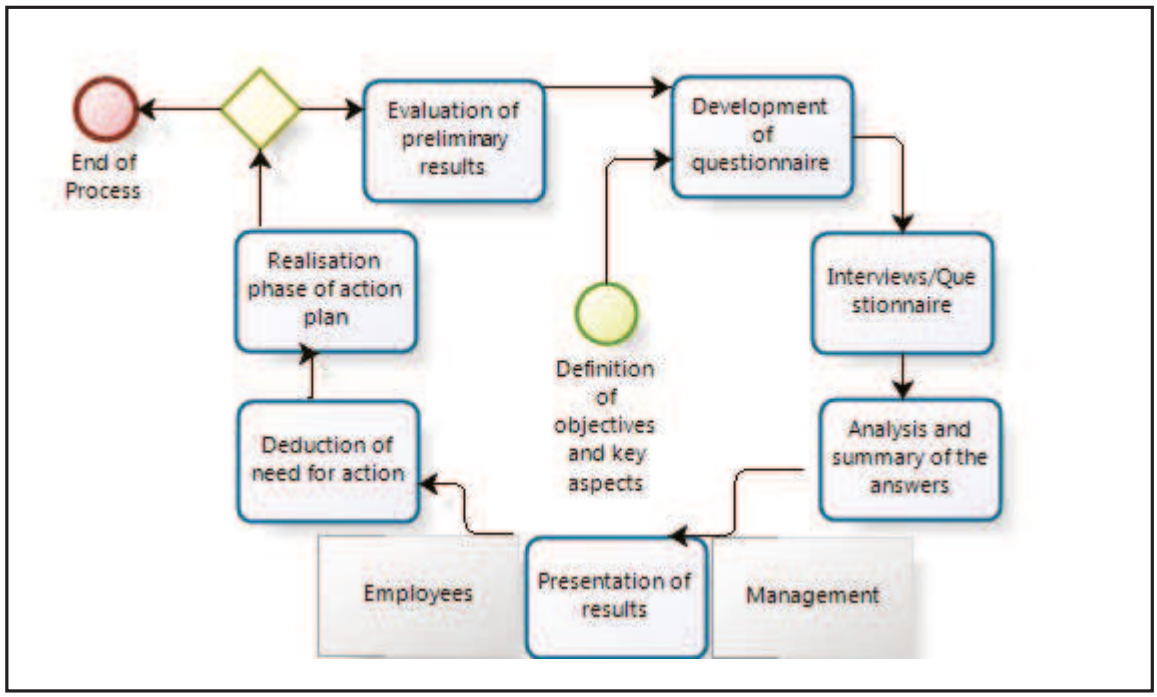


Illustration 4.2: Information Need Analysis (source: based on Gust von Loh, 2009, 139)

According to the concepts of service management information must meet a defined quality standard.

Gust von Loh mentions several areas which can be covered by an information need analysis. Among these there are: corporate identity, critical success factors, social relations, leadership, productive efficiency, work environment, task design, human resource development etc. (Gust von Loh, 2009, 139). In the first case study the focus was clearly on critical success factors, productive efficiency, information systems, work environment and task design respectively work processes. Special attention was paid to the quality of information and information systems. The main objective of an information need analysis is to find out about opinions and attitude of the employees. There are several methods which can be used. Most prominent are questionnaires and interviews. Further methods are observation, document analyses or organizational analyses (Gust von Loh, 2009, 140). Both subjective and objective information needs can be determined in meetings and workshops, too. Wishes can be uttered and recorded in writing. Especially in such an environment compliance between information needs can be reached which prevents that in the end various individual wish lists exist which cannot be fulfilled all at the same time (Gust von Loh, 2009, 140). Self-recording is recommendable as a preparation for meetings, for example. Another possibility is to determine one person who is responsible for the recording of information needs mentioned by the colleagues.

It is possible and comes in useful at times to combine several methods. Whatever method is used though, it is essential to involve the staff council. At the airline of the first case study a questionnaire was designed and then combined with interviews. In the following questionnaires and interviews are explained in detail.

Questionnaires can be distributed by mail, e-mail, on intranet pages or be handed out personally. They exist both in paper form and digital form. A distinction can be made between open-ended questions and closed-ended questions. Open-ended questions require more consideration from the respondent because no options for possible answers are given. Closed-ended questions give two or more options to choose from. They safe time when it comes to answering the questions and evaluating the answers, however, there is a risk that the designer of a questionnaire thus influences the results by giving only desired options. With open-ended questions it is important to consider the choice of the language that is used. Less ambiguity produces more valuable results. Special types of closed-ended questions are continuous questions where the respondent is presented with options of a continuous scale. The return rate can be a major problem.

Interviews: a major advantage of interviews is that information is retrieved directly. A return rate is no concern. As shown in table 4.1 there are various types of interviews. Structured interviews could be preferred when the interviewer is not well grounded in the topic of the interview. As no special skills or knowledge is required structured interviews are considered cheaper, faster and more effective (Beatty, 1995 147ff). The term standardization describes the predetermination of the course of the interview. Each interviewee is asked the same questions. Therefore, the answers are comparable to that of any other interviewee. Standardized interviews aim at avoiding disturbing factors as far as possible. Usually, however, not all bias can be eliminated, which is why one should at least try to keep it constant. In standardized quantitative surveys, this means that the wording of all questions and response items is identical for all respondents.

Furthermore, the sequence of the questions is specified exactly and the social situation should be constant in every interview (Houtkoop-Steenstra, 200, 2f). Standardization aims at comparability of results as an important prerequisite for generalization and representativeness of the whole survey.

	Structured Interview	Semi-Structured Interview	Non-Structured Interview
Wording of Questions	fixed	partly fixed/partly free	free
Order of Questions	fixed	general structure is given	free
Previous Knowledge with regard to Content	profound	medium	very basic
Terminology	consistent	largely consistent	inconsistent
Knowledge of Interviewer	very basic	medium to profound	profound

Table 4.1: Types of Interviews (source: based on Fank, 2001, 249).

Quantitative surveys are able to produce results that are considered representative for the part of the staff that participates in the interview. It is sometimes suggested, however, to slightly reword questions to clear up misunderstandings (Beatty, 1995, 149). One of the main objectives of structured interviews is the elimination of the interviewer as a source of error (Groves, 1989, 358).

Unstructured or non-standardized interviews have no interview schedule. There is just a list of topics that are to be covered. The interviewee is free to speak openly. Questions can be phrased as the interviewer wishes and can be asked in any order. Discussion usually begins as a general conversation. The interviewers can provide prompts and can join in the interview by discussing what they think of the topic themselves. It is recommendable to create a friendly relaxed and informal atmosphere. The unstructured interview is the most common form of qualitative interview and is used mostly for exploration in fields with little previous research. Profound skills of the interviewer are required for a non-structured interview. This requires a specific training. The problem is that results are too unpredictable and too little representative for a scientific context. Besides, a large amount of bias is produced. The outcome of a subjective information

need analysis, however, is the basis of further decisions. As mentioned before the result should not be a simple wish list but well-considered and comparable information needs.

Semi-standardized interviews are the most common form of interviews in an analysis of subjective information needs (Gust von Loh, 2000, 143). They allow for flexibility with regard to the wording and order of questions. Open-ended questions and closed-ended questions can be used likewise. In the course of the interview it is possible to change questions or even add new ones according to the answers of the respondent. Before the interview a general structure such as a questionnaire is elaborated. The questions should be related to the work processes in an analysis of subjective information needs and open-ended questions should be preferred in order to allow the interviewee to consider and express his actual needs. In case the answers are too long and complex they can be subsumed later when they are analyzed and evaluated.

Whatever method is used it will fail if the employees are not willing to cooperate. Therefore, it is important to involve them right from the beginning by communicating the necessity of an analysis of their subjective information needs. If they realize that an analysis will result in an improvement of their work condition and that they are getting a chance to have some influence on the process they will be more ready to support it. An early announcement also enables the individual employee to reflect their work environment and conditions which will result in more elaborate and useful answers.

In order to prevent an excessive amount of results it is essential to start a subjective information need analysis with a survey of the current state. This requires profound knowledge of the organization and the work processes. Gust von Loh suggests representing the current state by means of a knowledge map including both knowledge sources and assets (Gust von Loh, 2009, 145). The current state can then be considered when a questionnaire or a concept for an interview is designed. The results of the interrogations show the target state. The next step is to determine a representative number of employees. They can be chosen from all employees of the organization or department depending on where exactly knowledge management activities are intended to be implemented.

After a subjective information analysis it is important to both communicate the results and to use them. They can be published on the intranet for example or in internal magazines. In the first case study they were communicated via e-mail and in a workshop which was organized in order to discuss the further course of action.

According to Gust von Loh a workshop has the great advantage that the employees are once more involved in the process (Gust von Loh, 2009, 145). In the context of change management the communication and discussion of results promotes the understanding of measures that are taken. Furthermore future surveys will be of higher acceptance if the employees know that they provide an added value. During the process of implementing knowledge management new subjective information needs may arise. This may occur due to the fact that certain aspects are not fully understood in the first place and employees only become aware of them when they are confronted with them. An example could be the authorization scheme of a wiki. In the first case study the employees first wished for an open authorization scheme. This means that every member of the department was able to read and edit any article and also that every employee of the whole affiliate group was able to read every article in that wiki. It took a while before those, working with the application, realized that even the group management was able to read everything someone had written. Therefore the concept for a new authorization scheme was put on the agenda of a workshop. Another example of the same case study is the utilization of implicit knowledge. The results of the interviews showed that it was considered important to extract the implicit knowledge of the department members. Later though this important aspect was simply forgotten. This proves the validity of Gust von Loh´s suggestion to conduct another evaluation after a certain time be it with another questionnaire, interviews or in workshops (Gust von Loh, 2009, 145). The implementation of new methods always comes along with a learning process. Iterative information needs analyses accommodate this fact. Another possible solution would be the implementation of demand management and change management as it is defined in IT service management as will be explained in chapter five.

The ultimate goal of an analysis of subjective information needs is the identification of appropriate information for the employees. There are certain criteria which information has to meet according to Jung (Jung, 2006, 111ff):

- **Punctuality**: The recipient of information should not have to wait for information especially when it is needed for work processes. Usually information is delivered upon request or in intervals.

- **Topicality**: partly depends on the punctual provision of information. In any case it must be avoided that provided information is outdated.

- **Relevance**: Information is relevant when it is needed for work processes. An excess of information leads to a lack of transparency and an information overload. Therefore it is of great importance to provide relevant information only.

- **Subjective Relevance**: The user of information is involved and decides on a subjective basis which information is relevant for decision making and filling gaps of knowledge or whether information fulfills an early warning function. According to Stock relevance is always objective. He uses the term pertinence for the subjective evaluation by a user (Stock, 2007, 68).

- **Access**: Access to information must be granted at all times. This includes that the employee is both provided with necessary information and knows where to find it in case it is needed. It is also important to consider the employees' wishes concerning the format of information and the applications which are being used for storing and providing information. The question for appropriate applications can therefore be an important aspect of a subjective information need analysis.

- **Access Protection**: Especially in the case of critical information it becomes important to determine and design an appropriate authorization scheme with regard to accessibility.

Therefore an analysis of subjective information needs has two major objectives: discovering knowledge gaps and providing the right amount of adequate and relevant information at the right time.

The greatest risk for failure of information need analyses lies in a dysfunctional communication. Employees need to understand the reasons for employee surveys. In addition they are interested in the results. Employees will be more willing to answer questions thoroughly when they understand that they will benefit from it. The costs, the time required and the additional workload of surveys should remain within reasonable limits. Furthermore a certain quality standard should be established. In case the resources allow for an internal marketing surveys can be announced via intranet, in meetings or in internal magazines or newspapers etc. In any case it is important that work councils are involved in the process right from the beginning.

4.2 Supporting Tools and Concepts

The methods presented in this subchapter are not knowledge management tools in a strict sense. However, they come in very useful especially for the implementation of knowledge management. Among these there are project management and change management. Both concepts are used in many different contexts. Project management is an efficient tool for implementing new processes, methods, technologies and a number of other purposes. Change management helps to overcome resistance towards change and innovation. In the first case study both concepts have played an important role and will therefore be introduced in the following subchapters.

4.2.1 Project Management

Project management is a common tool in companies. Especially in the IT branch project management has become one of the standard tools for achieving goals. However, it is used in many other contexts, such as the introduction of new products, in research departments or in engineering. In the airline industry the introduction of a new aircraft type is usually supported by it. Project management is not restricted to knowledge management and, therefore, not one of its classical tools, but when it comes to implementing methods and applications of knowledge management it can be a valuable instrument. As the implementation of knowledge management and a wiki in the first case study was executed by means of project management it makes sense to consider it more thoroughly in this context.

The *Deutsche Industrie Norm 69901* defines project management as follows:

> Vorhaben, das im Wesentlichen durch die Einmaligkeit der Bedingungen in ihrer Gesamtheit gekennzeichnet ist, wie z.B. Zielvorgabe, zeitliche, finanzielle, personelle und andere Begrenzungen; Abgrenzung gegenüber anderen Vorhaben; projektspezifische Organization (DIN 69901, Deutsches Institut für Normung e.V.)

This translates as:

> Undertaking that is defined in particular by the exclusiveness of the conditions as a whole, such as objectives, temporal, financial, personnel and other limitations; distinction from other undertakings; project specific organization (own translation of DIN 69901, German Institute for Standardization).

Thus a project is defined by its uniqueness in contrast to a process or operations in general, which are repetitive, permanent or semi-permanent functional activities to produce services or products. It is a temporary endeavor with a defined beginning and ending. It has defined resources with regard to time, staff etc. Project management is a discipline of planning, organizing, controlling and motivating resources in order to achieve previously determined objectives. There are certain constraints that are to be considered. These constraints are usually listed as scope, cost and time (Kessler and Winkelhofer, 2002, 55f). These constraints are also referred to as the project management triangle. One side of the triangle cannot be changed without affecting the others. Sometimes quality is considered a fourth restraint. Time refers to the amount of time available to complete a project. Cost refers to the budget available for a project and scope refers to the necessary measures for producing the end results of a project. These three constraints are often competing. Increased scope typically means increased time and increased cost. A tight time constraint could lead to higher costs and reduced scope, and a tight budget could result in increased time and reduced scope. Therefore the right balance needs to be found by both project manager and project team.

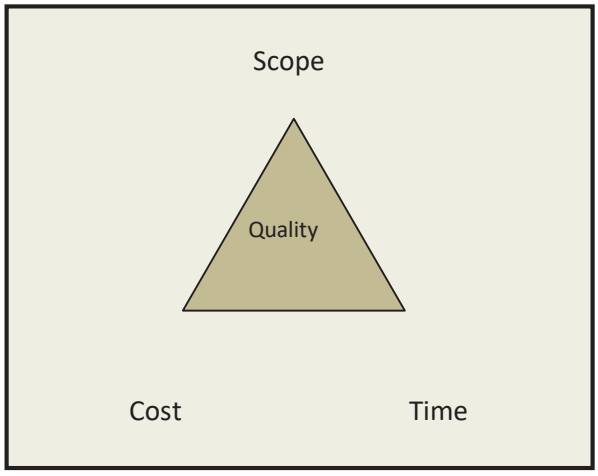


Illustration 4.3: Project Management Triangle (own representation)

Project management is a management tool that is required in order to achieve specific results with a specific project in a given time with provided resources. During a project a continuous target-performance comparison is made. Project management is a collection of managerial functions, techniques and instruments.

Projects consist of the phases initiation, planning or design, production or execution, monitoring and controlling and closing. According to Kessler and Winkelhofer (2002,

52f) planning, monitoring and directing form a control loop. In the planning phase objectives are defined, monitoring is responsible for evaluating the actual status quo and directing evaluates differences between goals and status quo and executes corrective actions.

When a specific endeavor has been defined as a project it is advisable to begin with a categorization of the project in order to be able to determine the required resources and methods (Hemmrich & Harrant, 2011, 10). The following criteria should be considered:

- importance of project in the business context
- number of participants
- duration
- budget
- departments and contractors that are going to be involved
- classification of risks

A clear definition of the objectives helps to prevent errors and loss of time and money or, even worse, failure of the project. This requires the involvement of all stakeholders. Their requirements need to be very clear and compromises have to be found in case of conflicts concerning the objectives. Then the objectives are ranked with regard to their importance. Eventually the objectives are evaluated and defined clearly. A continuous monitoring of the objectives, especially with regard to possible changes, is recommended in the context of project controlling (Hemmrich & Harrant, 2011, 16). A justification for a planned project helps to get support, especially from the management but also from the participants if they understand the importance of a project. Possible reasons for projects can be monetary by nature, such as extra income or money saving. They can be non-monetary, as well, such as business strategy, quality improvement of products and services, image improvement, the implementation of new tools or concepts etc.

The planning process begins based on the defined objectives. The initiator and the manager of a project are to be determined before the definition of the objectives. At the beginning of the planning phase project team members are chosen based on their know-how, availability and motivation. It is important that they understand the objectives and

agree with them. A means for the project documentation is chosen as well. The project is structured. This includes an estimation of the costs and efforts that will be required. Resources are planned as well as the course of activities. A schedule gives an overview of the important milestones. An analysis of possible risks helps with the contingency planning. All results of the planning phase are documented in a project plan (Kessler & Winkelhofer, 2002, 235ff). After the planning phase the execution phase begins. It includes all processes used to complete the work defined in the planning phase. People and resources are coordinated, the quality of intermediate results is assured, information is distributed, stakeholder expectations are dealt with and procurement is conducted. The project execution is structured by means of various schemes that are developed in the planning phase. A work breakdown structure illustrates all elements and activities that are required to achieve the project goals. It is a hierarchic arrangement of work packages. The project goal is at the top level. On the lower levels the project is divided into subtasks and work packages. Subtasks require a further breakdown while work packages are at the bottom of the hierarchy. They have to be very precise and do not allow for ambiguity with regard to workload, costs, time, responsibilities and resources. The result has to be defined clearly and redundancy between work packages is to be avoided (Hemmrich & Harrant, 2011, 42f). In the first case study a work breakdown structure might have looked as shown in illustration 4.4.

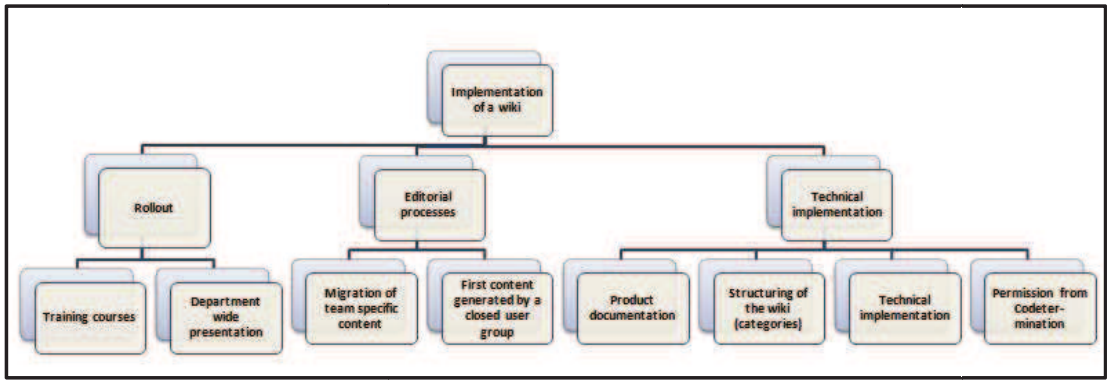


Illustration 4.4: Work Breakdown Structure (own representation taken from the first case study)

A project time schedule goes more into detail than a work breakdown structure. It defines the amount of time that is given for work packages, respectively their starting time and their end time. The work packages are arranged in a logical sequence, including time buffers for possible delays. In a next step milestone plans give an overview of the project schedule and of activities which were planned at the beginning of the project with their individual timelines. Illustration 4.5 shows the milestone

planning of the first case study project for the implementation of a wiki. This form is called Gantt diagram, which is a type of bar chart that illustrates a project schedule. It illustrates the start and finish dates of the sub goals of the project.

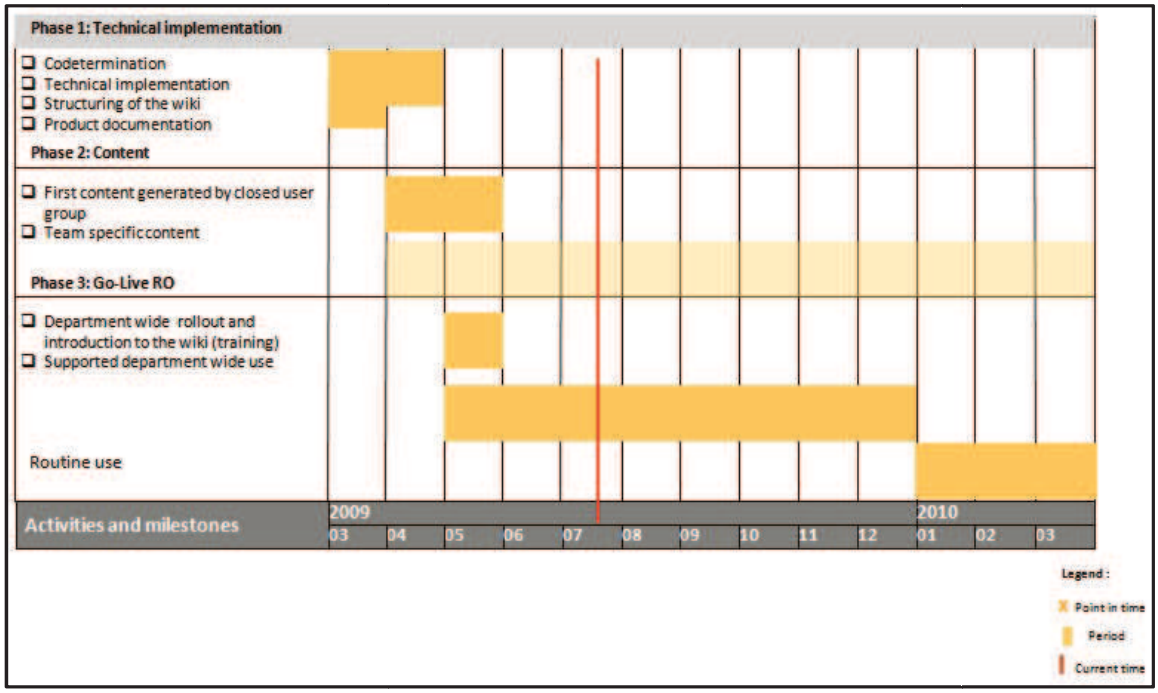


Illustration 4.5: Milestone Plan (own representation taken from the first case study)

When a milestone is reached a review can be made with regard to time, costs or quality of what has been achieved so far and corrective measures can be taken.

Monitoring and controlling is an important part of project management. It includes all measures that align the actual course of the project with the original plan. Therefore it is repetitive by nature. The execution of a project is observed so that potential problems can be identified in time and preventive action can be taken. Project performance is observed and measured regularly to identify variances from the project management plan.

Periodically the following steps are taken.

1. **Collection of actual data:** The project activities are measured and the status quo is determined.

2. **Analysis and evaluation of the actual data:** The project variables such as costs, time etc. are monitored and compared with the project plan. Possible effects on the further course of the project are estimated.

3. **Definition of corrective measures:** In case of variance from the plan: possible corrective actions are to be identified and executed in order to address issues and risks properly.

Project monitoring and controlling is a continuing process that includes the correction of errors, the continuous support of end users and updates of software in IT projects. Project management, therefore, has a close connection to quality management (Gust von Loh, 2009, 205).

The final phase in project management is the closing phase. It includes the formal acceptance of the project. Usually a project is closed when the objectives are achieved. Administrative activities include the archiving of the files and the documentation of lessons learned.

This phase consists of the contract closure and the project closure. Each contract made in the context of the project is settled. All activities across all of the process groups are finished. This includes the administrative closure as well. A closing report is written and archived along with all other project documentation. Especially in the context of project management lessons learned are common. Sometimes they are saved in a project data bank and thus available for future projects.

Project management has undergone changes over the past decades. Due to growth and globalization of companies the coordination of projects has become a challenge. A project manager needs to be an expert in communication (Hoffmann, 2008, 15) and has strong organizational skills. Models have been created such as the waterfall model. Due to the growing complexity of projects especially in IT more elaborate, iterative models have been developed, which means that the processes are repeated until the desired outcome is achieved. Illustration 4.6 shows an elaborate waterfall model with iterative elements.

The traditional model has a cascade of phases that are gone through once, indicated by the straight arrows. The iterative model allows for going up the cascade in order to correct errors at an earlier level. The great benefit of this model is a better trouble shooting and the chance to learn during the course of the project.

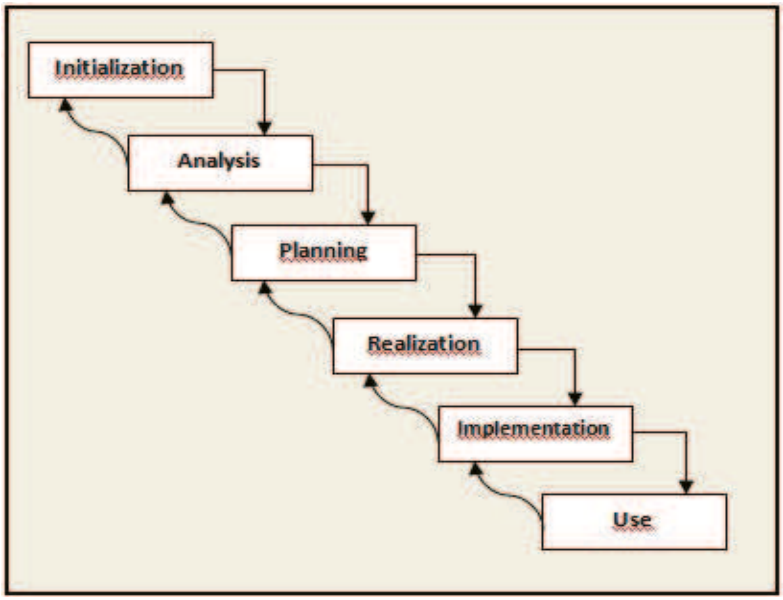


Illustration 4.6: Iterative Waterfall Model (own representation)

Gust von Loh recapitulates the importance of an efficient project management when she writes:

> Durch optimales Projekt Management wird Wissen aus, über und innerhalb verschiedener Projekte identifiziert bzw. entwickelt. Es gilt an dieser Stelle den Praktiker für geeignetes Projekt Management durch den Wissensmanager zu sensibilisieren Gust von Loh, 2009, 208).

In English this means:

> By an optimal project management knowledge about and within various projects is identified or developed. In this context it is essential to sensitize practitioners for adequate knowledge management by the knowledge manager (own translation of Gust von Loh, 2009, 208).

An optimal project management identifies and develops knowledge from, about and within projects. Gust von Loh sees a mandatory connection between project management and knowledge management. Projects require and generate knowledge. Knowledge is identified, shared and saved for future use. As a managerial tool project management is a useful tool for the implementation of knowledge management and its supporting IT systems.

4.2.2 Change Management

Many projects that affect organizational structures such as the implementation of knowledge management face opposition by those who are intended to be “blessed” by

the measures taken. As seen it is essential for the success of knowledge management that it is accepted by both management and employees. Some may be afraid that their position might become dispensable. Others are put off by the extra workload. In general human beings tend to fear changes and everything new is often accepted reluctantly. The predominant culture in an organization often needs to be altered in order to allow for the implementation of knowledge management (Zhang, Mei & Wang, 2007, 1451). Thought patterns and habits need to be changed. This requires time though and comes with extra costs.

Change management offers practicable solutions to these challenges and is, therefore, another valuable tool for the implementation of knowledge management. In this context the term change management has a different meaning than in the context of ITIL where it describes the managing of change requests in services. In fact it integrates a set of tools and measurements that comes in useful for accompanying organizational changes and for overcoming resistance in those who are affected by the changes.

There is a wide variety of definitions of change management because it's a comprehensive term used to describe change at both the individual and organizational level. The English Collins Dictionary describes change management as follows:

> Change management is a style of management that aims to encourage organizations and individuals to deal effectively with the changes taking place in their work (English Collins Dictionary, https://www.collinsdictionary.com/dictionary/english/change-management, 03.09.2018).

The US Government Accountability Office (GAO) defines change management as:

> activities involved in (1) defining and instilling new values, attitudes, norms, and behaviors within an organization that support new ways of doing work and overcome resistance to change; (2) building consensus among customers and stakeholders on specific changes designed to better meet their needs; and (3) planning, testing, and implementing all aspects of the transition from one organizational structure or business process to another. (http://www.gao.gov/special.pubs/bprag/bprgloss.htm, 15.12.2018).

In order to overcome resistance it is important to understand the reasons for it. Some have been mentioned above. Further reasons can be a lack of understanding of the problems that require changes. Poor communication often leads to resistance as well.

People prefer to be informed adequately and as soon as possible. If the employees do not trust the management this can be a major obstacle for changes. It happens that employees read about changes in the newspaper or online magazines before the management communicates them. Distrust is generated by poor communication or implausible statements. If employees are not involved actively in changes they often don´t see the necessity. When the goals of the employees don´t correspond with the goals of the organization resistance is almost inevitable. Employees may be afraid of a loss in income, prestige or competences. Illustration 4.7 gives an overview of the most relevant reasons for resistance in per cent.

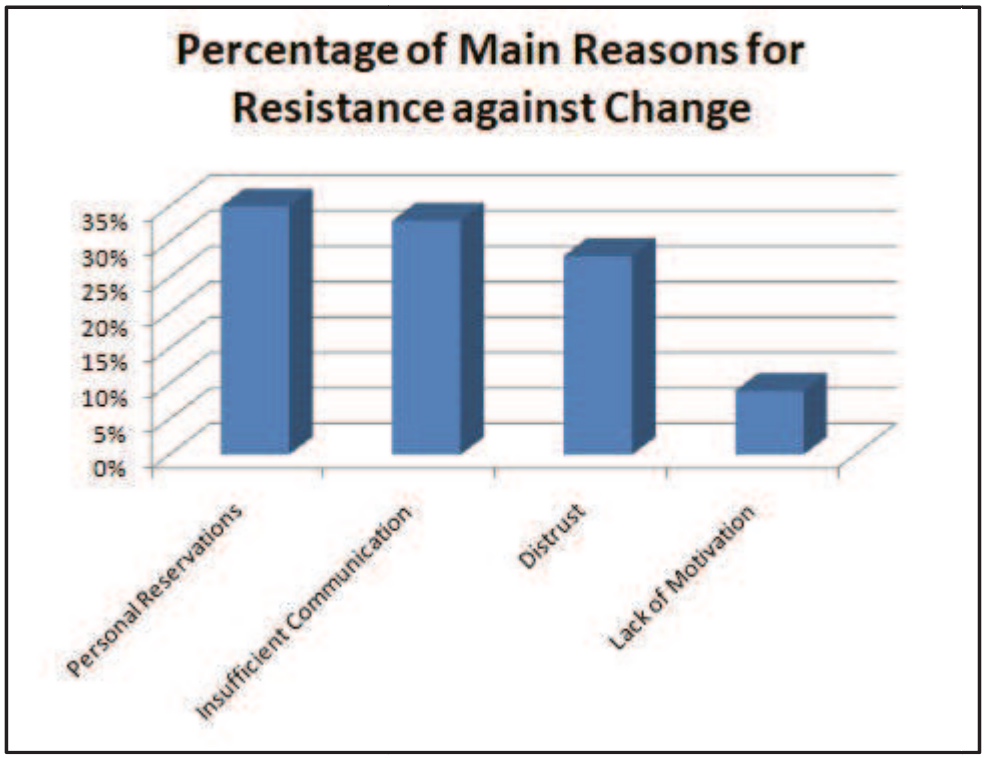


Illustration 4.7: Main Reasons for the Resistance against Change (source: based on Vahs, 2015, 295)

Out of 100 about 35 persons have personal reservations against change. Almost the same number, about 32%, considers communication about change processes insufficient. 28% don´t trust their management and 9% are not motivated to support change.

Insufficient communication and distrust are closely connected. As mentioned above implausible statements can generate resistance. Many change management concepts focus on communication. Kurt Lewin (1947, 34f) has developed a three-phase-model (model of change) which consists of the phases unfreezing, moving and freezing.

Applied to change management in organizations or companies they often include the following aspects:

- **Unfreezing**: Starting point is an understanding that reality doesn´t meet the requirements and expectations any longer. Old patterns and structures are questioned and the necessity of changes becomes obvious. This leads to a readiness for change. The most extreme situation to generate such an understanding would be a severe crisis, for example, if a company is about to fail. In this phase supporters of change must be strengthened and resistance must be lowered or overcome. This requires a promotion of the changes that are to come by communicating their necessity. The current static state is unfreezed.

- **Moving**: The second phase is the phase of transformation. Solutions are developed in various projects and new behavioral patterns are tested. The status quo is left behind in favor of a new balance. It is generally considered important that this process is accompanied by frequent and adequate information.

- **Freezing**: In the last phase the solutions are implemented and the change process ends. A new balance is established and needs to be stabilized.

Berner (2016) criticizes Lewin´s model by stating that the third phase of freezing is not desired. On the contrary, many companies wish to maintain the willingness to change on a permanent basis. According to Berner this model was based on an authoritarian concept of the world which he rejects.

There is a contrast between evolutionary and revolutionary approaches. While a revolutionary change consists of drastic change in a short time period, evolutionary change consists of small steps and slow changes. Employees are to be involved from the beginning. According to Vahs employees accept only slow change. Only when the problems are urgent enough drastic and quick changes are accepted more readily (Vahs, 2012, 328).
Kotter and Darius have described eight different phases of change management (Kotter & Darius, 1997, 55ff).

- **Sense of urgency:** A sense of urgency can be generated by numerous means and circumstances. Work processes that do not function properly and thus lead to frustration can create a sense of urgency as well as the fear that a company is

close to going bankrupt. Comparisons with the business competition may reveal that changes are necessary in order to remain competitive. Creating a sense of urgency requires a clever and plausible communication.

- **Building of a leadership coalition:** A team is built that is capable of bringing about change.

- **Design of a vision and a strategy:** It must be clear what the desired results shall be.

- **Communication of vision and strategy:** Vision and strategy need to be communicated and understood.

- **Removal of obstacles:** Old structures have to be replaced by newer, fitting ones. People need to be convinced and motivated.

- **Communication of short-term success:** In order to keep the project going every success should be made apparent.

- **Consolidation of success:** A slowdown must be prevented.

- **Changes must become part of the culture:** The dependency of entrepreneurial success on the newly established behavioral patterns have to be made clear.

Doppler and Lauterburg (2005) mention critical success factors for change management. Problems need to be perceived. No actions should be taken before a thorough analysis has been made. They mention five key qualifications for a culture that supports change. The first one can be translated with creative agitation. An organization should not be static but rather reward new ideas and promote fondness of experimenting. The second key factor is a positive culture of disputation. Conflicts should be discussed and solved. Another key factor is a good team spirit. Transparency,

trust and acceptance are important for change management as well as for knowledge management. Explanation of meaning and promotion of understanding cannot be overrated. On the one hand it helps the employees to understand why changes are necessary and on the other hand they feel appreciated. The last key factor is communication. This includes individual and public communication across hierarchies. Everyone should have the same level of information. The necessity of changes must be communicated clearly as well as vision and goals. It is important not to wait until questions come up but rather to start the dialog proactively. It also helps to be open for changes in the concept. Doppler and Lauterburg get to the heart of it when they write:

> Nur informierte Mitarbeiter sind engagierte Mitarbeiter (Doppler & Lauterburg, 2005, 383.)

Which translates as:

> Only informed employees are active employees (own translation of Doppler & Lauterburg, 2005, 383).

There are numerous tools of change management. It is very flexible and requires a good imagination, empathy and strong communication skills. In the first case study the implementation of knowledge management was accompanied by methods of change management in combination with concepts of service management. In the beginning there was the realization that the management of information and knowledge in the department was insufficient. Handbooks, tips and tricks and other important information and knowledge existed in many different locations such as e-mails or in a variety of applications. The individual knowledge was not shared to a desirable degree. Therefore, the entire process was started with creating a sense of urgency. The existing structures were questioned and workshops were organized in order to communicate the need for change. This was supported by the fact that the group management had recently initiated a program for improving the use of knowledge in various strategic fields. When the decision was made in favor of a wiki the team leaders served as multipliers. They motivated their team members to participate in the process. Thus the project team and the team leaders aligned in supporting the changes that were to come. A vision was developed and explained with the help of PowerPoint presentations that were made available for everyone in the information management department. The integration of every individual in the development of both vision and strategy proved a powerful change management tool. Interviews were made where the employees had the chance to

communicate their concepts of knowledge management and their wishes and requirements. The results were communicated which promoted the feeling that the individual needs were taken seriously. The knowledge management concept and the applications that were going to be used for knowledge management were communicated and presented as a service that was intended to support every day's work. Thus the unfreezing process began. Kotter (1997) writes that obstacles need to be removed and old structures need to be replaced. In this case one of the major obstacles was the bad experience that had been made with former applications. Therefore the focus was put on finding solutions with a better usability that would take into consideration the expressed requirements. Later obstacles were dealt with by the project team. User support was considered as a special and important service. Whenever necessary, users of the wiki were helped to overcome difficulties. Furthermore possible difficulties were anticipated and solutions were developed before a problem arose. The project team was also responsible for the handling of change requests. The success of the project depended strongly on the ability of the project team to anticipate obstacles. For example the problems caused by the word-to-wiki-macro had not been anticipated and therefore became a severe threat to the motivation to use the wiki. A solution was found though and then communicated which had a positive effect on the department wide perception of the application. Kotter (1997) calls this "communication of short term success". In order to motivate the users of the application a newsletter was edited every two weeks with success stories of the local knowledge management and knowledge management in general, including statistics about the use of the wiki. Flyers were made with tips and tricks for an efficient use of the application. Along with public and individual training lessons they proved to be a strong tool for promoting acceptance. Personal resistance was partly overcome on an informal level by taking concerns seriously and offering solutions. In the end the new balance was established and strengthened. Breaking all this down it can be said that above all two concepts were extremely helpful in the process of implementing knowledge management: communication and a strong service mentality. The latter combined with an understanding of the desires and needs of the individual.

4.3 Technical Knowledge Management Tools

As mentioned before a distinction between technical and social tools is not always easy. Especially Web 2.0 applications combine technology with human interaction. Therefore, they will be dealt with in an extra subchapter. The following tools have a

strong focus on technical aspects. Some of the tools are not exclusively used for knowledge management. A document management system, for example, can as well be used for mere data management. Nevertheless, especially in larger organizations it is often the basis of knowledge management activities. Further applications can be integrated into the existing system. Thus money can be saved and the acceptance of new methods or applications is increased due to the familiar framework conditions. Document management systems allow for custom fit solutions which tend to be rather expensive and which have a wider range of functionalities, solutions which then are customized to the requirements of the company or systems that are developed by the company itself by integrating exactly those methods and applications that possess the required functionalities such as wikis and blogs for example. The choice of appropriate tools is simplified and more efficient if a thorough analysis of organizational requirements and of the processes that are to be supported is made beforehand. A guideline for a knowledge landscape that considers the different types of knowledge that need to be dealt with could help to find appropriate applications and to prevent redundancies. Knowledge management does not need to be expensive nor labor-intensive, for example when the requirements are limited to storing and finding knowledge. A wiki based on freeware may be sufficient for that purpose. Another simple option would be meetings with the purpose of sharing knowledge or lessons learned. A large affiliate group on the other hand might not be able to operate efficiently without a portal solution or an intranet.

4.3.1 Document Management Systems

Document management systems support the document lifecycle. This includes the compilation, organization, structuring, distribution, search, output, accessing, editing and filing of documents (Lehner, 2009). They are one of the oldest contemporary knowledge management tools (Gust von Loh, 2009, 193). Nowadays knowledge management architectures are often based on any kind of document management system. Documents can be text based or audio based. They exist in paper form and in digital formats. Examples of documents are text files, audio files and video files (Stock, 2007, 83). Despite the different formats, they all share certain characteristics. They have content, be it data, information or knowledge and they have a structure. Metadata includes author, title, creation date etc. While in the past documents existed in paper form new technologies have enabled the organization of documents in digital formats. Unless legal requirements for the paper form apply nowadays documents tend to be

digital. This comes with many advantages. The search for documents is facilitated, access is location independent and documents can be edited by different people at the same time, which saves time and costs.

Digital document management systems are designed for the centralized administration of digital documents. Those can be found according to certain criteria and are thus made accessible more easily. Before they are implemented a strategy needs to be developed based on processes and requirements. Existing documents are analyzed and archived. Metadata such as author and title are collected and saved. Ideally process relevant information such as possible users or processes that are supported by a specific document is added. This could result in the creation of categories before the actual implementation. The current state of the document organization is compared to the target state, ideally based on both business requirements and on user requirements. During the implementation process the system is tested, continuously improved and the future users are instructed.

A document management system should support the entire document lifecycle *(*(Gust von Loh, 2009, 194). The main stages of a document-lifecycle are:

Creation: describes the making of an analog or digital document.

Capturing: Physical or analog documents are converted into a digital format.

Indexing: is a cataloging process. Documents are indexed, metadata such as author, title or an abstract are added via manual or automatic methods. These attributes enable a structured search for documents (Gust von Loh, 2009, 195).

Access/Retrieval: Documents are viewed from search results. For that reason searching processes are created to find documents using classification, meta-data, full text or other search technologies.

Administration: includes the management of users, resources, content types and structures.

Distribution: Documents are distributed to those who need them for their work.

Disposal: Documents are destroyed or deleted which have passed beyond their agreed retention periods.

Preservation: Documents with enduring value are preserved in order to ensure their long-term accessibility.

There are other stages, too, according to individual requirements.

Concepts such as imaging, groupware and workflow are closely connected to document management (Lehner, 2009, 249). Groupware and workflow, for instance, used to be specialized and isolated applications which have been integrated more and more as well as elaborated retrieval systems. Due to these developments standards have been developed with a range of varying functionalities. Furthermore there has been a tendency to combine systems and integrate them into a suite. IBM has developed the EDM Suite (Enterprise Document Management) which combines Domino.Doc developed by LotusNotes for a distributed document management with ImagePlus, an archiving tool, Flowmark, a workflow system and IBM´s COLD OnDemand solution, a content management system (Lehner, 2009, 249). The benefits of such solutions are the wider range of functionalities and the grouping of different systems under one surface. Whether they make sense with regard to the costs depends on the requirements on a document management system.

There are three overall objectives of document management systems (Gust von Loh, 2009, 195).

1. **Quantitative objectives**: Archiving, distribution and access are accelerated and thus time is saved. The costs of storage are reduced.
2. **Qualitative objectives**: Decision making processes are accelerated. Information is preserved and transferred.
3. **Content goals**: A decentralized access is granted and simultaneous editing is enabled. There are interfaces with other systems such as an intranet for example. The consistency of documents is improved etc.

A major challenge of implementing a document management system is the expenditure of time and human labor but that is a general problem of new systems that are used for documentation. Once a document management system has been established it makes sense to create further documents in the digital format unless the law or other regulations require the paper format.

4.3.2 Content Management Systems

A content management system consists of software that allows the publishing of content, for example in the internet or in an intranet without requiring HTML skills. In this context this includes content, structure and layout. In a content management system these are separated. Thus content can be displayed with different layouts or structures via different applications or media. This fact allows for a direct connection of content and business processes (Gust von Loh, 2009, 196). When content management systems are being used for an intranet or the internet they are also called web content management systems. A clear distinction between document management systems and content management systems is difficult (Gust von Loh, 2009, 195). According to Büchner et al. the separation between content and layout has the advantage that the raw data can be administrated, changed and provided with meta data independently from its representation. At the same time the design can be changed for all pages without altering the content (Büchner et al. 2001, 157). The automatization of many processes lowers the expenses for the maintenance of content and enables a more efficient use of human resources thus saving costs, too (Büchner et al. 158).

Similar to document management systems the administration of content follows a lifecycle. In the beginning content is created or collected. Furthermore, structures and layouts are developed. Then both content and metadata are stored in a repository. In a third step content is published be it in print media or in the internet/intranet (Lehner, 2009, 150). A distinction is made between administrators and editors.

A content management system has an architecture that consists of an asset management component, a workflow component, user administration, access administration and interfaces (Büchner et al. 2001). Asset management in this context describes the administration, structuring and presentation of content. The workflow component consists of the release and review cycle thus building a bridge between the editing and publishing of content. User administration is responsible for assigning roles to users such as administrators, “readers only” or “readers and editors”, for example. What this can look like will be shown in the first case study. Access can be granted via various means or applications respectively user interfaces, which themselves can have interfaces with other applications such as MS Office products, for example. Content can be saved as XML in a web content management system, and is then transformed into any desired format such as HTML, PDF etc.

The advantages of content management systems are numerous. Costs and labor time can be saved by reusing content, structures and layouts for publishing. The usability is improved and even users with lesser skills are able to edit and publish content. Programming skills are not required for publishing web pages, for instance. Web content management systems also allow for the integration of links. Templates can be used and thus structured documents are available for other media as well. PDF files can be generated and printed. According to Gust von Loh a good content management system includes the following core processes and functions (Gust von Loh, 2009, 196).

- an adequate and structured user administration
- page structures, navigation aids, style sheets or templates
- quality and release management, which requires an authorization scheme
- supervision and style sheet administration.

Among the downsides of a content management system there are the costs and the efforts required to implement it. This includes the installation of the system and further costs for user trainings and technical maintenance.

4.3.3 Portals and Intranet

Portals, also known as Enterprise Information Portals or Corporate Portals grant a structured access to information. They integrate different types of information and various applications respectively functions. An essential feature of portals is the possibility of personalization. Users can chose what information is relevant for them. A user profile can be created according to one´s needs. The user is able to access a portal from different locations and with different computers.

Among the typical functions of portals there is a search, a classification system, access control or single-sign-on which means that only one password is required to use all applications that are integrated into a portal. Portals themselves usually don´t have enough functionalities for an efficient knowledge management but they provide the possibility to integrate further knowledge management applications such as wikis, blog, feeds etc. Thus they can serve as a basis or all knowledge management systems.

The intranet of one of the airlines in the case includes a portal solution. The user interface can be personalized according to personal preferences and objective

requirements. The wiki and other knowledge management applications had been integrated into that portal.

Larger companies tend to have an intranet. In contrast to the internet it is not open for everyone. It is rather a confined virtual space that can only be accessed by a specific group of people. It´s main objective is the provision of up-to-date information at the right place and time. The possibilities are numerous. From general business information to very specific working processes, information of all sorts can be found in a businesses´ intranet. Knowledge about a company and the respective markets can be found in intranets as well as handbooks, libraries, tips & tricks etc. It is important that the information found in the intranet is either related to the work done in a company or that it at least triggers interest in the use of the intranet. Especially a poor usability can be a major barrier for the use of an intranet. Therefore, the appealing and structured provision of information is able to boost the use of an intranet. Further ways to improve the acceptance and promote the use of an intranet are presented in the first case study. A good and efficient search function that provides an output with a high relevance comes in useful. Besides a structured categorization system is often appreciated. Gust von Loh states that the use of a knowledge organization system is essential (Gust von Loh, 2009, 199). Intranets can contain workspaces that are used by subdivisions or departments of larger organizations. Thus employees only get the information they really need. These workspaces can often be personalized. This enables the users to adjust them according to their wishes and needs which can also improve the acceptance of an intranet. Barriers to use an intranet should be low. A personalized starting page when a browser is opened grants a direct access to the intranet and attracts attention to the information provided. Furthermore, all technical knowledge management applications can be integrated into an intranet and be accessed via single-sign-on, which means that only one log in is required. Thus an intranet can become the starting point of all knowledge management activities that are based on technical tools as seen in the first case study. Furthermore, it is a tool that connects all employees of a company. According to Seibel the intranet is like a neural system and essential for knowledge management. It enables communication, directs information and knowledge flows and is, therefore, important for the distribution of knowledge (Seibel 1999, 149f). However, an intranet only makes sense for companies that have reached a certain size. An intranet might be over the top and too expensive for small businesses.

4.3.4 Knowledge Maps

Knowledge maps provide a structured graphic overview of knowledge assets in an organization. They do not contain knowledge but indicate where it can be found. In contrast to knowledge maps a knowledge landscape does not only indicate where knowledge can be found it rather serves as a guideline where knowledge should be stored and how it should be processed. In any case a knowledge landscape is an advancement of existing types of knowledge maps. There are various types of knowledge maps. They can include information about knowledge sources, knowledge structures, knowledge application, knowledge development and knowledge assets (Eppler, 2003, 189ff). Knowledge source maps and knowledge asset maps can be used to create a directory often referred to as yellow pages. Knowledge maps are an efficient tool to improve the transparency on knowledge assets in an organization. Knowledge sources and knowledge holders are identified and are found more easily. New knowledge can be classified more easily and assignments or processes can be related to knowledge assets and knowledge holders (Probst et al. 2006, 67). On a knowledge source map the experts of an organization are displayed graphically according to preselected criteria which can be departments, products, processes etc. The following illustration gives an example of a knowledge source map of a cabon operations department of a fictional airline.

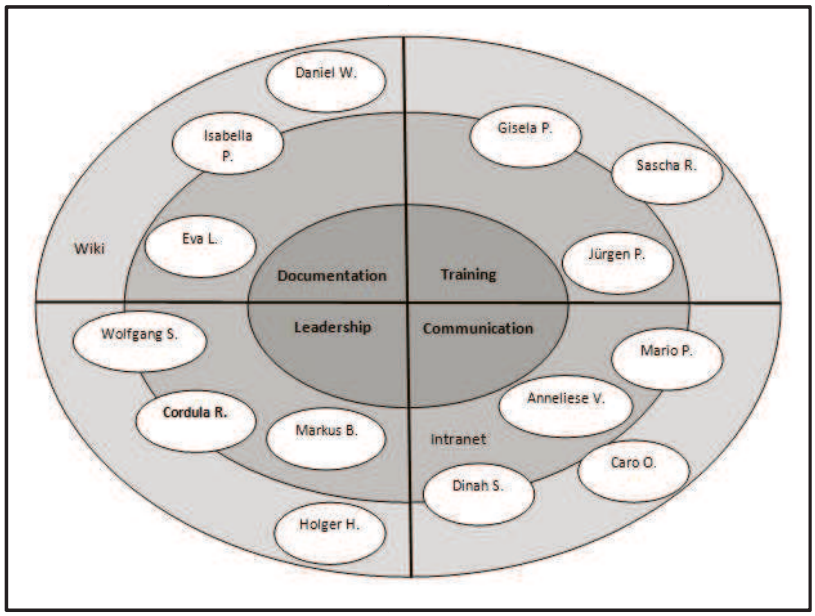


Illustration 4.8: Knowledge Source Map (source: based on Eppler, 2003, 195)

The department categories in this example are “documentation”, “training”, “leadership” and “communication”, the products are “intranet” and “wiki”. Furthermore different colors could be used to represent the locations of the experts.

A knowledge source maps allows not only for the identification of experts but also for the identification of knowledge gaps that need to be filled.

Knowledge assets maps are another useful tool that makes knowledge assets visible. They can include everything from individual knowledge and team or divisional knowledge to the knowledge of entire organizations. Illustration 4.9 displays the knowledge assets found in a company. The longer the beam the more profound is the knowledge of the respective consultants in the various fields of the consultancy.

Illustration 4.9: Knowledge Asset Map (source: based on Eppler, 2003, 196)

A knowledge asset map displays the strengths and the weaknesses of individuals and shows who is of special value for an organization. In the case above "A" is an expert in IT and quality management. On the other hand it becomes visible that further knowledge is desirable in the field of controlling, for example.

Knowledge structure maps illustrate the structure of a specific field of knowledge. Relevant knowledge is categorized. Allweyer (1998) gives an example by creating a knowledge structure map for project management. As can be seen in illustration 4.10 project management requires knowledge from the fields "project knowledge"," project management knowledge", "technology", "leadership skills" etc. Further subdivisions of the respective fields are possible.

According to Bach (1999, 57ff.) fields of business activities such as staff, customers, processes, projects etc. are connected by knowledge flows. Thus an employee can be related to a specific project for example (Lehner, 2009, 195). In the second case study the extended knowledge landscape shows how departments and individuals are connected with and by knowledge flows.

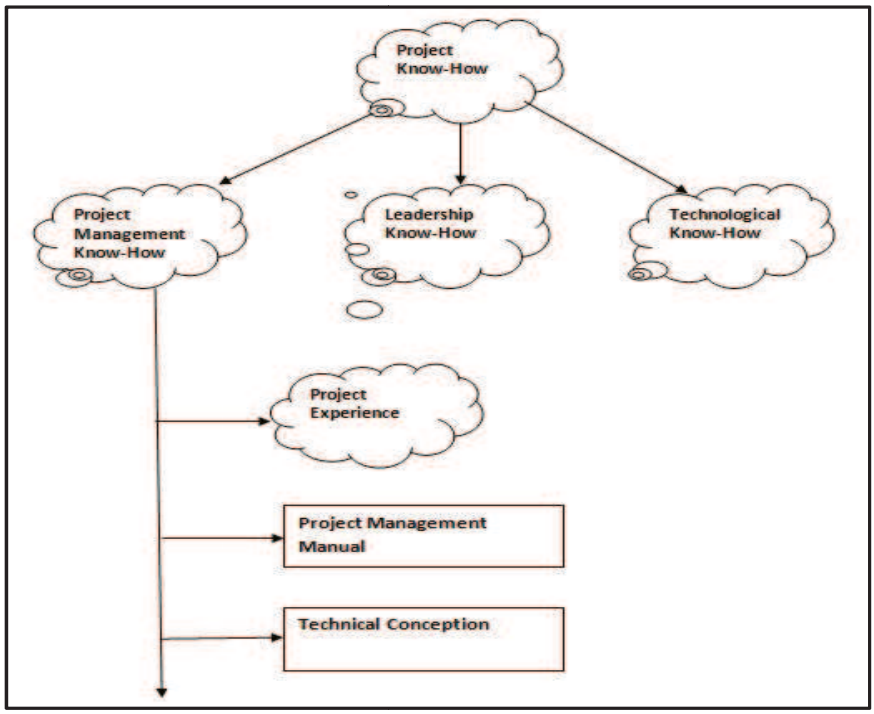


Illustration 4.10: Knowledge Structure Diagram (source: based on Allweyer, 1998, 42)

The illustration below shows a knowledge application map for the cabin operations departments of an airline. It is a visualization of the steps that are necessary for individuals, groups or organizations in order to achieve a certain level of knowledge (Lehner, 2009, 195). Upon clicking on one of the methods or tools a larger excerpt appears that gives further information on how the respective knowledge can be acquired or deepened.

Probst et al. give another example of a knowledge map: the knowledge matrix (Probst et al, 2006, 69f.). They allow for a distinction in perspective, for example into internal/external, new/existing and implicit/explicit knowledge. According to Probst et al. the following steps are to be taken in the process of creating knowledge maps (Probst et al., 2006, 70). First a survey of knowledge intensive processes has to be made. Then relevant knowledge assets and knowledge holders are identified. In a next step both assets and holders are codified. The last step then is the integration of the codified assets into a navigation system that is connected with the processes. After establishing a knowledge matrix decentralized updating must be enabled. These steps are also important for creating a knowledge landscape as will be shown later.

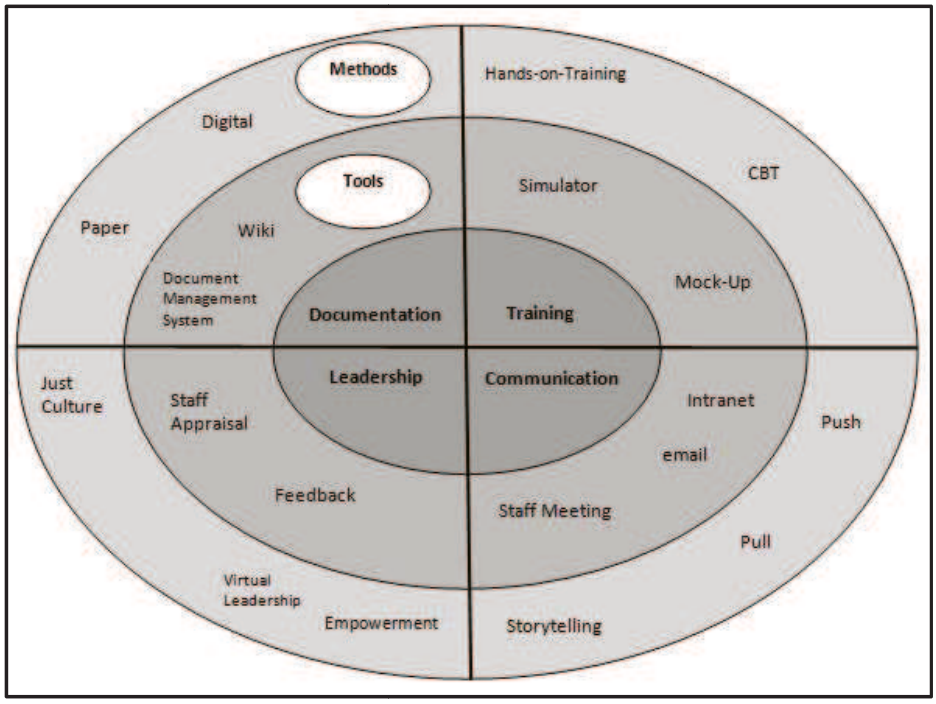


Illustration 4.11: Knowledge Application Map (source: based on Eppler, 2003, 198)

4.3.5 Learning Management Systems

Learning management systems provide all necessary functions for e-learning which means electronic learning and describes learning processes via electronic media. Examples of e-learning would be online seminars or computer based trainings. Larger airlines often use computer based trainings in various contexts, for example for cockpit and cabin crew trainings.

Lehner describes learning management from the process perspective and from the technical perspective (Lehner, 2006, 254). Among the processes there are the definition of educational goals, the identification of learning needs, the choice of the right learning material and the execution of learning processes. Technical aspects of the systems are user administration, the administration of learning courses, communication systems, learning tools, a web based user interface etc. Furthermore, learning management systems can have interfaces with other applications. The primary purpose of learning management systems is knowledge sharing. However they are often capable of more. Some systems offer tests in order to determine the learning process. A good system is also capable of analyzing learning needs.

4.3.6 Knowledge Management Systems

The term knowledge management system is often used inconsistently. Especially in advertisements all sorts of applications are referred to as knowledge management

systems even though they may be no more than simple content management systems. Therefore, a clear definition is difficult. In this paper the term will be understood as defined below.

Numerous technologies and systems for processing data and information have been developed. Krcmar describes a computer based information system as a socio-technical system that consists of subsystems which provide information and enable communication (Krcmar, 2003, 25). Knowledge management systems do not only contain knowledge, they also support users with solving specific problems according to Borgelt et al. They are capable of delivering exactly the kind of knowledge a user requires.

> Wissensbasierte Systeme sind Programme, die auf der Grundlage von Wissen über einen bestimmten Anwendungsbereich Schlussfolgerungen ziehen können und so dem Benutzer helfen, ein Problem zu lösen oder eine Entscheidung zu treffen (Borgelt et al., 2014, 235).

This statement can be translated as follows:

> Knowledge based systems are programs that are capable of drawing conclusions on a specific field of application based on knowledge and thus they help the user to solve a problem or to make a decision (own translation of Borgelt et al., 2014, 235).

According to this definition they provide support with problem solving and decision making. Gust von Loh defines the ideal knowledge management system as an information system that is capable of storing explicit knowledge and of supporting the development of implicit knowledge (Gust von Loh, 2009, 40). Knowledge is collected and distributed or at least made accessible easily.

Whereas the applications that have been mentioned so far can be used to support individual knowledge management activities knowledge management systems go far beyond individual concepts or isolated applications. They are capable of handling the knowledge of entire organizations globally and extensively. This contains hard facts such as numbers, facts, statistics etc. as well as personal notes, expertise, stories, processes, routines etc. (Lehner, 2009, 271).

Knowledge management systems contain different technologies and functions that range from mere documentation to communication functions which can be used as a whole or be chosen according to one´s knowledge management strategy. Information retrieval systems, content management systems etc. often are the basic components of knowledge management systems. Dilz and Kalish (2004) have created a model of the architecture of knowledge management systems. They distinguish several categories of knowledge management systems based on tasks and the knowledge building blocks of Probst et al. (Dilz & Kalish, 2004, 29ff). They call aspects of knowledge development *Ideenorientierung* meaning creative techniques such as mind mapping. Knowledge sharing is realized by means of communication (e-mail, instant messaging etc.) and communities. They call this *Communication-/Community-Orientierung.* Knowledge identification is categorized by the term *Discovery.* They mention yellow pages as an example. *Experience Base* serves knowledge storing, for example by means of best practices and lessons learned. The aspects *Visualisierung, Präsentation und Publikation* (visualization, presentation and publication) are matched with the building blocks knowledge distribution for publication and knowledge use for visualization and presentation. *Dokumenten-Orientierung* is about storing knowledge which they consider a relevant aspect of knowledge management. Among the further possible applications that they describe there are document (2004, 126ff) and content (2004, 135ff) management systems, e-learning (2004, 192ff), skill management (2004, 69ff), knowledge mapping (2004, 99) and others. These applications support services. Among these there are collaboration, documentation and publishing. The system also requires a taxonomy, respectively a classification or categorization scheme. It includes knowledge repositories, templates, metadata, content, users and an authorization scheme. Sources of all kinds can be integrated such as databanks, e-mail, internet, intranet or files from an external server. This categorization may help with a first distinction between a variety of tools that exist in a company when it comes to designing a knowledge landscape.

Any knowledge management system ought to be capable of supporting some or all of the processes that have been identified by Probst et al. for effective knowledge management which are the identification, acquisition, development, distribution, storage and use of knowledge. The more processes are supported the more complex the system becomes though.

Standardized knowledge management systems often support push services (RSS Feeds), knowledge representation and visualization, editing and structuring of knowledge, knowledge combination, knowledge acquisition, communication, cooperation and collaboration, administration of the knowledge base, analysis of data and computer based learning (Lehner, 2009, 272).

Lehner (2009, 274f) introduces possible categories of knowledge management systems. According to their functions they can be subdivided into systems for:

- communication
- content management
- decision making
- aggregation and retrieval
- visualization
- collaboration
- distribution

Maier (2004) describes possible architectures of a knowledge management system. He distinguishes between centralized architectures with a focus on technical applications and distributed architectures that focus on “peer to peer” activities (Maier, 2004, 278ff).

Centralized knowledge management architectures help to consolidate the often fragmented and widely spread knowledge of a company. Several models have been developed. Maier has developed an architecture of a knowledge management system that integrates components and layers of several different models or architectures designed by other authors. His architecture consists of the following services: infrastructure, integration, discovery, publication, collaboration, learning, personalization and access services (Maier, 2004, 250ff). At the core there is a central knowledge management server that can be accessed by everyone who has to work with the system. In illustration 4.12 the components of the layers are shown ranging from browsers as an access service via search functionalities, knowledge maps, co-authoring, skill management, tutoring etc. as knowledge services to intranet infrastructure services

or groupware services etc. as infrastructure services that get their data and knowledge from various sources.

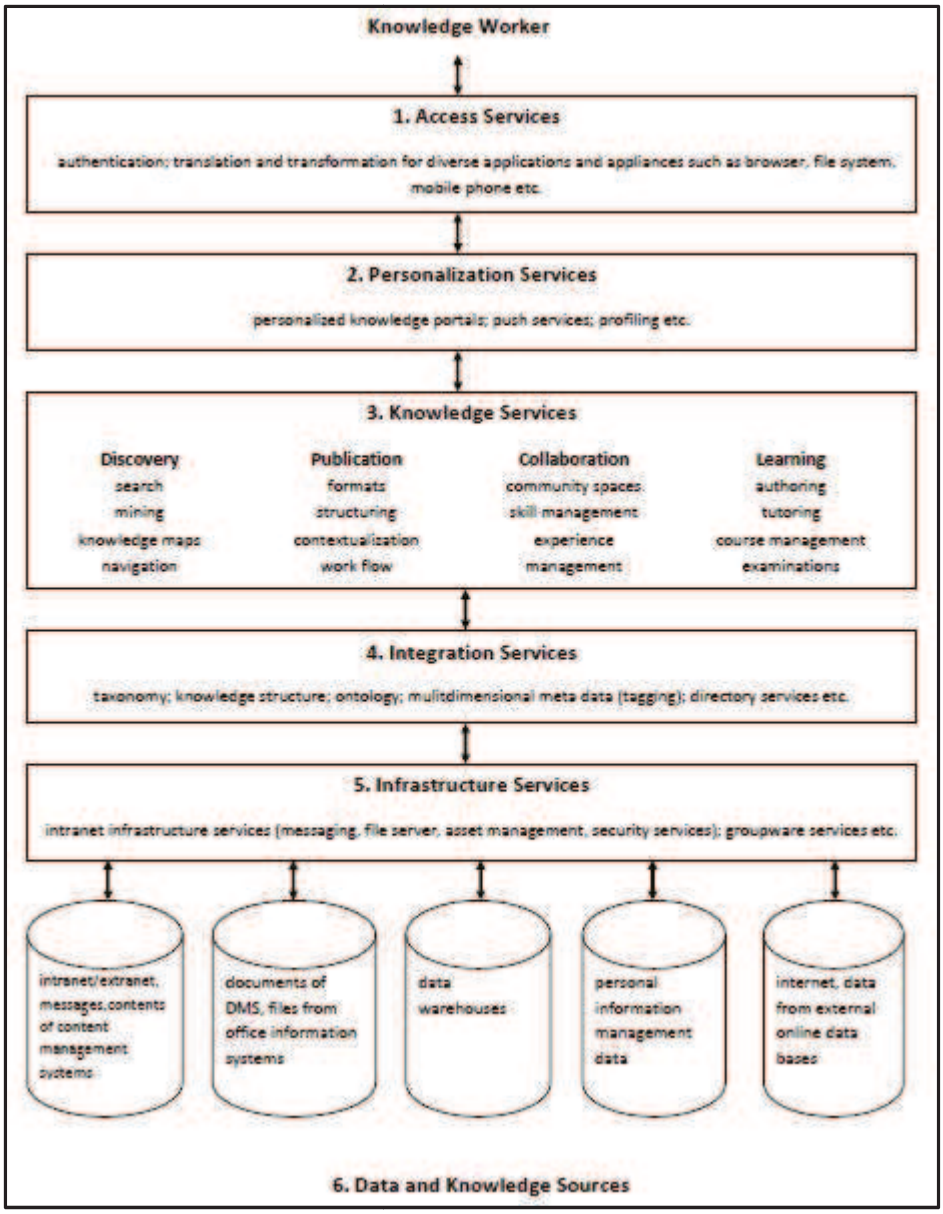


Illustration 4.12: Architecture for Centralized Knowledge Management Systems (source: based on Maier, 2007, 319).

According to Maier this is the "ideal" knowledge management system (Maier, 2004, 257). Many of the components had already existed at the airline of the first case study. With regard to the first layer of access services there were browsers and mobile telephones for example. Personalization services existed as well. The intranet workspace allowed for personalization, profiling, push services and other components of the second layer. Among the knowledge services of the third layer there were search functionalities, expert management, community spaces, tutoring and others. The fourth

layer still was a bit neglected at the time. With regard to the infrastructure layer some of the components mentioned by Maier existed, too. They were mostly integrated into the group wide intranet. Among the data and knowledge sources there was the intranet, internet, content management systems, document management systems and data from external stakeholders to give some examples. However, the employees were still having great problems with the existing system. Having all or most of these features still does not mean that they are of a good quality and neither does it mean that they meet the requirements of the users. On the contrary, a survey revealed that complex solutions were not desired by many. People were lacking orientation with all the applications and functionalities. A guideline (in this context called knowledge landscape) had to be developed intellectually by a knowledge manager who had the time, capacities and experience to evaluate and match requirements, different types of knowledge and functionalities thus proving the importance of such a position.

The second type of architecture is called distributed architecture by Maier. It is all about decentralized networks between people. They are client and server at the same time and decide which knowledge they share and with whom. Maier gives an example of a peer to peer knowledge management system as can be seen in illustration 4.13.

Solid lines stand for physical connections such as local area networks, telephone lines or the internet. Dashed lines show examples of supported processes such as search and distribution but also processes of knowledge conversion. Super peers are responsible for the collection, organization and distribution of knowledge as well as other peers but in addition they are also responsible for quality management and performance improvement of the network. Among the advantages of a peer to peer architecture Maier lists autonomy, direct communication, flexibility, and, most important in the context of this paper, acceptance (Maier 2004, 284).

In the second case study a similar architecture was designed to facilitate the knowledge transfer between two companies. Comparable to super peers an interface was established consisting of one knowledge manager and a few colleagues in both companies that were assisting. Main purpose of that network, however, was the directing of knowledge flows. The system was, therefore, a hybrid of a knowledge management system according to Maier and a guideline that could be followed by everyone in cases of necessary knowledge transfer. It can be considered as a possible extension of the knowledge landscape designed in the first case study.

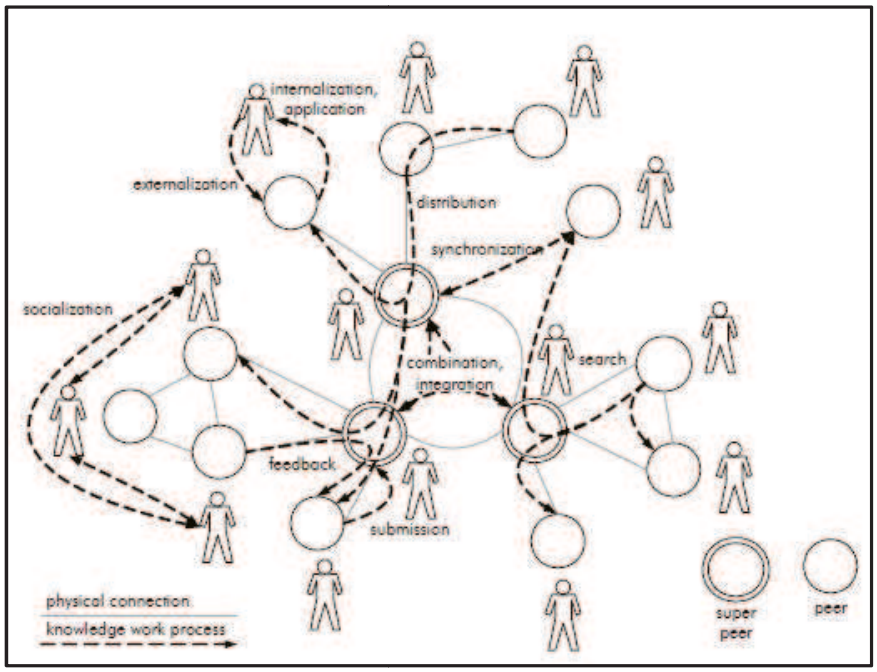


Illustration 4.13: Architecture of a Peer to Peer Knowledge Management System (source: Maier, 2007, 343).

Often knowledge management systems are implemented like standard software. A common phase model for the implementation of standard software can be found in Jochem (1997, 213ff.).

- **Phase 1:** The project is planned and preparations are made. This includes the organization of the project and an analysis of the current status and existing weaknesses as well as a to-be-concept.

- **Phase 2:** The system is planned. The project team is instructed. The structures and processes of the company are analyzed and mapped. The standard system is tested.

- **Phase 3:** A prototype of the system is created. Typical business processes are chosen and analyzed. Internal developments are tested.

- **Phase 4:** The decisions based on the experience made with the prototype are realized. A user´s manual is generated and the quality of the system is ensured.

- **Phase 5:** A test of the system is designed and executed. The test results are evaluated and documented.

- **Phase 6:** All hardware and software components are installed. The users are instructed in the use of the system and the data is migrated.

- **Phase 7:** The system is optimized with regard to organization and technological features. Change requests are documented and granted where applicable. A maintenance and operation manual is edited and the system is handed over to daily operation.

A major challenge of the implementation of complex systems lies in convincing the management of the efficiency and usefulness of such systems and in the motivation of the future users to accept and to use them. Therefore, it is important to figure out beforehand what range of functions a knowledge management system really needs and if it is used for collaboration, content management or any other of the major functions of standard knowledge management systems.

4.3.7 Expert Systems

Expert systems, also known as knowledge based systems are computer programs that derive recommendations for action from a knowledge base following a set of rules, such as if-then-relations, in order to support people with complex situations and decisions. PROLOG is an example of a language used in expert systems. With the help of statistics and heuristics expert systems are capable of generating new knowledge. Furthermore they document the path that leads to the solution of a problem and the methods used. Lehner gives a classification of expert systems (Lehner, 2006, 256f). Among these there are:

- **Diagnosis systems:** provide information about the condition of a specific system and it´s causes. The term system includes both technical and social systems. Diagnosis systems can be expanded to repair systems that not only analyze the causes for the conditions of a system but also provide solutions to possible problems. Diagnosis systems are common in a medical context, for example.

- **Counseling systems:** support users with decision making by providing helpful information. The input of the data that is required usually happens as a dialog between user and system.

- **Forecast systems:** derive predictions from current and past data. There is always a factor of uncertainty. Both mathematical, statistical and heuristic methods are applied. Forecast systems are used for weather forecasts or demographic developments, for example.

- **Planning systems:** support complex planning processes. This includes methods of forecasting. The effects of planned procedures are predicted. Planning systems are used for developing business strategies, for instance. Configuration systems, too, are a type of planning system. They can help with the design of technical systems such as hardware or software. The rules used in these systems are often conditions that allow for checking the compatibility of the individual components.

- **Training systems:** help to learn how to solve given problems. They combine some of the aforementioned methods. They are capable of counseling how to solve a problem and display the possible consequences of decisions using forecast algorithms.

According to Lehner (2006, 257) especially counseling systems are useful for knowledge management. They can provide information about existing knowledge assets, for example. Some of the aforementioned methods are integrated into knowledge management systems. So-called inference engines, the term denominating specific artificial intelligence software, possess the ability to develop new knowledge from an existing database by drawing conclusions. Thus they are a valuable tool for knowledge development.

4.3.8 Management Information Systems

Middle and top management use management information systems for fulfilling tasks that are difficult to structure. Based on the operative business data they are an important part of the organizational memory. In the context of knowledge management various management information systems are being used. Among these there are data warehouse systems, OLAP systems and data mining systems which, therefore, will be described in detail.

William Inmon has written one of the standard works about data warehouse systems. He describes them as an integrated collection of data that is meant to support management decisions. They are subject oriented, non-volatile and time variant (Inmon, 1996, 33). In

this context subject oriented means that a data warehouse can be used to analyze a specific subject area. As data that is in the warehouse will not change it is non-volatile. Therefore, historical data in a data warehouse should never be altered. Time-variant means that historical data is kept in a data warehouse. This contrasts with systems, where often only the most recent data is kept. Data from different sources (data banks) is integrated into one standard form which makes information retrieval more comfortable. Both internal and external sources can be integrated. Data is extracted from documents, for example, and then unified, aggregated and imported into the data warehouse on a regular basis. There are five classes of applications that base on a data warehouse (Bach et al., 1999, 95f).

- reporting systems
- management information systems
- decision support systems
- data mining systems
- business support systems

Due to the fact that there can be various different sources the implementation of a data warehouse system may cause a lot of extra work and take a long time which may result in acceptance problems. Once a data warehouse system is implemented, though, the advantages are manifold. The aggregated data can be used by managers in the process of decision making or in a scientific context for the analysis of empiric data. Data sources and analyzing systems are independent from each other. Thus data can be analyzed by different tools in various ways. Data is provided permanently, can be used several times and is customized to the needs of the individual user. The overall architecture can be customized to the requirements imposed by purpose. Data sources can be added any time. Furthermore processes are automatized (Lehner, 2006, 262f).

Using analyzing systems data warehouses are an efficient tool for generating new knowledge and up-to-date information.

OLAP stands for Online Analytical Processing. OLAP systems are a special databank technology that allow for multidimensional queries. They are capable of deriving information from data. A dimension is a combination of data. A so-called OLAP cube is a helpful visualization of the principles. It consists of the following components: a measure for the data which, in illustration 4.13, is the sales numbers. Dimensions are

the parts of a cube that categorize the data. In the example below the dimensions are: “Product”,”Location” and “Year”. Dimensions have hierarchies, attributes and dimension members. Hierarchies are a set of parent-child relationships, typically where a parent member summarizes its children. For example “Illinois” would be the parent of “Chicago” and child of “United States of America”. A dimension attribute describes a characteristic that is shared by dimension members. Data based on similar characteristics can thus be selected. The cube below contains sales numbers in different cities in different years.

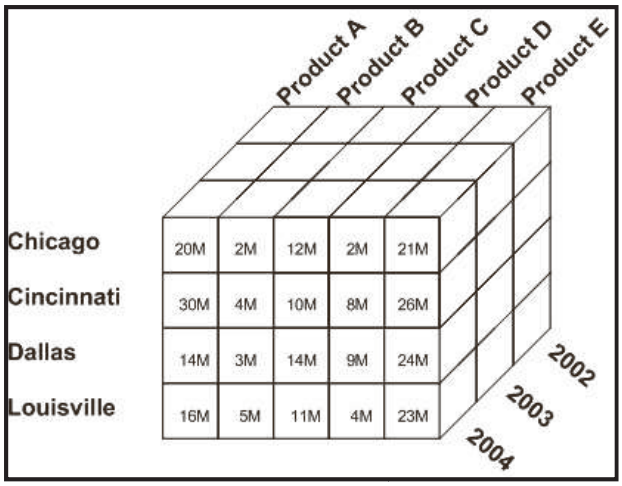


Illustration 4.14: OLAP Cube
(source:http://docs.oracle.com/html/B13915_04/i_olap_chapter.htm, 10.01.2018)

The system user can combine the dimensions he or she is interested in. For example the sales numbers in Chicago in 2004. Furthermore it is possible to analyze which product was the most successful or which market was the best for that specific product.

Whereas relational data bases work with tables, with OLAP further dimensions can be added. Several operations can be executed with a multidimensional OLAP cube.

- **Slicing**: A “slice” or subset of a cube is taken into consideration by choosing a single value for one of its dimensions. Thus a new cube with fewer dimensions is generated. In the illustration above the sales numbers of all products in Louisville in the years 2003 and 2004 would be a slice of the entire cube.
- **Dicing**: In contrast to the slicing function dimensions are not removed. For example it is possible to create a cube that shows the sales figures of just two cities of all products and in all years.

- **Pivoting / Rotation**: The cube can be rotated in space. For instance, cities could be arranged vertically and products horizontally instead while viewing data. Pivoting could replace products with time periods to see data across time for a single product.
- **Drill-Down**: means zooming in, respectively focusing on a specific area of the cube.
- **Drill-Up/Roll-Up**: means zooming out.
- **Drill-Across**: This operation allows for switching to other dimensions in the same hierarchy, for example from Chicago to Cincinnati or from product A to product B.
- **Drill-Through / Drill-In**: This operation refines the data.
- **Split**: The split operation analyzes a specific figure by adding further dimensions. A year, for example could be subdivided into months or weeks.
- **Merge**: The merge operation removes dimensions in contrast to the split operation.

A possible source of the information analyzed in an OLAP system is a data warehouse.

Data mining systems consist of a variety of techniques such as statistic methods or semantic retrieval (Bodrow et al., 2002, 29). They are used to extract new information from large quantities of data by correlating the data.

Decker and Focardi define Data Mining as follows:

> Data Mining is a problem-solving methodology that finds a logical or mathematical description, eventually of a complex nature, of patterns and regularities in a set of data (Decker & Focardi, 1995, 3)

Data mining systems are capable of classification, segmentations, prediction, association, clustering, text mining, dependence analysis and variance analysis (Lusti, 1999, 252 and Alpar, 2000, 3ff). Alpar explains these terms as follows.

- **Classification:** Objects are correlated with specific classes according to their properties. This happens with the support of if-then-functions **(if** a customer spends more than 10000 Euros for the products of a company **then** he is

classified as a “type A customer”.) This sort of classification is monitored by people.

- **Segmentation:** Objects respectively data are/is correlated with each other but in contrast to a classification the classes do not exist but are created in the process of segmentation. Classes are derived from the characteristics of objects with similar properties based on a cluster analysis. This analysis determines similarities between objects. After the definition and creation of classes or segments their notation is found with the help of mathematical operations.

- **Prognosis:** Based on historical data a prognosis on characteristics of specific data is made using both statistical methods and methods of artificial intelligence such as artificial neuronal networks, for example.

- **Dependency Analysis:** Data is analyzed and scanned for possible relations, which are to be confirmed by statistical tests and require interpretation.

- **Variance Analysis:** Data that is too deviant from the rest of the corpus is identified and filtered. The causes for variances need to be found.

With the help of data mining new data and information is deduced from existing data which can be used in managerial decision making processes.

Lehner mentions a new development from the mid 1990ies called knowledge warehouse system (Lehner, 2009, 263). He paraphrases Dittmar according to whom a knowledge warehouse is a technical implementation of the organizational memory (Dittmar, 2004 in Lehner 2009). A knowledge warehouse includes both structured data like an ordinary data warehouse and unstructured information that exists in an organization. According to Nemati et al. only a small part of the required knowledge exists in data banks. The larger part is found in the minds of the members of an organization (Nemati et al, 2002, 144). The final goal of a knowledge warehouse system is the capturing and coding of knowledge as well as the improvement of the retrieval and sharing of knowledge across an organization thus supporting decision making processes especially with regard to knowledge intensive decisions.

> …a data warehouse does not necessarily provide adequate support for knowledge intensive queries in an organization. What is needed is a new generation of knowledge enabled systems that provides the infrastructure

> required to capture, enhance, store, organize, leverage, analyze, and disseminate not only data and information but also knowledge. The existing enterprise-wide data warehouses can be extended to create a knowledge warehouse…The primary goal of a KWis to provide the knowledge worker with an intelligent analysis platform that enhances all phases of the knowledge management process. (Nemati et al., 2002, 144).

Hence, a knowledge warehouse system is based on a data warehouse system. It may include OLAP systems, data mining systems, portal systems etc. (Lehner, 2009, 263). It grants access to the various sources of knowledge in an organization. Lehner states, however, that it is restricted to explicit knowledge (Lehner, 2009, 263). Nemati et al. suggest the identification and cataloguing of different types (explicit vs. tacit knowledge) and forms (e.g. text streams, binary large objects, production rules, mathematical models, and what-if cases) of knowledge (Nemati et al. 2002, 144). They state that tacit knowledge can be converted into explicit knowledge with the help of IT and artificial intelligence. As seen before, this statement can be doubted, however. Based on the knowledge spiral model created by Nonaka and Takeuchi (1995, 84ff) they apply the four steps which they call socialization, articulation (externalization), integration (internalization) and combination of explicit knowledge. For the process of socialization they suggest the sharing of experience, skills, mental models etc. by observing, imitating and practicing guided by a teacher. This can be done by means of on-the-job-training complemented with film clips of an expert who performs a task, virtual reality representations, and kinematic analysis. The film clip can also include slow motion segments and comments or explanations for a better understanding of what is demonstrated. As mirror neurons in the human brain react on observed actions, this method might be promising for a successful integration of implicit knowledge. In a kinematic analysis reflective dots or sensors are used which are attached to the limbs and joints of a demonstrator to improve the determination of quick or subtle movements or actions during the demonstrated process. After the recording of a process kinematic analysis software analyzes the motions made.

Nemati et al. meet the challenge to render implicit knowledge extractable with a concept which reminds remotely of Nonaka´s and Takeuchi´s approach using metaphors and analogies (Nonaka & Takeuchi, 1995, 23f). For this sake they suggest the use of IT and artificial intelligence through the specification of mathematical models (2002, 147). This requires a number of steps. Information given by a knowledge worker is

interpreted with the goal to detect and capture the underlying knowledge and reasoning processes. The interpretation is the basis of further actions. A model or special type of language is developed to describe the performance that has been guided by implicit knowledge. So far this understanding of tacit knowledge does not correspond with the definition given by Polanyi, that tacit knowledge cannot be articulated at all. Then Menati et al. focus on the externalization of implicit knowledge in decision making processes. Decision support systems are capable of constructing mathematical models. In the construction process a knowledge worker is asked to specify the objectives of the model, the decision variables and their importance in relation to one another. The model constraints are determined with regard to the decision variables and the objective functions are described. All this is explicit knowledge but it reflects the implicit knowledge that has been developed in a decision making environment over the years. As a next step they suggest to store the models as a set of mathematical inequalities, as annotated graphs of arcs or nodes in network flow models, as arc descriptions or as a condensed canonical model formulation. Furthermore, they suggest the construction of what-if-cases that represent situations that are to be analyzed.

What exactly is the impact of tacit knowledge in this context though? A knowledge worker changes the model coefficients or right hand side values in order to explore its effect on the modeled solution. This is done by estimating the possible ranges of the parameters that reflect decision making environments represented by the model. A knowledge worker is enabled to do so by the experience that has been built up in past situations. The tacit knowledge of various historical situations and decisions is converted into explicit knowledge that can be shared with other workers and be used to enhance decision making. Thus Nemati et al. use a loop way to reach the goal of externalizing implicit knowledge. It is not articulated by words though, nor is the actual implicit knowledge that leads to choosing certain parameters explained in a way that it can be understood by other people and thus be reproduced, however a representation of that tacit knowledge i.e. the parameters and values, can be used for future decisions. Those decisions will not base on internalized actual knowledge though but rather on trust in the experience that has been incorporated into the system. Another weakness of the model is the fact that circumstances have a tendency to change. Parameters or values that may have proven effective or efficient in the past are not necessarily useful in future situations. The effectiveness of the system to incorporate implicit knowledge will

be highly dependent on the evolution of software algorithms. Sometime in the future they may be capable of copying or even imitating human thought patterns.

Knowledge warehouse systems also support the process of combining explicit knowledge. Stored knowledge is made available to other users of the system. New knowledge can be created from existing knowledge. Text mining, for example, can be used for information extraction (Nemati et al., 2002, 147). Thus specific information is found in a document according to a predefined set of rules. Case based reasoning is used for making decisions based on past cases, similar to lessons learned. Therefore, cases are stored. Filters are implemented that help to find relevant cases using key factors. Multiple related model cases can be stored including the underlying principles that have been applied in the process of decision making. Thus a user of the system is enabled to gain new knowledge by learning about other perspectives, relations and mental models that have led to specific decisions in other cases.

A major challenge for knowledge warehouse systems is the object they focus on. In contrast to a data warehouse system which deals with structured data that can be stored easily in a database, knowledge does exist in various forms. Knowledge is stored in the form of models and solved model instances that are connected logically with the associated models or with related instances. All this requires both inductive and deductive artificial intelligence technologies as well as various forms of input data, execution parameters and output forms (Nemati et al. 2002, 150). In contrast to the periodical updating of data in a data warehouse knowledge in a knowledge warehouse system is updated constantly. Every transaction can create new knowledge.

Nemati et al. suggest an architecture as an extension of the data warehouse architecture as seen in illustration 4.15. The “knowledge acquisition module” supports the conversion of tacit knowledge into explicit knowledge with the help of mathematical model specification and what-if case specifications in a model-based environment, idea generation in a brainstorming environment and other methods. Similar to the corresponding module in a data warehouse the “data and knowledge transformation & loading” module uploads data and knowledge from external sources. At the heart of the system the “knowledge warehouse storage” module integrates both knowledge base, model base, and analysis tasks including knowledge objects such as numerical data, text streams, movie clips, validated models, meta-models etc. and, in addition, the software

to manipulate them and all tools that are used to process, interpret and produce knowledge.

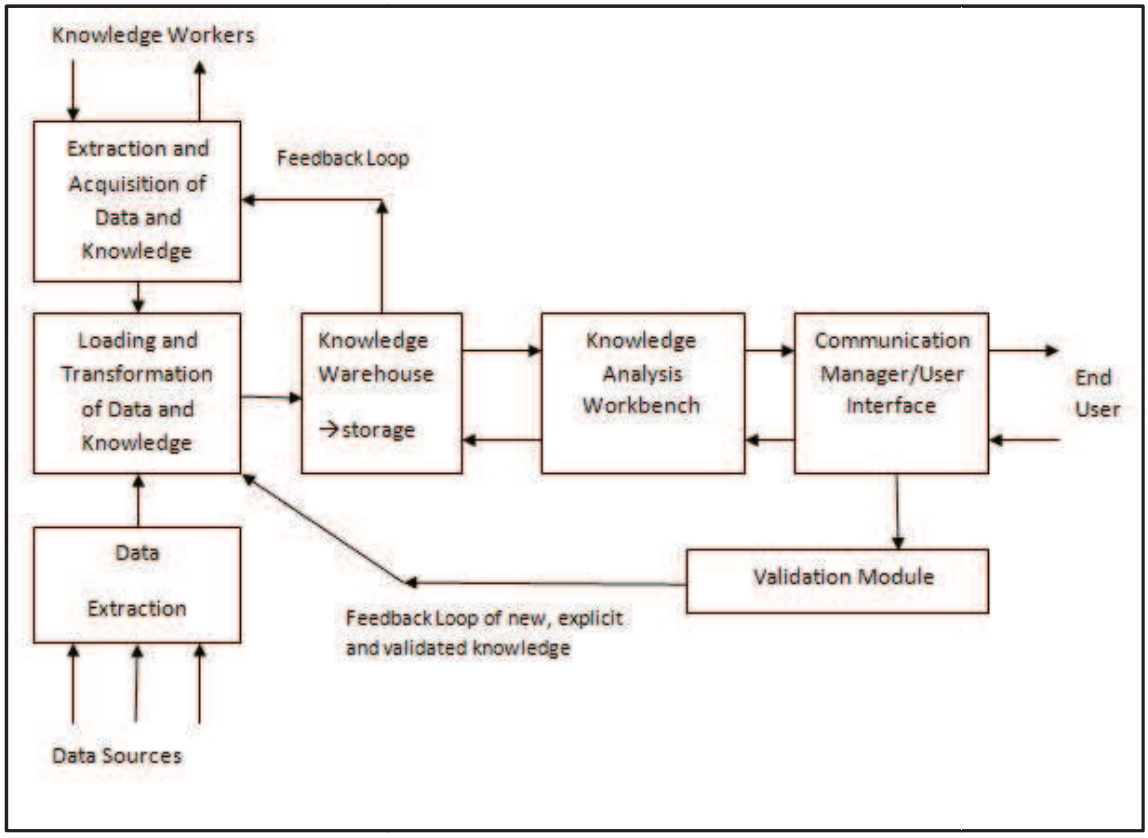


Illustration 4.15: Knowledge Warehouse Architecture (source: based on Nemati et al., 2002, 151)

The knowledge analysis workbench is the module where all analysis processes take place. For example, the outputs of analysis tasks are evaluated with regard to consistency. A task controller handles requests for data and run-time interactions that are required by the analysis tool the repository of which is managed as well. The communication manager serves as an interface between a user and the system. A "knowledge engineer" sub-module interacts with the user in order to figure out the purpose of an analysis and the underlying principles of the modeled environment. As a result arguments are developed. A what-if-interface helps to create what-if-cases. Parameters of suggested examples can be changed and existing examples are provided that help to take past cases into consideration. The module also includes a query processor that translates natural language into queries that can be processed by the system. Furthermore, there is a representation manager, which is capable of choosing

the appropriate presentation of the results considering the user's preferences, and a help function. Feedback loops enable the transfer of knowledge from one user to the other.

4.3.9 Information Retrieval Systems and Search Engines

Being among the most useful and important technologies for knowledge management information retrieval systems help with finding relevant information. Whether information is relevant or not is a subjective decision. Therefore, the relevance ranking algorithms of such systems should consider the user´s needs and requirements. Information retrieval systems include both technologies that search in an existing information inventory upon request (pull services) and technologies that provide a user with information in regular intervals (push service). Search engines are a good example of a pull service and probably the most prominent tool for information retrieval worldwide. The functionalities of search engines vary, however. Search engines such as Google or Bing etc. search for information in the World Wide Web. Intranet search engines only search in the information repository of an organization or company.

Lewandowski (2005) distinguishes between manually generated catalogues and search engines the functions of which are based on algorithms. He further distinguishes the latter between universal search engines that search the entire World Wide Web, specialized search engines that are limited to a geographical area, a language area or a specific topic and archive search engines that save websites in a databank (Lewandowski, 2005, 25).

In the context of this paper the functionalities of search engines are of particular interest. A combination of useful and user friendly functions and relevant results can enhance the acceptance of a retrieval system. A data base that contains different types of documents such as word files, PDF files, wiki pages etc. requires a search engine that is capable of searching (in) various types of documents. The internet, for example, includes, besides text documents, many other multimedia files of strongly varying length (Lewandowski, 2005, 75). In the first case study one of the major challenges was to find a search engine that does not only search the implemented wiki for information but also for and within uploaded word documents and other types of documents. The final solution was Apache Lucene, an open source information retrieval software library which is also used by Wikipedia. In order to retrieve relevant results several methods have been developed. Term frequency, term proximity, term location or inverse document frequency are used, for instance (Lewandowski, 2005, 74). In contrast to the

internet, which contains all sorts of information, an intranet database usually contains only documents that have been relevant at some point in time. The major challenge is to maintain topicality of the information. When a new knowledge management system is implemented it is important to intellectually decide which documents and what versions are to be migrated to a new application. A wiki like the one implemented in the first case study offers further options to increase the relevance of the search results. It is possible to search documents both by their names if they are known or, in case of a keyword search, the search can be restricted to a namespace. If, for example, a company consists of several teams, each team can get a prefix representing a namespace or work space that, when added to a wiki page, confines the article to the work space of a specific team. When the prefix is used for searching for information only the files that belong to the respective name space are found.

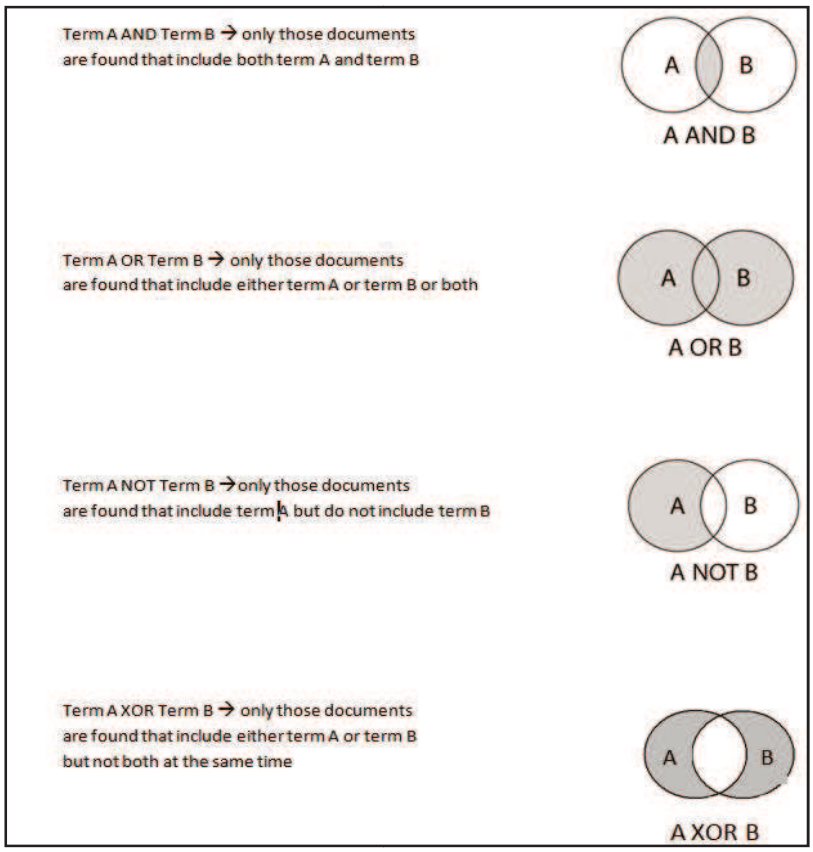


Illustration 4.16: Boolean Search (source: based on Stock & Stock, 2015, 245)

Wildcard characters or the Boolean retrieval are further functions of a search engine. Wildcard characters are placeholders. The most common wildcard characters are the interrogation mark, the asterisk and the hash mark, however, there are many more. The interrogation mark usually serves as placeholder for exactly one character, the asterisk for any number of characters and the hash mark for numbers. An example for a search

term using an asterisk would be *card, replacing “wild” or at the end of the search term wild*, replacing “card”. The Boolean model is about finding exact matches. Boolean systems consist of search atoms (Term A, Term B etc.) and operators (Stock & Stock, 2015, 242ff). Search atoms can be individual words or phrases. The operators used by the model are “AND”, “OR”, “NOT” and “XOR” as seen in illustration 4.15.

4.3.10 Yellow Pages

The nature of yellow pages is revealed by their name. Like a phone directory they give an overview of the members of an organization. However, they have a whole lot more to offer. As they include a competence portfolio of the employees they can be a great help to find experts in the various knowledge fields of an organization. Especially for large organizations or affiliate groups with branches in different locations or countries yellow pages is a simple and efficient tool to identify knowledge. Employees can keep their data profile up-to-date themselves if they like. Lack of motivation to do so might be a challenge, however. An open and transparent culture is a basic prerequisite if the employees are to maintain their data.

Yellow pages do not only contain information about the skills of the employees they also enable communication via different means, be it via telephone, e-mail or online. A possibility would be a phone symbol embedded into each profile. A click on that symbol would establish a phone connection.

A tendency towards decentralization and constant changes in the structures of companies make directories very useful. In case of a lack of motivation to maintain the data Gust von Loh suggests a workaround. Information about employees can be extracted from documents (2009, 200). However, it is important to consult the workers council beforehand, especially if the law requires the approval of the workers council when data is collected about employees. It is doubtful that this method could be used in large affiliate groups with a strong co-determination.

Another type of directory is called blue pages. They contain information about external experts. In the context of a knowledge landscape a function could be added that determines the flow of knowledge from one person to another with regard to type of knowledge and amount of knowledge or intensity of knowledge transfer as will be demonstrated in the second case study. Yellow or blue pages are usually realized by technical means. However, they may exist in paper form, too. Therefore it might be debatable whether they still belong to the technical tools of knowledge management. As

seen before knowledge management is by far not limited to technical applications. Subchapter 4.4 will introduce a couple of tools with a strong focus on social interaction.

4.3.11 Knowledge Management Apps

In the last years a number of apps for mobile phones have emerged. Knowledge management software such as Zendesk, SABIO Knowledge Management or Confluence, for example, can also be used on smart phones. Some of them can be used with Android, some with iOS and some with both. Confluence, for example, is a collaboration tool that offers an open and shared workspace that connects people to the ideas and information they need. There are group related pages in dedicated work spaces and it comes with a search engine and page trees (https://de.atlassian.com/software/confluence, 26.04.2018).

4.4 Social Knowledge Management Tools

In the context of all knowledge management activities the human factor must not be forgotten. Considering the business studies definition of knowledge, knowledge management does not make sense without involving people in the processes and activities. The following subchapters provide a brief survey of social methods that have been developed in order to promote the identification, acquisition, sharing, storing and development of knowledge.

4.4.1 Lessons Learned

Experience is an essential success factor, be it positive or negative experience. The idea behind the concept of lessons learned is that employees provide each other with the experience they have made in order to prevent redundancies, extra work and the repetition of mistakes. Experience is documented and provided systematically. Documentation should become an integrated part of existing processes. Lehner suggests to establish a structure for lessons learned with regard to which aspects are to be documented (Lehner, 2009, 189).

Some of the major advantages of lessons learned are the preservation of knowledge even when an employee leaves the organization. Information can be provided to new employees, shorten the period of job training and thus facilitate integration. Thus the use of existing knowledge is supported because it exists in a context and it becomes more obvious what it can be used for.

The documentation of lessons learned requires time and effort which requires support from the management. A business culture that allows for making errors and that grants extra time for documentation is of great value in this context. Employees must be able to write down errors without fear of sanctions. Confidential reporting systems, which are very common in the aviation industry, are quite useful in this context.

The documentation of lessons learned at the end of a project is a good example because it has become quite common in project management. Hemmrich and Harrant suggest a discussion at the end of a project about what went wrong and, even more, about what went right (Hemmrich & Harrant, 2011, 122). The objective is a comparison of the results with the original planning with regard to time, costs etc. and the identification of the causes for discrepancies. They suggest a lessons learned workshop in order to avoid the same mistakes in future projects, to share experience and good practices, to establish best practices, and in order to improve attitude and processes (Hemmrich & Harrant, 2011, 123). Furthermore, they suggest considering the following aspects (p.124):

- What positive contributions have been made by whom?
- How was the cooperation?
- Have there been any major disturbances in the cooperation?
- What were the strengths and what were the weaknesses?
- Is there room for improvement?
- Are the members of the project team satisfied with their achievements and the development of the project?

A final meeting allows for feedback between team members and project managers. Lessons learned also allow for the identification of best practices.

4.4.2 Best Practices

Internal benchmarking helps to identify best practices. Given a specific problem the best solution is searched by comparing the efficiency of different solutions. These solutions can be found within an organization as well as outside of it. A solution that is of adequate quality, however, not the best solution is called good practice. Existing processes are replaced by good and best practices. Probst et al. mention Buckman Laboratories that attribute an increase in business volume by ten percent by using best

practices (Probst et al. 2006, 162). In order to identify best practices the improvements they add to an organization need to be measurable easily. Furthermore, they must be reproducible (Lehner, 2009, 191).

Best practice sharing enables the search for and identification of best practices and their organization wide provision. Problems can be solved faster and more efficiently if there are already solutions available. Nevertheless, there are some challenges. A lack of motivation to share best practices can be an obstacle that needs to be overcome. According to Probst et al. the following obstacles are most prominent when it comes to best practice sharing in descending order. A business unit that may benefit from a best practice is lacking the basic knowledge that would help to understand the value of it and how it can be used for its own purposes. Besides, often it is not understood which factors determine the success of a best practice. At last the relationship between two units can be a barrier, too, especially when there is a lot of competition in an organization. Sometimes the attitude, ("not invented here"), prevails that a unit does not want to use processes that have not been developed in that unit (Probst et al., 2006, 163). In order to overcome obstacles in best practice sharing Lehner suggests that it should be supported by management, organizational structures, technology and responsibilities. Someone could be in charge of identifying and sharing best practices. Best practices could be saved in a databank accessible to all business units (Lehner, 2006, 190). However, best practices cannot be used anywhere at any time. They are always connected to certain circumstances such as the structure of an organization or human resources and conditions concerning the staff. The more similar the circumstances the better best practices can be copied (Davenport and Prusak 1998, 168). Whenever a problem requires new thinking or new recipes, however, the use of best practices might even cause damage (Malhotra, 2000, 44).

4.4.3 Job Rotation

In trainee programs it is a common practice that the trainee gets different assignments. The purpose of this practice is the acquisition of a wide variety of skills and experience. Job rotation is guided by the same philosophy. An employee is appointed several areas of activities throughout a company. Instead of specializing people in just one field those who go through job rotation become generalists who can be useful in a variety of different positions. Therefore, chances of getting a promotion are usually good in the end. All sides benefit from job rotation. The employee gets the chance to improve his skills and to collect more knowledge on different topics which makes him more

valuable to a company. In the end the company is able to determine which position suits best for this employee. The different departments benefit from an influx of new ideas and an exchange of knowledge, especially with regard to implicit knowledge. Implicit knowledge is exchanged and passed on to other departments that are part of the rotation program. Job rotation proves to be a good method to keep implicit knowledge within an organization, even when employees leave (Gust von Loh, 2009, 213).

Furthermore, job rotation is a good means for motivating those employees who want to evolve and who need to face ever new challenges for their personal fulfillment.

4.4.4 Press Reviews

Press reviews provide an up-to-date summary of news that concerns a specific field of interest. In the context of a company press reviews could be about branch specific information, such as news about new inventions, markets or competition etc. They consist of articles in magazines or newspapers, online articles etc. Research services, respectively online databases such as ProQuest or Lexis-Nexis are an extensive source of information for press reviews as well. A more elaborated method is called media response analysis. Statements that are made about a company in the media are analyzed. This includes newspapers and magazines as well as television and radio broadcasts, online articles, blogs etc. The collected information helps to manage public relations activities.

4.4.5 Communities of Practice

Communities of practice are groups of people who have areas of interest in common. Knowledge is shared and new expertise is developed. Due to the close contact group members get a feeling for what kind of information is relevant for the others. Trust and team spirit can grow. A lack of trust is one of the major obstacles of efficient knowledge management. Communication takes place at regular intervals. According to Gust von Loh a number of five to ten group members is ideal (Gust von Loh, 2009, 184). Communities of practice exist on various levels. There are virtual communities of practice and those that meet in person. The ideal situation consists of both. Personal meetings provide the chance to build stronger ties between the group members and thus enhance trust and improve cooperation. Results can be saved virtually and made available for all group members at any place and time by using applications such as wikis for example. Besides, personal meetings enable the transfer of implicit knowledge, as well. The members of a community of practice often work in different

parts of a company. The composition is not limited by locations or organizational structures which makes them especially valuable for companies.

Communities of practice have existed for a long time, with the term originating in social learning theory (Probst et al. 2006, 168). With the growing importance of knowledge management they have become more popular. The idea is much older though. The archetype can be found in the guild system in the middle ages (Wenger & Snyder 2000, 140). Typical of that system was the knowledge transfer from a master craftsman to his apprentices and between newer and older apprentices.

Modern communities of practice are rather informal groups of people. Usually the participation is voluntary. As they are not founded by the management a knowledge manager has to find other ways to bring people together. They could be the result of a successful project, for example. Members of a training class could be encouraged to stay in contact in order to exchange knowledge. Despite all informality Gust von Loh suggests that some rules are required (Gust con Loh, 2009, 184). Expectations should be expressed and drafted. Sources of information are to be chosen by a member of the group. Lehner mentions several roles within a community of practice (Lehner 2006, 216f.). There is a moderator who is responsible for the organization of the group and the definition of the objectives. He also provides all required resources and organizes meetings. Sometimes the moderator has assistants who support him and who administer, collect, classify, evaluate and pass on knowledge to the other members of the community. Some group members are experts in specific areas of knowledge and can thus support the group by identifying and evaluating knowledge. So-called boundary-spanners are members that belong to other communities of practices as well. They are able to mediate between different groups and between a group and outsiders. Thus they improve the knowledge transfer between groups and with external sources.

Despite the informal character of communities of practice there is a tendency of exploiting them by using them for the transfer of best practices (Probst et al. 2006, 168).

4.4.6 Knowledge Cafés

Similar to communities of practice knowledge cafés include groups of people who meet in order to exchange and develop knowledge about a specific topic. Compared to communities of practice, these meetings take place once only. Like in a café there are several tables. At each table, which all have a moderator, at least twelve people come together to discuss a specific topic or find solutions for a given problem (Hage-Malsch,

2007, 27). After a previously defined period participants switch to a different table. This method is especially common in Anglo-Saxon countries and used at expert conferences and symposia.

4.4.7 Storytelling

Storytelling was introduced by Kleiner and Roth (1997, 172ff). It is a method for passing on knowledge in the form of a story. Based on the fact that information can be recalled more easily when embedded in a context story telling is an efficient tool for sharing knowledge (Davenport & Prusak, 1998, 81f). Storytelling was first used at universities. Later it was introduced to companies as well. The informal character of the stories is important. They live from being interesting. Experience shows that after a meeting interesting anecdotes are remembered more easily and willingly than dry facts.
Storytelling is often used in communities of practice but short stories are also common in meetings or presentations. During the latter special emphasis can be put on important information with the support of an anecdote.

Storytelling can be used for various purposes. Knowledge such as best practices or lessons learned can be shared, future events can be announced and even the corporate culture can be changed by the use of stories. Gust von Loh mentions the use of so-called counter stories in order to prevent negative stories or rumors that exist in an organization from being harmful (Gust von Loh, 2009, 188).
A special type of stories is called *Erfahrungsgeschichten*. They are a collection of short stories about recent important events on an organization. They include both individual experiences and annotations (Reinmann-Rothmeier et al., 2000, 3).
Skeptics might call story telling a waste of work time. There are numerous arguments in favor of storytelling, however, which can be used to refute their objections. Among the major advantages there are:

- Communication between employees is improved and informal networking is strengthened.
- Complex, theoretical facts are explained practically.
- Implicit knowledge can be passed on to a certain degree by using metaphors and analogies (Nonaka & Takeuchi, 1997, 23f.).
- Stories help to govern a business; counter stories neutralize negative stories and rumors.

The downside of storytelling is the extent of time and effort that is required. Furthermore, organizational learning processes always take some time. However, when used in an adequate way story telling makes the static exchange of knowledge more flexible and it is an efficient tool for starting organizational learning processes.

4.5 Web 2.0 and Social Software

Along with complex knowledge management systems such as MS SharePoint, Sabio or Confluence, Web 2.0 applications are currently the state of the art in knowledge management. Due to the wide range of functions Web 2.0 tools can be employed in the context of all knowledge management strategies. Applications such as wikis support the storage and retrieval of documents, the main objective of the codification strategy. Social networking can be used in the context of both socialization and personalization strategy. However, as one of the major aspects that define Web 2.0 is the aspect of participation it is above all useful for socialization strategies. The readiness of employees to use the applications is essential, though. Often typical Web 2.0 functions are integrated into knowledge management systems. However, especially for smaller companies or small departments in larger groups the use of individual applications may be more appropriate and efficient because complex systems require enormous resources with regard to costs and time and effort during the process of implementation, whereas the implementation of most individual Web 2.0 applications is rather simple and due to the fact that there is a lot of open source software the implementation and operating costs are much lower than those of complex systems.

In the following the characteristics of Web 2.0 in general will be explained followed by a choice of currently popular applications in order to show what chances they offer for knowledge management and what critical factors need to be considered to prevent failure.

While in the past content was edited by webmasters, Web 2.0 has been a change in paradigm. Content can be edited by anyone. Before, the edited knowledge had been the intellectual property of an individual. The collaboration of different individuals adds a new quality to the information and knowledge that is provided which causes Peters and Stock to speak of collective intelligence (Peters & Stock, 2007, 22). According to Peters and Stock Web 2.0 includes all services that can be used for collaboration and that involve the user in the process of content generation (Peters & Stock, 2007, 22). According to Meckel and Stanoevska-Slabeva (2008, 2) Web 2.0 is based on both user

generated content and on social software that supports user generated content, communication and collaboration. Toffler claimed in 1980 that the roles of consumers and producers would overlap in the future and eventually they would become one. In this context he introduced the term *prosumer* (Toffler, 1980, 275ff). He argues that consumers are a phenomenon of the Industrial Age. As society moves toward the Post-industrial age, the number of pure consumers will decline. They will be replaced by prosumers, people who produce many of their own goods and services themselves.

In an attempt to define what Web 2.0 actually is, O´Reilly, who has coined the term Web 2.0, compares Web 1.0 with Web 2.0. This comparison was the result of a brainstorming session and is shown in illustration 4.17. Some applications and concepts that are subsumed under the term web 1.0 are still in use while others play no role anymore and not all web 2.0 applications are evenly successful.

The importance of the principles that guide the development of Web 2.0 applications are shown by O´Reilly when he mentions the competences of which companies need at least one in order to be successful (O´Reilly, 2005; Alby, 2008, 15).

- Use of the web as platform.
- Integration of the collective intelligence of the users. This can be achieved by means of blogs, folksonomies or social software, for example.
- Access to data that is otherwise difficult to find.
- A procedure for the development of software that integrates the users.
- Software that can be run on various devices.
- “Lightweight” models for programming, user interfaces and business.
- Integration and leveraging of the so-called long tail by means of systems that allow for a self-service.
- A distinction can be made between applications that come as a package and applications that are customized or developed in companies according to their specific needs (Peters & Stock, 2007, 23). Services are to be preferred, not packaged software, with cost-effective scalability. Among the Web 2.0 technologies there are for instance Wiki-Engine, RSS and Ajax.
- Control over unique data sources that get richer as more people use them.
- Trusting users as co-developers.
- Harnessing collective intelligence.

- Software above the level of a single device.
- Lightweight user interfaces, development models and business models.

Web 1.0 vs. Web.2.0		
Web 1.0		**Web 2.0**
DoubleClick	-	Google AdSense
Ofoto	-	Flickr
Akamai	-	BitTorrent
mp3.com	-	Napster
Britannica Online	-	Wikipedia
personal websites	-	blogging
evite	-	upcoming.org and EVDB
domain name speculation	-	search engine optimization
page views	-	cost per click
screen scraping	-	web services
publishing	-	participation
content management systems	-	wikis
directories (taxonomy)	-	tagging ("folksonomy")
stickiness	-	syndication

Illustration 4.17: Comparison of Web 1.0 with Web 2.0 (source: O´Reilly, 2005)

Essential in this context is the shift of web technologies towards social aspects. The user is at the center of all activities. This requires that users use the tools proactively. It has become their responsibility not just to generate content but also to collaborate with others and update existing content. Here lies a great challenge for successful knowledge management activities because it is essential to convince employees of either the necessity or the usefulness of participation. Table 4.1 depicts some of the most common Web 2.0 applications or concepts including a short description. Well known and popular examples of applications or services are given where possible. Beside the applications mentioned in the table there are many more on the market.

Web 2.0 Tool	Description	Examples
Blogs	Discussion or informational site consisting of discrete entries, so-called posts, typically displayed in a reverse chronological order	Twitter
Wikis	(Collaborative) creating, editing and storing of articles and documents. Articles can be discussed.	Wikipedia
Social Networking	Every user can create a profile, users interact by sending or posting text messages or other files that can be evaluated by other users (for example: like vs. dislike).	Facebook, XING, Skype
Social Tagging	Social Tagging is used for web content including text, bookmarks, pictures etc. There are no strict rules in contrast to the strict rules of a thesaurus or ontology, for instance. Everyone can index freely according to his/her own logic, needs or wishes.	
Folksonomies	Collections of tags as described under the term social tagging.	
Tag Clouds	A way of illustrating tags graphically that looks like a cloud. Most frequent tags are displayed larger than other, less frequent tags. 	TagCloud ULB Heinrich-Heine-Universität
Presentation Creation and Sharing tools	These tools allow users to create cloud based presentations. Among the functionalities there are: panning, zooming, sizing, rotating and editing of objects. Possible objects are videos, images, texts and other presentation media. Work can be done online or offline. Tools such as Prezi Collaborate allow up to ten people to co-edit and show their presentations in real time and simultaneously. Each user is visually represented in the presentation window by a small avatar.	Prezi, Sliderocket

Web 2.0 Tool	Description	Examples
Photo Storage and Slideshow Tools	Photographs are published and rated by others.	Flickr, Instagram
Text Cloud Tool	Wordle is a toy for generating "word clouds" from text that users provide. The clouds give greater prominence to words that appear more frequently in the source text. You can tweak your clouds with different fonts, layouts, and color schemes. The images created with Wordle can be used freely. They can be printed or saved on a computer. (http://www.wordle.net, 03.08.2018).	Wordle
Poll and Survey Tools	Creation of surveys and polls online. Results can be monitored in real time as they come in. Filters can be used and data be exported to other media (e.g. PDF). Some tools allow for collaboration in a group.	Survey Monkey,
(Virtual) Document Storage and Sharing Tools	Documents are uploaded to a virtual storage space where they can be read and edited by any authorized person.	Google Docs
Podcasts	Media files that users can subscribe to on the internet. Podcasts can be audio files or video files (vodcasts). A podcast consists of a series of episodes that can be received via web or RSS feeds.	Tagesschau Podcast, last.fm
Vodcasts	Videos can be published and edited by users. Other users can rate and comment the videos.	Youtube

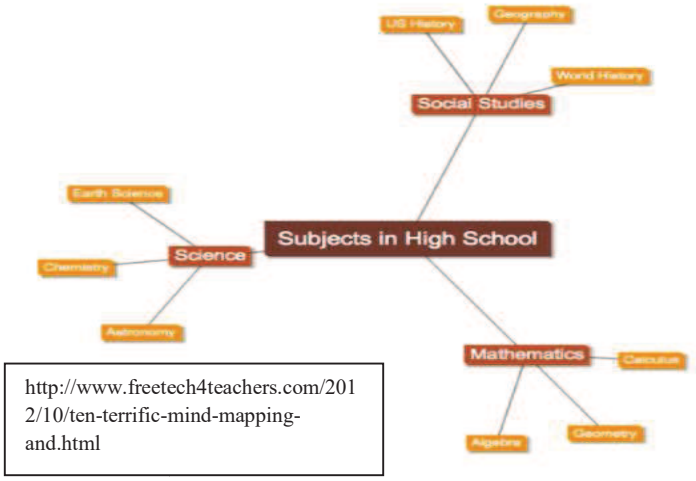
Web 2.0 Tool	Description	Examples
Mindmapping and Brainstorming Tools	Mind mapping is the process of using visual diagrams to show the relationships between ideas or information. It can be used for project planning, collecting and organizing thoughts, brainstorming and presentations. It comes in useful for solving problems, mapping out resources and uncovering new ideas.  http://www.freetech4teachers.com/2012/10/ten-terrific-mind-mapping-and.html	Bubbl.us
RSS Feeds (Rich Site Summary Feeds)	Standard web feed formats to publish frequently updated information such as blog entries, news headlines, audio or video that may include full or summarized text and metadata. Users subscribe to feeds and receive updates when available.	
Mashups	Mashups are web application hybrids. They use so-called application programming interfaces (API) provided by web applications. Content such as text, images, sound etc. can be recombined. Google Maps, for instance, offers an API that enables web designers the integration of maps and satellite images into their websites.	SAP Business By Design

Table 4.2: Survey of Web 2.0 Tools

O´Reilly states that some startups that consider themselves Web 2.0 are not Web 2.0 and that, on the other hand, some of the applications identified as Web 2.0, like Napster and BitTorrent, are not even properly web applications. Therefore, his approach to define Web 2.0 focuses on a set of principles and practices as a framework for sites that demonstrate some or all of these principles which identify them as suitable for the Web 2.0 concept. Some of these principles are depicted in illustration 4.18.

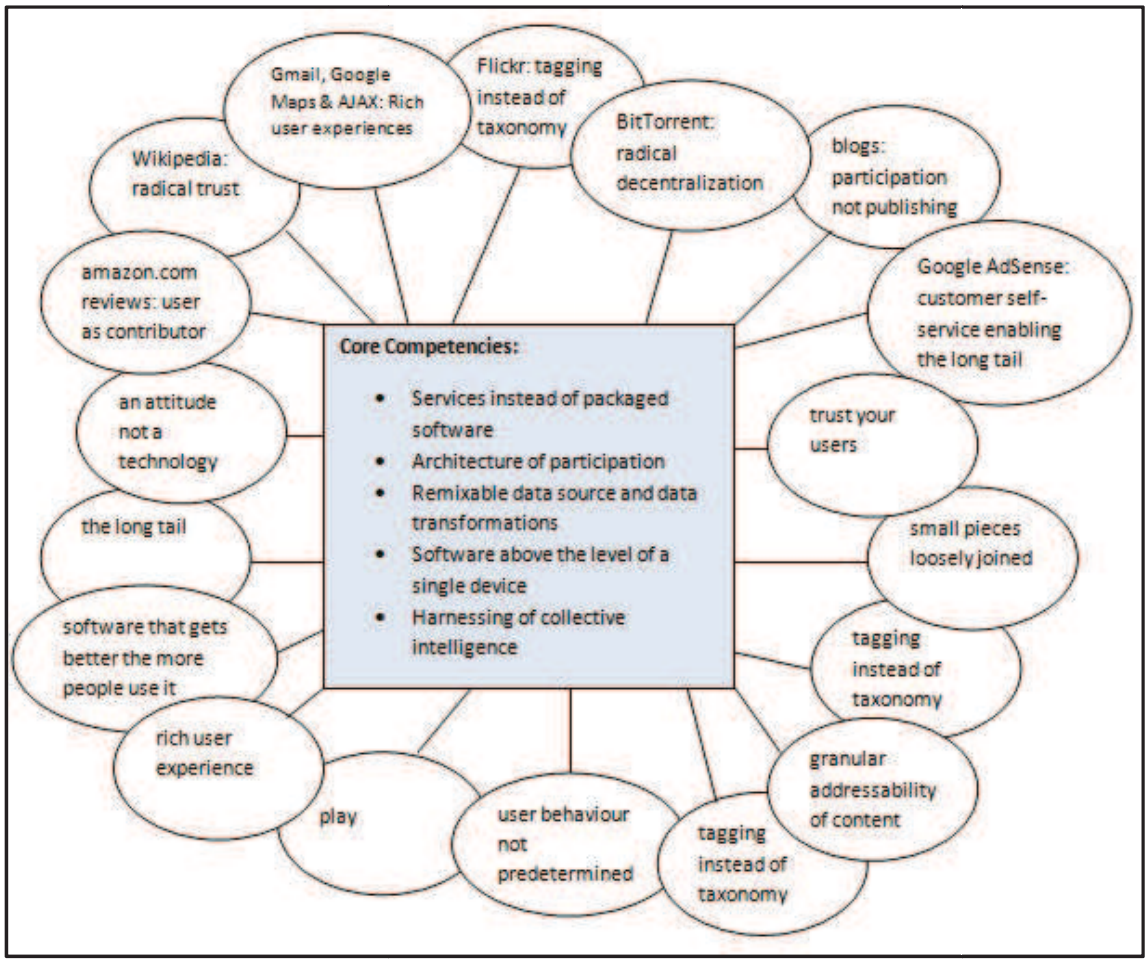


Illustration 4.18: Web 2.0 Principles (source: based on O´Reilly 2005, 3)

Illustration 4.18 shows a meme map of Web 2.0 that was developed at a brainstorming session and shows the many ideas coming from the Web 2.0 core. Web 2.0 was facing some of the challenges knowledge management is confronted with. How would it be possible to motivate possible users of Web 2.0 applications to use them? A closer look at the basic principles shown in the illustration might be interesting. Among the core competencies there are services instead of packaged software, architecture of participation and cost-effective scalability. Whereas the latter is of greatest interest when trying to convince managers in favor of knowledge management in general the first two competencies come in very useful when the objective is to convince employees to participate in knowledge management activities. At times packaged software may be the first choice but offering rather simple services may be more successful which can be seen with the success of Web 2.0. The average employee is not an expert in complex knowledge management systems and, therefore, prefers simple solutions that can be learnt quickly and at best intuitively. O´Reilly gives a good example:

> Google, by contrast, began its life as a native web application, never sold or packaged, but delivered as a service, with customers paying, directly or indirectly, for the use of that service. … No scheduled software releases, just continuous improvement (O'Reilly 2005, 4).

Unnecessary to mention how successful Google has become despite its shortcomings. In the context of this paper, however, the term "services" does not only describe services based on technology such as applications but also all accompanying services that assist and support those using them. The second core competency is the architecture of participation. Knowledge management architectures that invite people to participate increase the intrinsic motivation to do so as shown before.

O´Reilly notes that a core competency of those companies originating from the Web 1.0 era that have survived to lead the Web 2. 0 era has been the ability to "harness collective intelligence". He lists up some of the current global players. First there was Yahoo created as a catalogue in the early years of the World Wide Web. Then Google came, becoming the search market leader with the help of its page rank algorithm that uses the (partly user generated) link structure of the internet rather than just the characteristics of documents. eBay offers rather a framework and is filled with life by the activities of all its users thus growing organically like the web. What has made eBay successful is the surpassing of a critical mass of users. The better the chances to sell or purchase something at a good price the more likely potential users will refer to eBay as the very website for buying and selling. The fourth and last example he gives is Amazon which he compares with its competitor barnesandnoble.com. They receive the same product descriptions, cover images, and editorial content from their vendors. However, Amazon has a strong focus on user engagement using user reviews and a variety of other ways to participate. Furthermore, they use user activity to produce better search results. While a research on barnesandnoble.com is likely to deliver information about the company's own products or sponsored results, Amazon always comes up with what´s most popular. While Yahoo is currently struggling for survival all the other examples that "harness collective intelligence" flourish and keep growing.

Bricklin (2006) distinguishes three different ways of building a large database. One way is to pay people to do it. As an example he mentions Yahoo. The second way is to motivate volunteers to do the work and a third way is to involve users automatically as

is the case with file sharing platforms. The latter method deals with the problem of a lack of motivation of users by setting defaults for aggregating user data. Thus, building added value comes rather as a side effect. The basic principle is the assumption that users pursue selfish goals generating collective value as an automatic by-product. However, enormously successful websites such as Wikipedia show that there are many users out there who put a lot of time and effort into creating a database without directly benefitting from it. It can be assumed that their motivation is mostly intrinsic. Some of them follow the ideal to make the knowledge of mankind available to everyone, for others it may be a hobby that gives them purpose in life and in turn others do it for recognition or appreciation. The latter motivation plays, as seen, an important role in a business context. Komus and Wauch mention several success factors of social software (Komus & Wauch, 2008, 145ff). Among these there are shared goals and a shared vision. Another success factor is the fact that social media is participatory and integrative. Furthermore, they mention trust, flexible rules, self-realization, simplicity and others.

O´Reilly makes the following important statement:

> As noted above in the discussion of Google vs. Netscape, one of the defining characteristics of internet era software is that it is delivered as a service, not as a product. This fact leads to a number of fundamental changes in the business model of such a company (O´Reilly, 2005, 13).

Applied to the concept of a knowledge landscape the software or applications used therein should be considered as services for the employees who are expected to use them for the storing and sharing of knowledge. This, of course, has a significant impact on the implementation and maintenance of applications. Their operation must become a core competency in a service oriented organization. If the performance of an application is interrupted for a too long time or too often it will eventually be at risk of losing acceptance. A knowledge management application that is designed to store and share knowledge needs continuous monitoring, tending and updating. The basic challenge is to grant its continuous operation but, furthermore, it is essential to keep the knowledge up to date. This requires a monitoring of both function and content on a regular basis. Failure to do so may result in a loss of trust in the information and knowledge stored in the data banks of an application. There should be no, or as little as possible, irrelevant

knowledge. Even details can be important when it comes to building trust. A query that produces poor results undermines the acceptance of a knowledge management application. Even before an application is rolled out it is important to fill it with a certain amount of quality assured content before the ordinary user is confronted with it. While filling the data base with knowledge the future users' needs and wishes need to be considered with the goal that the data base can be worked with right from the beginning in order to prevent discouragement. But even when an application has been rolled out successfully a continuous quality assurance is essential. This emphasizes the importance of a service oriented approach especially during the implementation of knowledge management activities and tools but also to their maintenance later on that always takes into consideration the users as customers. O´Reilly goes even further by writing that users should be treated as "co-developers". It enhances acceptance enormously if at least a test user group is involved in the development of a new application for at least two reasons. The first reason is the identification with both project and application. Having the chance to have a say in the design of a tool may let it grow on someone thus rendering him or her more eager to promote and defend it against criticism. The second reason lies in the fact that users of a specific user group already know the dynamics within that group. They know, for instance, the company culture, they know about the requirements and needs for a good performance and they also know their colleagues well enough in order to determine who usually supports and welcomes change and who rather has a tendency towards opposition. Having learnt how to use and navigate a new application these test users can efficiently help others during the company-wide roll out. Of course the main responsibility remains with the project leader/knowledge manager until the project is ended and regular operation begins. Then a nominated person, preferably a knowledge manager, should be responsible for maintenance, quality assurance, updates and support ideally considering these tasks as services. O´Reilly puts it this way:

> "Real time monitoring of user behavior to see just which new features are used, and how they are used, thus becomes another required core competency." (O´Reilly. 2005, 14)

All these measures played an important role in the first case study. As the core of the knowledge management activities was a wiki the next subchapter will explain wikis

more in detail in order to provide a better understanding of the challenges the project team had to face.

4.5.1 Wikis

A special focus shall be put upon wikis since a wiki was the core knowledge management tool in the first case study. Wikis have become well known in particular thanks to Wikipedia, an online encyclopedia with millions of entries in more than 200 different languages. Articles can be generated, read and edited by all users (unless certain restrictions apply which will be explained later). When Alby describes Wikipedia he speaks of self-regulating mechanisms due to the fact that every visitor has the possibility to join the work on an article. If a user discovers incorrect facts it is possible to correct those (Alby 2008). He mentions Surowieckis *Wisdom of Crowds* which he describes as collective intelligence. At the same time he warns that this leaves wiki articles vulnerable to manipulation. Therefore Wikipedia often is not considered a reliable source. Komus and Wauch quote Robert Mc Henry the former editor in chief of the Enyclopaedia Britannica who called Wikipedia a "faith-based encyclopedia". (Komus & Wauch, 2008, 46). Nevertheless, it is a perfect example of the efficiency and success of social media. Alby distinguishes between Web 2.0 and Social Software. Nevertheless, social software such as wikis fulfills many of the Web 2.0 criteria. The web can be used as platform, collective intelligence of the users is integrated and harnessed, data sources get richer as more people use them etc. As mentioned before in the list of the characteristics of Web 2.0 tools social software is mentioned as a means for the integration of the collective intelligence. Mörl and Groß state that a certain critical mass of users needs to be achieved in order to get "the process going". They estimate that at least ten percent of all possible users are required which, in the case of the wiki of the first case study, would have been around six users. In the end it turned out that around ten people were the most frequent users of that wiki (Mörl & Groß, 2008, 72). Huber describes wikis as software that enables everyone to have an easy access to information as well as to share one´s own knowledge and experience in real time. Technical proficiency is not required according to Huber (Huber, 2013, 83). However, as the first case study has shown more complex applications of wikis may require certain technical skills. She also writes that wikis are often used by companies for the administration of knowledge. Interesting enough that the first wiki ever, designed by Ward Cunningham in 1995, was meant to be a knowledge management tool.

In the following a short description of the possibilities that wikis have to offer will be given, thus revealing their usefulness for knowledge management. First of all the technical requirements need to be considered. Costs play an important role in business. The vast majority of companies nowadays use computers and some kind of networks, be it the internet, an intranet, cloud solutions, social media platforms or whatsoever. There are web based solutions as well as customized intranet solutions as was the case at the airline of the first case study. Embedding a wiki into an intranet facilitates things and single-sign-on helps to lower barriers. Furthermore, knowledge of PHP and HTML comes in useful for implementing a wiki. www.mediawiki.org (22.11.2018) provides a short installation guide.

The MediaWiki software is downloaded from that website. Another requirement is a web server such as Apache and PHP version 5.5.9 or a newer version with PHP standard library that is compatible with Perl and includes regular terms. JavaScript Object Notation must be supported. A possible data bank server would be MySQL 5.0.2 or a newer version. In this context this short description of the technical requirements shall be sufficient. MediaWiki then offers several configuration settings. This allows for customizing the application according to one´s needs and requirements. Among these settings there are administrative rights, the installation of extensions, language settings, maintenance scripts, conversion and import of existing data, customizations etc.

Administrative Rights

After installing a wiki it is important to begin with the setting of administrative rights because MediaWiki is a permission-based system which means that users are only able to perform the actions they are allowed to do namely reading, editing, deleting and creating categories, among others. Therefore, users are divided into different user groups. The MediaWiki software offers the options sysop (administrator), bureaucrat and bot. An administrator is a user who possesses a wide range of possibilities and rights. Administrators can protect pages against editing and moving at various levels and they can enable users to edit pages. They themselves can edit protected pages at any time. There are various levels of protection. For instance, MediaWiki speaks of semi-protection when pages are protected against being edited by an unregistered user. Full protection describes the protection of a page against editing by a user who is not an administrator. Thus, images embedded on the page are protected as well as incorporated pages, provided that they are on the same site respectively incorporated into the page. Protection can also be applied to entire namespaces which are spaces that are assigned

to specific user groups. Administrators can delete pages and their history, and they can view and restore deleted pages and their history. They can also delete and undelete images. Any user can restore a page by going back through the page's history. In addition administrators have a rollback button to accelerate the process. The edits of users can be reverted to the last version created by the previous editor. The rollback button allows for marking edits as minor edits and an automatic summary of all edits is given. Another option is hiding certain edits from the history of a page.

Administrators can block and unblock users from editing, uploading files, moving pages and other functions if necessary or desired. They can also establish new user groups or namespaces. The next lower level in the MediaWiki user hierarchy is that of bureaucrats. They can change certain user rights concerning the editing or reading of wiki pages. They can also invite users to namespaces and exclude them. Bot accounts are useful when it comes to changes in pages. Edits by a bot account do not appear by default in the recent changes list which comes in useful for mass imports of data.

Extensions

Another very useful feature of the MediaWiki software, especially in a business context, is the possibility to install extensions. Extensions are compilations of PHP code that add new features to or enhance functionalities of the main MediaWiki core. The airline wiki had a number of different extensions which had been installed based on user requirements. The most important extensions were a Rich Text Editor, Word2Wiki and a PDF creator. The Rich Text Editor was implemented in order to facilitate the editing process. There are various ways of editing. One way is the use of HTML which excludes all those users that have no knowledge of that language. Another way is a specific wiki language somewhat similar to HTML, yet simpler, but even that requires the study of that language first, which would impose a barrier for users. Editors are the most user friendly option. The Rich Text Editor has similar buttons and functions as MS Word and is, therefore, easy to use for most people because many users, especially in a business environment, work with MS Office on a daily basis. As seen in the case study this editor has its flaws, however. Word2Wiki is an extension which converts Word documents into wiki text, made of the aforementioned wiki language. It preserves the formatting of the document such as headlines, tables etc. Word2Wiki is open source but at the time when it was implemented it had already been announced that it would not be updated any longer. However, it still exists (10/2018). At the time of the first case study the conversion of large documents containing many images with Word2Wiki required a

powerful RAM because dozens of new tabs were opened in the process. Excel2Wiki is another, similar extension, yet less elaborate. It converts the formatting of Excel tables into wiki language. If required there are extensions that allow for the conversion of wiki pages into PDF files as well.

MediaWiki includes a search engine. On every page there is a search box. Both key words and entire phrases can be entered. If a page title corresponds with a search term the user is directed directly to that page. Otherwise all pages of the wiki are searched unless certain restrictions apply. For example, certain namespaces can be made "invisible". The search engine presents a list of articles that match the search terms. The article content is searched in its wiki text form which is the text that appears in the edit box of the wiki pages. This means that content coming from an included template will not be found, but the target of piped links will be. At the time of the first case study the search functionality was not case-sensitive. It operated on whole words, separated by spaces or other punctuation marks. This excluded wild card searches. Furthermore, the results did only include pages that contained all the words typed into the search box. Double quotes, as in "interior designer" could be used. Extra searching options were available if the user clicked on the search button without filling in anything in the search box. For example it was possible to search for articles in a particular name space only.

In order to improve the search functionalities of a wiki, software such as Apache Lucene TM can be implemented. Lucene is a high-performance, full-featured text search engine library written entirely in Java and it is an open source project which might be interesting for cost sensitive projects. Lucene itself mentions its competencies as follows (http://lucene.apache.org/core, 01.11.2018):

Lucene´s indexing capacities are:

- over 150GB/hour on modern hardware
- small RAM requirements -- only 1MB heap
- incremental indexing as fast as batch indexing
- index size roughly 20-30% the size of text indexed

Lucene´s search algorithms provide the following possibilities:

- ranked searching

- powerful query types: phrase queries, wildcard queries, proximity queries, range queries etc.
- fielded searching (e.g. title, author, contents)
- sorting by any field
- multiple-index searching with merged results
- simultaneous update and searching
- flexible faceting, highlighting, joins and result grouping
- fast, memory-efficient and typo-tolerant suggesters
- pluggable ranking models
- configurable storage engine

Lucene is a cross-platform solution under Apache License which allows for using it in both commercial and open source programs. Implementations in other programming languages are available that are index-compatible. Mediawiki.com provides helpful information on how to install and upgrade a wiki and is, therefore, a resource of information for businesses running a wiki free of costs as mentioned before.

Settings and Other Features

A wiki offers a large variety of different settings from design patterns to language settings. With a little knowledge of HTML the design of a wiki can easily be adjusted to the respective corporate design. A variety of languages can be chosen from. Categories and templates can be implemented.

Templates

Templates come in useful for documents where only some variables are to be changed as seen in illustration 4.19.

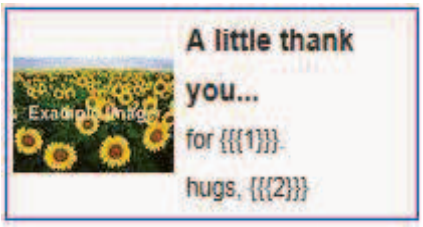


Illustration 4.19: Wiki Template (source: https://www.MediaWiki.org/wiki/Help:Templates/de, 01.10.2018)

This template includes an image and standard text that always appears on respective wiki pages. In addition there are two variables, “1” and “2”. When editing a wiki page

with that template a user only needs to fill in text for these variables in brackets which safes a lot of time. This is useful in cases where standardized forms need to be filled with information.

Categories

Categories help to browse a wiki. If required wiki articles can be organized in categories and subcategories. Pages and files are categorized by adding category tags to the content text. These tags create links at the bottom of the page that take users to the list of all pages in that category, which makes it easy to browse related articles. Category pages themselves consist of two parts, at the top of the page, which is an optional part that may contain text that can be edited, like any other page and one at the end, an automatically generated alphabetical list of all pages in that category, in the form of links. Assigning a category to a page can be done easily by adding the link "[[Category:Category name]]" to the page's wiki text which is usually done at the bottom of the page. In order to link a category page within a page as a normal wiki link without adding the page to the category the link name is prefixed with a colon as follows:" [[:Category:linked category]]" New categories are created in the same way as any other regular page. To add a page or uploaded file to a category the following text needs to be added: "[[Category:Category Name]]" Every page in a wiki can be part of several categories which also applies to category pages themselves which thus become subcategories. A wiki contains a list of all categories, for example in the form of a category tree as shown in illustration 4.20.

Illustration 4.20: CategoryTree (source: https://en.wikipedia.org/wiki/Special:CategoryTree?target=Category%3AKnowledge+management&mode=categories&namespaces=&title=Special%3ACategoryTree, 10.10.2018)

In illustration 4.20 the numbers in brackets stand for the number of subcategories and pages. The category “Knowledge Management” includes two subcategories and 65 pages, the category “Knowledge Management Journals” includes no subcategories but eleven pages etc.

Some users may have difficulties with understanding how categorizing in a wiki works. Therefore, it is essential to explain the respective processes in a user manual or on help pages in the help-namespace. A frequent error is the creation of new categories that have no links to parent categories and are, therefore, somewhat “lost” in the wiki.

Namespaces

Although similar to categories namespaces have further special properties. They are a way of grouping wiki pages on a high level. Namespaces are indicated in page titles by prefixing the page name with "namespace:page name", so the prefix "Help:" in “Help:Namespaces" indicates that a page is in the Help-namespace. If a page has no namespace prefix it is in the mainspace. The standard MediaWiki comes with sixteen different namespaces that are organized in pairs consisting of a subject namespace and a discussion namespace. The latter can be deactivated if discussions are not required. The names of the namespaces are Media, Special, Main, Talk, User, User Talk, Project, Project Talk, File, File Talk, MediaWiki, MediaWiki Talk, Template, Template Talk, Help, Help Talk, Category and Category Talk. The following descriptions explain the purpose of the namespaces and their special properties.

- **Main**: This namespace usually contains the larger part of all the wiki pages and has no prefix separated by a colon. As mentioned before it is also called mainspace and it generally has no special properties.

- **Media**: This namespace contains media files. It is used for direct linking to the files that have been uploaded to the wiki. Possible files are: images, videos, sound files, Excel tables, Word documents and other media files. Media:image.jpg links to just the image rather than to the image description page as would be the case with: File:image.jpg.

- **Special**: This namespace is used to group special pages, reports and interfaces that are generated by MediaWiki. These pages cannot be created or edited except by extending or modifying the MediaWiki software.

- **Talk**: The majority of namespaces has a talk namespace attached. The Talk-namespace is the discussion namespace attached to the mainspace. It possesses no special properties.

- **User**: Each wiki user has a page in the User-namespace. Every page that contains a user´s name as a link directly links to that user page. Among these there are edit histories, recent changes, watch lists and others. This page, and subpages of it, can be used by users to record information about themselves or to test and draft new content. As this comes with the exact time and date it is possible to monitor all users´ activities. Users can create and edit their own pages which can only be edited by themselves or an administrator.

- **User Talk**: This is the talk space attached to the User-namespace. It can be used for leaving messages of which the receiving user is informed at the top of any page that he or she visits.

- **Project**: The Project-namespace is used for discussions related to the operation and development of the wiki. There are no particular properties.

- **Project Talk**: Pages of this namespace are used for discussions related to the associated project pages. There are no special properties.

- **File**: While the Media-namespace is used for the actual files, the File-namespace is used to store metadata for these files. Each file has a corresponding page in the File-namespace. Files from this namespace can also be embedded in other wiki pages.

- **File Talk**: Namespace that is normally used for discussions related to the associated media files without any special properties.

- **MediaWiki**: The MediaWiki-namespace is used to contain system messages and other important content such as the CSS code that is loaded for each page. By changing this code the design of the wiki pages can be changed. This namespace can only be edited by an administrator.

- **MediaWiki Talk**: Namespace attached to the MediaWiki-namespace that is normally used for discussions related to the associated system messages. There are no special properties.

- **Template**: This namespace contains all the templates as described in the template chapter.

- **Template Talk**: Talk namespace that is used for discussions related to template pages without special properties.

- **Help**: This namespace contains all the help files, manuals and guidelines how to operate and work with the wiki. It has no special properties.

- **Help Talk**: Talk namespace which is used for discussions related to the associated help pages. It possesses no special properties.

- **Category**: The Category-namespace contains categories as described in the chapter about categories.

- **Category talk**: Namespace that is normally used for discussions related to the associated category pages. This namespace has no special properties.

Namespaces can be renamed if necessary. However, only administrators are allowed to rename namespaces. Another option would be the use of aliases for the actual names of namespaces. By default, “Image” is an alias for “File”, so [[Image:Wiki.jpg]] is equivalent to [[File:Wiki.jpg]]. In the first case study each one of the six teams had their own namespace with a prefix according to the name of the respective team. A wiki can define additional namespaces which behave exactly like normal namespaces. These custom namespaces generally have no special properties.

Further Features

Users of a MediaWiki can use a variety of features to keep themselves informed about the content of the wiki. It is possible to track both recent and older changes of most pages. The activities of specific users can be tracked down including information about date and time. Furthermore it is possible to bookmark pages and to get information on recently created pages. The special page “Special:RecentChanges” which is part of the respective namespace displays all edits, file uploads, page moves, deletions and other actions that have been done recently. The display can be customized to the user´s requirements with regard to the number of changes or their timeframe etc. Furthermore, it is possible to block certain changes. The recent-changes-lists provided by a MediaWiki contain links to the revision history of a page. By clicking on a specific revision changes are highlighted. It is also possible to restore an older version of the page. A problem might be the timestamp especially with regard to the workers council in a company. It can be removed by rewriting the respective part of the PHP code.

Beside these important features there are others that shall be mentioned shortly only. One of the advantages of a wiki is the possibility that articles can be edited simultaneously by several users. The edited articles can be converted into PDF and be printed. Formatting is possible. Text can be written in bold and italic and can be highlighted or underlined. Size and color can be changed as well as the position of files such as images. Both internal and external links can be created and text can be organized in tables. An editor like the Rich Text Editor may provide further options. A wiki also offers a so-called sandbox which is a page in the Project-namespace that allows a user to experiment and to learn about the editing features before starting to create and edit pages in the wiki. Another interesting page, especially in a business environment is the statistics page which contains information on the use of the wiki with regard to the number of articles edited, retrieved or read etc. This allows project

managers responsible for the implementation of a wiki to monitor the use of the new tool and to initiate counter measures in the case that user acceptance does not reach the desired level. In the first case study this function was used to evaluate the use of the wiki and the effects of the service activities.

Wikis in a Business Context

There are differences between wikis that are used in a business context and public wikis like Wikipedia. The openness of a wiki is a great opportunity and a risk at the same time. There is a temptation to adjust a wiki to the existing complex structures of a company. For example a rigid authorization scheme might be established which does not correspond with the original idea of wikis. Another difference is the motivation to work with a wiki. A variety of motivating factors for Web 2.0 tools and social software has already been discussed and it can be said that they were mostly intrinsic. Nerdinger distinguishes between intrinsic and extrinsic motivation:

> Die motivierende Wirkung, die von der Tätigkeit ausgeht, wird als die intrinsische, der Tätigkeit, bzw. der Arbeit als solche innewohnende Motivation bezeichnet. Wer arbeitet, weil ihn die Aufgabe interessiert, weil sie ihm Spaß macht und ihn befriedigt, der ist intrinsisch motoviert. Arbeitet dagegen ein Mensch aus Gründen, die nicht in der Arbeit als solcher liegen, bezeichnet man ihn als extrinsisch motiviert: Wer also zum Beispiel arbeitet, um möglichst viel Geld zu verdienen oder sein soziales Ansehen zu steigern, der ist extrinsisch motiviert (Nerdinger, 2004, 93).

Nerdingers remarks on intrinsic motivation can be translated as follows.

> The motivating effect of an activity is denoted as intrinsic, the immanent motivation within the activity or work itself. Whoever works because he is interested in the work and because he delights in what he does and gets satisfaction from it, is motivated intrinsically. On the other hand, if someone works for reasons that are not immanent to the respective work, that is called extrinsic motivation: who, for example, works to make as much money as possible or to increase his social reputation is motivated extrinsically (own translation of Nerdinger, 2004, 93).

Intrinsic motivation comes from the work itself. People are interested in the work and enjoy it. On the other side extrinsic motivation has nothing to do with the work itself. It is rather triggered by external factors such as money or recognition. While users of Wikipedia can be said to be intrinsically motivated employees that are expected to work with a wiki might have to develop this kind of motivation first. Nerdinger recommends a focus on intrinsic motivation (Nerdinger 2004). Another factor is time. Different from leisure time activities the use of a wiki in a work context occupies some of the already limited time, which needs to be considered.

These and other differences can be a challenge. They will be described in more detail in the first case study in chapter six. Along with change management, which has been a useful tool for successfully implementing knowledge management, service management has the potential to become a powerful tool for increasing the acceptance of knowledge management activities and applications. Therefore, service management and, in particular, IT service management will be introduced in the following chapter.

5 (IT) Service Management

The main objective of service management is the improvement of services and their processes. Service management has become an important aspect of the strategy of big companies. The service sector, also called tertiary sector has grown to great importance in western societies. As a consequence of this influential change many new services have been developed on the one hand. On the other hand, even in the industrial sector, the so-called secondary sector, additional services that come along with the product have become more important. In order to grant growth and customer loyalty on highly competitive markets services and a good customer relationship management have become indispensable. New technologies enable new kinds or levels of services. In the context of this paper the users of knowledge management applications are considered "customers", while knowledge managers are seen as service providers. The idea derived from the case studies in the airline industry which is, to a large extent, service oriented. The philosophy of the companies was to promote service-mindedness throughout the entire organization which, in the end, the customers would benefit from. This concerned not only the service professionals with customer contact but every single employee from human resources to controlling etc. Thus service-mindedness had become part of the DNA of the whole organization. Considering this in the course of the implementation of knowledge management in the first case study the idea emerged to develop a service oriented approach which was later partly continued in the second case study. Whereas a process oriented approach helps to convince the management of a company of knowledge management, a service oriented approach promotes the acceptance of knowledge management activities among the employees. In the case studies the benefits of this approach will be explained more in detail. This chapter will explain service management on the basis of IT service management. IT service management concepts have been applied in the first case study because the main focus of the knowledge management was on IT applications. Many of the concepts can be transferred to a more general level, though.

Grönroos mentions several key aspects of services (Grönroos, 2007, 2f). Services support the individual processes of customers with the objective to facilitate value creation. Both customer and service provider benefit from their relationship. Services can be physical goods, service activities, information or combinations of these. Service provider and customer engage in a long-term contact which can be seen in the case

studies. In order to provide a good service the service provider needs to gain insight into the customer´s processes and everyday work. All this includes the establishing of networks and partnerships. They also suggest building a database containing information about customers. This played a role in the design of the extension of a knowledge landscape in the second case study where information about the knowledge assets and knowledge needs of the departments and some of the colleagues helped to determine optimal knowledge flows. According to Grönroos the success of a business depends on how well a company understands their customers. This was taken into consideration in the case studies.

5.1 Terminology

A service is a useful effect provided for a service user by a service provider. A service user does not need any resources or expertise. He is spared the risks and costs for the desired results. Delivering value is essential. A business dictionary describes services as

> Intangible products such as accounting, banking, cleaning, consultancy, education, insurance, expertise, medical treatment, or transportation. Sometimes services are difficult to identify because they are closely associated with a good; such as the combination of a diagnosis with the administration of a medicine. No transfer of possession or ownership takes place when services are sold, and they (1) cannot be stored or transported, (2) are instantly perishable, and (3) come into existence at the time they are bought and consumed (http://www.businessdictionary.com/definition/services.html, 30.01.2018).

In the context of implementing a knowledge management system, information technology service management, in the following called ITSM, can provide helpful guidelines. If knowledge management is regarded as a service it can be assumed that it benefits from the advantages of a good service management among which there are:

- transparency of processes
- customer/user orientation which results in satisfaction and higher acceptance
- provision of services just in time at the location where they are needed
- a high quality standard
- reduction of errors and risk of failure of (IT-) projects

5.2 ITSM

Service management has been analyzed and developed comprehensively in the field of information technology. Standards have been developed such as ITIL, eTom (enhanced Telecom Operations Map), COBIT (Control Objectives for Information and Related Technology) or MOF (Microsoft Operations Framework). ISO/IEC 20000 defines the standards of service management in the context of information technology. It specifies requirements for a service provider to plan, establish, implement, operate, monitor, review, maintain and improve a service management system. These requirements include the design, transition, delivery and improvement of services. According to Beims service management is a set of specialized organizational capabilities. The goal is the creation of value to customers (Beims, 2012, 3). These capabilities consist of functions and processes that need to be managed. Thus resources are transformed into services that meet the customers´ requirements and thus add value.

Among the most widely accepted frameworks is ITIL which, therefore, shall be the basis of further investigation on possible improvements in knowledge management activities supported by service management. An overview of ITIL will be given in this chapter. Due to the large scope of ITIL the focus will be on those aspects which have proved useful for the knowledge management activities in the case studies. Therefore, this chapter will explain in detail these aspects while other aspects that did not play an important role will either be explained briefly only or neglected because an in-depth introduction of ITIL would be far beyond the scope of this paper. Before the introduction of the concepts of ITIL, ARIS had been the basis at the beginning of the knowledge management project at the information management department. Therefore, ARIS will be introduced briefly.

5.3 ARIS

The concept used for the architecture of information systems was ARIS (*Architektur integrierter Informationssysteme)* which means architecture of integrated information systems. Here a short description will be given based on how it was used by the information management department of the first case study. The main objective of ARIS is that an operational information system meets all requirements. It is a process model for the illustration and improvement of business processes that consists of descriptive perspectives and levels that allow for a description of elements by means of specific methods without the need to consider the entire model. Processes are illustrated

on every descriptive level from an abstract level all the way down to the implementation level of an information system.

In order to facilitate the process design ARIS makes a distinction between five perspectives which are:

- **Organizational perspective**: encompasses all resources and organizational units such as human labor, machines, hardware, software etc. and their relations to each other.
- **Data perspective**: all incidents that generate data, especially data and information that is relevant for the organization, including documents, correspondence etc.
- **Service perspective**: includes all kinds of services.
- **Function perspective**: processes and their relations to each other such as groups and hierarchies. Objectives are a part of the functional perspective as well. Function trees are a way to describe functions.
- **Process perspective**: integration of the aforementioned perspectives into a chronological and logical plan of procedures such as process chains, for example.

Each perspective is further subdivided into three descriptive levels. These levels are:

- **Functional concept**: structured representation of business processes by means of descriptive models that are intelligible for the business units considering their respective perspectives. Among these representations there are organization charts and function trees.
- **Data processing concept**: implementation of functional concepts into data processing descriptive models such as relations or topologies.
- **Implementation level:** realization of the process parts by means of program code, data bank systems etc.

ARIS has been extended by two components of knowledge modeling. It categorizes knowledge content-related and represents these as implicit knowledge. Knowledge is allocated to specific business units and various attributes describe topicality and quality. Documented knowledge is seen as explicit knowledge. The main focus of ARIS lies on the documentation of knowledge within the modeling of information processing

business processes. Creation and use of knowledge come as additional meta information (Scheer 1998, 166).

ARIS was a prominent approach to the description of information system architectures being widely used for information management at the airline at the time. However, ARIS is a rather formal and abstract concept. According to Pogorzelska ARIS is not suitable for modeling knowledge intensive processes because essential characteristics of knowledge management such as personal knowledge or conversion mechanisms of knowledge are not taken into consideration and cannot be modeled. ARIS models input and output of information but personal knowledge is neglected. Pogorzelskas solution is KMDL which is explained in detail in chapter four (2009, 8).

In order to motivate employees to go along with changes a more personal approach can be very helpful. With regard to this aspect ITIL has proved to be the better choice. It must be mentioned that the concepts of ITIL were not applied one-to-one. They were rather taken into consideration as an inspiration to enhance the success of knowledge management activities. ITIL is a collection of best practices some of which came in useful in the case studies.

5.4 ITIL

First of all it must be mentioned that this thesis is not about applying ITIL for knowledge management in general. ITIL has not been developed for the implementation of abstract concepts but for IT solutions. It consists of a collection of best practices deriving from decades of experience with the implementation and use of IT applications. Nevertheless, ITIL is a valuable resource of best practices that have been proved adequate for the implementation of knowledge management activities and a knowledge landscape, especially that part of it that consists of IT applications, as shown in the case studies. ITIL stands for Information Technology Infrastructure Library. In order to improve ITSM best practices have been collected and summarized. Thus, a process oriented approach has been developed. The British Office of Government Commerce is leading in the further development of the library along with ITSM institutions and forums. In 2007 the current version, ITIL v3, was released. In 2011 there was an update. ITIL is structured in three category groups:

- ITIL Core
- ITIL Complementary Guidance

- ITIL Web Support Services

In this chapter the emphasis will be on the ITIL Core category which consists of five books. In these books a lifecycle model is described which encompasses topics from service strategy to continual service improvement once a service has been implemented. The titles and topics are:

- Service Strategy
- Service Design
- Service Transition (or implementation)
- Service Operation
- Continual Service Improvement

The chapters 5.4.1 to 5.4.5 are based on the respective ITIL books. ITIL is a widely accepted ITSM standard and, therefore, a useful guideline for the implementation of a service oriented knowledge management system. Furthermore, some of the general service concepts can be applied to knowledge management activities in general if they are considered as a service for employees and companies. This is not the actual purpose of ITIL but the case studies have showed that some of the principles can also be useful for other knowledge management tools than IT applications. In the following chapters an overview of the concepts and best practices of ITIL will be given. The next chapter will start with service strategy which is the basis of all further service activities.

5.4.1 Service Strategy

In ITIL a service is defined as a possibility to create value for a customer, by helping him to reach goals more easily. Customers are not responsible for any risks and some of the costs. Service management is defined as follows:

> Service management is a set of specialized organizational capabilities for providing value to customers in the form of services. The more mature a service provider's capabilities are, the greater is their ability to consistently produce quality services that meet the needs of the customer in a timely and cost-effective manner. The act of transforming capabilities and resources into valuable services is at the core of service management. Without these capabilities, a service organization is merely a bundle of resources that by itself has relatively low intrinsic value for customers (Service Strategy, 2011, 15).

As information technology has undergone a shift from mere operational functions to an important strategic aspect, IT services have become strategic assets which decide whether an organization is competitive or not. Based on a good strategy IT creates an added value for a business, for clients and stakeholders. Service strategy links service management to the general strategy of an organization. The objectives of service strategy are (Kresse & Bause, 2011, 76-77) the focus on practical and general approaches to service management. Strategies are defined and implemented as well as their economic aspects which then are monitored. Standards and guidelines concerning design, development and implementation of service management are defined.

In the context of a successful implementation of knowledge management, which can only be considered successful when accepted and when knowledge is used by the employees, practical solutions for service management should be preferred. An approach to service management which is widely accepted and can be used as a guideline without too much extra work is to be preferred. Beside ITIL there are other approaches to service management and it facilitates things to apply the approach on service management which is already being used in an organization as long as it meets certain criteria. The IT service management concept of the knowledge management project in the first case study, for example, was originally based on ARIS. However, in order to improve acceptance of the knowledge management applications some of the best practices of ITIL have been applied. With ITIL the first step would be the definition and implementation of strategies. A decision in favor of knowledge management itself is already a strategic decision, yet it still has to be determined how to manage the knowledge of an organization. This includes the questions about an appropriate mix of knowledge management strategies and about which knowledge is considered important and by what means this knowledge should be managed. On the technical level decisions are made in favor of specific IT based knowledge management applications. The question here is which applications create the best added value from a strategic point of view. This includes the question about which functionalities of an application are needed to deal with different kinds of knowledge. Knowledge management is not limited to technical aspects, though. There are various tools such as communities of practice, mentoring or lessons learned, to give just a few examples, which can be, and often are, supported by IT systems but do not necessarily require them. Knowledge management in many cases requires a holistic approach depending on the objectives or other factors such as the size of an organization or company or their

structure and it would come in useful to extend the principles of service management to social tools which are used for knowledge management. If an organization decides in favor of service management the economic aspects have to be considered. This also applies to individual services. The costs and the labor input of knowledge management should be calculated as well as possible costs respectively incurred losses of failing to manage knowledge, if possible. Strategic assets play an important role in this context while knowledge itself is a valuable asset.

In ITIL it must be determined which services are offered to whom and quality standards must be defined. A service provider must be distinguished from his competitors. An in-house provider of knowledge management, for instance, may save money which distinguishes him from external consultant agencies, yet without the required expertise the risk of failure is increased. ITIL describes three basic concepts of service supply: services which are provided internally, services which are provided externally and services that use internal shared service units. In the case of business consultancies knowledge management is an external service which can be bought but in a number of companies the implementation and support of knowledge management activities can be considered as internal services, as is the case in the case studies. It is furthermore essential that services generate an added value for customers and stakeholders. In order to provide an added value services have to meet two essential criteria. They need to be fit for purpose (utility) and fit for use (warranty). A service is fit for purpose when it meets the requirements of the customers and when it supports business processes successfully. It is fit for use when it guarantees continuity and security in availability. Only the customers can decide whether a service meets these criteria. Therefore, a thorough analysis of subjective and objective information needs helps to prevent the rejection of a service.

Basic Terminology of Service Strategy

In order to understand the concept of service strategy some terms require an explanation. Among these there are business case, value composition, value proposition and, most important, utility and warranty.

Business Case

In ITIL business cases are a central instrument of service strategy. They include information about economic aspects, costs, options, risks and the utility of an important issue or business scenario. The implementation of knowledge management would be

such a scenario, for example. A business case is used as the basis for decisions as well as a conceptual starting point. It justifies the extension of a service strategy and the service portfolio. Impact, risks and contingencies are defined as well as recommendations (Service Strategy 2011, 108f).

Value Composition

Value composition describes the composition of necessary service assets or the components of business supporting information technology with regard to objectives and requirements.

Value Proposition

Value proposition describes the contribution of a business process that is supported by a service to the creation of value**.** As mentioned before the value of a service can only be determined by a client respectively user of a service. Value propositions are distinctive capabilities that are hard for competitors to duplicate (Service Strategy, 2011, 20).

Fit for Purpose (Utility)

A service meets the requirements of the clients so that the output is positive. This means that the service supports the performance of a business process or removes restrictions. The service is fit for purpose.

Fit for Use (Warranty)

Warranty means that the provision of a service needs to be stable and safe and is thus fit for use. This includes an adequate degree of availability, capacity, continuity and security. Only when utility and warranty are granted an added value is created for the customers.

Market Space

The market space is a frameset for IT services which are considered relevant and useful by service providers based on the requirements of the costumers. Furthermore, market space includes all possible IT services that appear to be useful to service providers for meeting requirements. Services that share the same market space also share resources, costs, risks and challenges. The definition of market spaces is one of the main activities of service strategy. It needs to be figured out how a specific service can create an added value and what service assets and infrastructure are necessary for achieving this goal. The current situation is expected to be improved and costs are to be reduced as well as

risks. The exact definition of a service is essential for the appropriate perception of its added value by the customers (Kresse & Bause, 2011, 85).

Service Portfolio

The service portfolio reflects the requirements of a business or the costumers and the appropriate reaction of a service provider to these requirements. A service portfolio puts emphasis on three focal points. The first one is called service catalogue. It consists of standardized and ready-for-use services. In the case study no official service catalogue was documented, however, the applied services were documented as best practices and can thus be used for future projects. The second focal point is called service pipeline. It consists of future services and innovations that have been planned already but have not yet been implemented. The third point, abandoned services, is about services that do not belong any longer to the catalogue of operational services.

Service portfolio management is one of the main processes in the phase of service strategy. A service provider should ask the following questions before determining a service portfolio (Kresse & Bause, 2011, 88):

- Why should a costumer use specific services?
- Why should a costumer buy these services from me? In the case study other departments and their services had been taken into consideration but the project team was able to convince the department team leaders that the wiki was the one most fit for use.
- What are the strengths, weaknesses, priorities and risks?
- How can the use of resources and abilities be optimized?

A service provider is able to adapt his offered services anticipatory to the requirements of his customers when he questions the service portfolio continuously. Thus, bad investments in service management can be prevented. The core activities are defining, analysing, authorizing and setting out in writing.

Creating services requires thorough considerations with regard to their structure, elements, constraints and risks. First of all a service provider must be aware of his strategic assets which enable a service provider to deliver the right mix of services according to requirements. These assets need to be flexible in order to be able to adapt

to constantly changing conditions in a business. A fundamental requirement for adding value is excellent interaction between resources such as budget, infrastructure, applications, information, employees etc. and capabilities, among which there are management, organization, processes or knowledge, for instance. (Kresse & Bause, 2011, 86). Among the assets of a knowledge manager as service provider there should be, of course, expertise in knowledge management but also knowledge about state-of-the-art strategies and tools. Furthermore, expertise in the business field of a company would be very useful, too.

Demand Management

Before solutions are developed a thorough analysis of all internal and external factors is essential for being able to meet business requirements. A clear understanding of the service components and functionalities that create the added value for a customer supports the finding of usable solutions. This should, above all, include the critical success factors. In the case of a wiki, for instance, usability can be a critical success factor. This leads to demand management. The objective of demand management is the equilibrium between business requirements and provided capacities. Demand management prevents extra costs as a result of excessive capacities. On the other hand insufficient capacities have a negative impact on the quality of services. Demand management is related to information need analyses. While the latter should be done before knowledge management processes are initiated, demand management is an ongoing process considering requirements and needs that come up during the use of a service in order to build and provide adequate capacities (Service Strategy, 2011, 244ff).

Return on Investment

An essential concept for every strategy is return on investment, a quantitative evaluation of investments. In the context of service strategy the profitability of strategic service management projects must be given because return on investment is the basis of all business activities. This is a crucial point when it comes to knowledge management. Although various approaches for evaluating the benefits from knowledge have been developed it remains a challenge to determine the monetary value of knowledge assets and, therefore, knowledge management as well. A quantification of the efficiency of knowledge management activities remains difficult mostly due to limitations of financial and personnel resources. Probst et al. state:

> Insgesamt sind „Wissensindikatoren“, welche die Veränderungen zentraler Größen der organisatorischen Wissensbasis messen können, in der Praxis wenig verbreitet und es besteht wenig Erfahrung mit dem Controlling nicht-monetärer Größen. Auch die mangelhafte Operationalisierung von Wissenszielen (vergleiche Baustein Wissensziele) kann leicht dazu führen, dass der Erfolg von Interventionen in die Wissensbasis nur schwer abgeschätzt werden kann (Probst et al. 2005, 214).

This statement can be translated with the following words:

> In total, knowledge indicators that are capable of measuring changes in key factors of the organizational knowledge base are rare in practice and there is little experience with the controlling of non-monetary factors. The insufficient operationalization of knowledge objectives (compare building block knowledge goals) also can easily lead to difficulties in estimating the success of interventions (own translation of Probst et al. 2005, 214).

In order to convince managers in favour of knowledge management a way must be found to connect it with existing management and controlling tools. Therefore, other means of measuring and evaluating the success of knowledge management activities such as a balanced scorecard, for example, have to be considered or new approaches have to be developed. The balanced scorecard was developed in the early 1990´s by Kaplan and Norton. Enterprises are analysed from four different perspectives. Strategic non-financial performance measures are added to traditional financial metrics. The four perspectives are financial, internal business processes, customer and learning and growth. Probst et al. see a connecting factor between knowledge management and the learning and growth perspective. With the assistance of a balanced scorecard a connection between long-term enterprise goals and the management of knowledge can be established (Probst et al. 2005, 217f).

In the context of service management return on investment is used to evaluate the possibilities and the capability of a service asset to add value. However, in this context, too, it remains a challenge to base a return on investment evaluation with regard to the implementation of service management and the improvement of processes on quantifiable evidence. The question is, how can the specific necessity of a service be proved and justified? Customer perspective is subjective and there are intangible factors involved in delivering services. Return on investment is not calculated by the service

provider but by the business unit that pays for the services (Service Strategy, 2011, 105 & 107f).

Chances and Risks of Service Strategy

As IT organizations have become quite complex service strategy helps to build reasonable and efficient structures. Complete systems are subdivided into smaller, service related units. The use of specific service processes supports long-term projections of necessary decisions, thus enabling the evaluation of the consequences such as budgets, staff and time assignment etc. As an important result Kresse and Bause see the development of a learning organization. Furthermore, they state that the focus of tasks and responsibilities on specific processes enables the development of required skills and know-how (Kresse & Bause, 2001, 96). Wrong decisions present a major risk in strategy. They can be the result of wrong or insufficient information or false conclusions. Especially projections of future events bear the risk of being inaccurate. Therefore, the evaluation of possible risks and a good contingency planning are prominent aspects of service strategy. In the case of the wiki project contingency planning played an important role at the beginning of the project. The risk of failure had been considered high but the impact of failure rather low.

5.4.2 Service Design

The overall objective of service design is the determination of customer requirements and their implementation as services. It is all about planning, developing, changing and adapting services. This includes processes and products as well as people. Communication plays an important role in order to completely understand costumer requirements before planning and design processes begin. Regular feedback from customers helps to reduce errors. Usually the requirements on services result from the existing service portfolio. The goal is a service architecture. At the end of the design process a service is transferred into service operation. Both case studies have shown that the respective knowledge management strategies had to be flexible in order to come to a full effect. Repeated feedback helped with adapting tools and services to the needs of the employees. The case studies will show that this improved acceptance enormously.

Designing Service Solutions, Supporting Systems and Processes

New or changed services need to fit into the service portfolio. Therefore, it may be necessary to customize either new services or the existing portfolio based on business

requirements. The same applies to the supporting systems and applications as they are an important factor of a successful and efficient service management. All systems and applications together compose the enterprise architecture. According to Lankhorst an enterprise architecture is

> a coherent role of principles, methods and models that are used in the design and realisation of an enterprise´s organizational structure, business processes, information systems and infrastructure (Lankhorst, 2009, 3).

Kresse and Bause mention the essential aspects of enterprise architectures which are service architecture, application architecture, information and data architecture, IT-infrastructure architecture and the surrounding architecture. These could be augmented by a knowledge landscape which interacts with both, business processes and information systems. The process design and the associated responsibilities must support services. It may be necessary to adapt services to the existing processes. This includes service management processes, service design processes and IT processes (Kresse & Bause, 2011, 104).

Service Design Processes

A service catalogue is a single source of information on all services and provides transparency on the service portfolio. It contains both technical aspects (technical service catalogue) and business aspects (business catalogue). The technical service catalogue includes information on hardware, software, data and applications, whereas business catalogues focus on processes that are to be supported by services from a customer view (Service Design, 2007, 60ff). Service level management establishes general conditions that aim at aligning IT organizations with the constantly evolving customer requirements. Requirement engineering, which is explained in chapter four, is a part of service design, too (Service Design, 2007, 167ff). Agreements between service providers and customers are set up. This results in the maintenance and improvement of service quality. Therefore, service level management can be summarized as the qualitative and quantitative management of services. Kresse and Bause put emphasis on service level management as one of the most important processes within the ITIL framework due to its impact on organizations (Kresse & Bause, 2011, 109). Both the customers and the IT organization are held responsible for the IT services. Thus, a successful cooperation is granted. They agree on the definition, monitoring, evaluation

and reporting of provided services. This guarantees that objectives are defined which can be evaluated. Monitoring is important with regard to customer satisfaction, too. Customer satisfaction can only be reached when there is a common understanding of the provided services. Therefore, the evaluation and documentation of customer requirements is essential. At best this leads to a constant improvement of services. In the first case study the monitoring process consisted of two main parts. The first being interviews and meetings with the respective teams in order to receive feedback. The second being the monitoring of the use of the wiki with regard to numbers of new wiki pages within a certain time period and numbers of page views. Additionally the employees were asked for feedback on a regular basis.

Capacity management is responsible for the adequate provision of IT capacity with regard to requirements and costs (Service Design, 2007, 79ff). Among the major objectives there are the design of an up-to-date capacity plan that reflects current and future business needs, provision of information and guidelines with regard to all questions concerning capacity throughout the entire business. Beside business requirements both service needs, service performance and technological components are monitored, analysed and reported. With regard to technological components such as applications it is important to know to what degree they are being used and to create minimum standards respectively profiles of what is needed. A wiki, for instance, allows for retracing its use at any time.

Services are only appreciated by customers when they are available. A malfunctioning service is a threat to customer satisfaction. Therefore, availability management is used as a means to grant stable services according to service level agreements (Service Design, 2007, 97ff). From a business perspective costs play an important role. For these reasons, a balance between a high service level and cost efficiency needs to be found. The availability can be improved during design processes of services and by monitoring, analysing and managing dysfunctions and problems. A concept is developed how to grant respectively improve the availability of IT systems. Usually agreements are made between service providers and service users with regard to the level of availability. Therefore, it should be a major objective to fulfill these agreements and provide the expected availability and more. Assistance with dysfunctions and problems also belongs to a good availability management. In the first case study, due to physical proximity and close contacts between project team and wiki users, all these conditions were granted. As vital business processes have become highly dependent on

IT services, continuity has become essential. IT service continuity management is responsible for restoring services in case of failure (Service Design, 2007, 125ff). Corresponding efforts and costs are reduced. Both availability management and continuity management were an integral part of the project plan in the first case study. Responsibilities, however, were shared between the project team and the internal IT infrastructure service provider

Another important aspect of service design is information security management (Service Design, 2007, 141ff). The case study about the implementation of a wiki has shown how important a secure environment is with regard to people's readiness to share knowledge. In ITIL the degree of security is determined by customers or by law and becomes part of service level agreements. By planning, implementing and evaluating security measures the required security level is provided. This concerns people, organization, infrastructure and technology (Kresse & Bause, 2011, 118f). The basic concepts of security management are availability, integrity, correctness and confidentiality of data, requirements that were mentioned frequently in the survey of information needs and requirements made at the beginning of the first case study. Especially confidentiality played an important role in the process of implementing the airline wiki. At first the users were not aware of the fact that virtually anyone in the company was able to read any wiki content. As soon as this was discovered a solution had to be found or otherwise the application would have lost acceptance. Therefore, the dimension of confidential versus non-confidential knowledge was added to the knowledge landscape.

5.4.3 Service Transition

During the third phase called service transition services are transferred to operations according to the requirements of service strategy and service design. Service transition combines elements of change management (Service Transition, 2011, 60ff), service asset and configuration management (2011, 89ff) and knowledge management (2011, 181ff). They support the entire service lifecycle with transition planning and support, release and deployment management, service validation and testing and evaluation. Change management in this context must not be confused with change management as described in chapter 4.2.2 which describes the proactive management of changes within organizations. In ITIL change management deals with requests for change in IT systems or applications coming from the users. Further important methods and processes are project management, risk management and early-life-support. Standards and processes

for the implementation and management of new or changed services are defined. New or changed services are transferred to business operations. Required resources for a successful implementation are planned and managed. Communication is planned including essential information about the services and their structures. Early-life-support is provided and quality and validation management is defined and applied including performance tests. Interesting in this context is the fact that a service knowledge management system is provided, which is part of the support of a learning organization.

These activities result in a higher quality of services. The process of implementation is accelerated and more efficient. Thus, quick adaptations to new requirements deriving from changes in the market are simplified which allows for more flexibility. The risks of failure are reduced and planning processes concerning staff assignment and budgets become more transparent and predictable (Kresse & Bause, 2011, 129). In the following the most important processes of service transition will be introduced.

Transition Planning and Support

The main objectives of transition planning and support are the definition of basic prerequisites of service transition and the provision of basic information and transition standards, furthermore, the support of the other processes of service transition. Important activities are the planning, coordination and definition of standards for the processes of service transition (Service Transition, 2011, 51ff).

Service asset and configuration management provides a model for all IT components, including hardware, software and services as well as contracts and documents concerning services (Service Transition, 2011, 89ff). These components are called configuration items in ITIL. An IT based knowledge landscape, therefore, consists of configuration items. All existing configuration items including all of their versions are stored in the definitive media library which was not clearly defined as such in the first case study but of course lists and descriptions of IT infrastructure and services did exist and the construction of a knowledge landscape added to this. Transparency on the composition and interdependencies of IT components has become a critical factor for success in business due to the complexity of business processes and the required complex information systems. Configuration items and service assets are identified, controlled and updated. Configuration management has several benefits (Kresse & Bause, 2011, 143; 148). The effects of changes are evaluated. When one configuration

item is changed it can be seen at one glance which items are affected by it and to what degree. This reduces the risks of changes due to a transparent overview of services and infrastructure. The effects of changes can be calculated and thus contingency planning is simplified. New or altered services are planned and designed. When, for instance, a knowledge management system is implemented it comes in useful to know about existing service assets that might support the process. Having an idea of their relations might help to find the adequate scope of knowledge management (compare chapter 6: *KM-Ablage*). Technology is planned and designed as well as improvements and exchange of technology. When a decision in favour of a knowledge management system is to be made it is helpful to know about existing applications in order to avoid redundancy and to find out which functionalities are still missing in an IT organization. Users are supported efficiently based on trouble-shooting and (root) cause analysis. Weaknesses in services that might lead to deficiencies are identified. Thus, future problems can be solved faster and more efficiently.

The main activities of configuration and service asset management are planning, configuration, identification and controlling, reporting, verification and audits (Kresse & Bause, 2011, 146). In the airline industry audits play an important role as a means of quality management.

As shown by the summary of its benefits, service asset and configuration management is a process that supports the entire service lifecycle. A service asset and configuration management system serves as a primary source of information for all processes of the service lifecycle phases.

Release and deployment management is responsible for the practical implementation of changes (Service Transition, 2011, 114ff). Furthermore, it is responsible for updating the documentation after changes have been rolled out. This is important for both quality control and for the topicality of the information of the configuration management system. Main activities are the design, testing and the release of release units or release packages. Release units are those components of an IT service which are released together. An example of a release unit could be a knowledge management application including operating procedures and user training. Release packages can be one or several release units. The illustration below shows the service transition v-model, a key principle of the service transition phase.

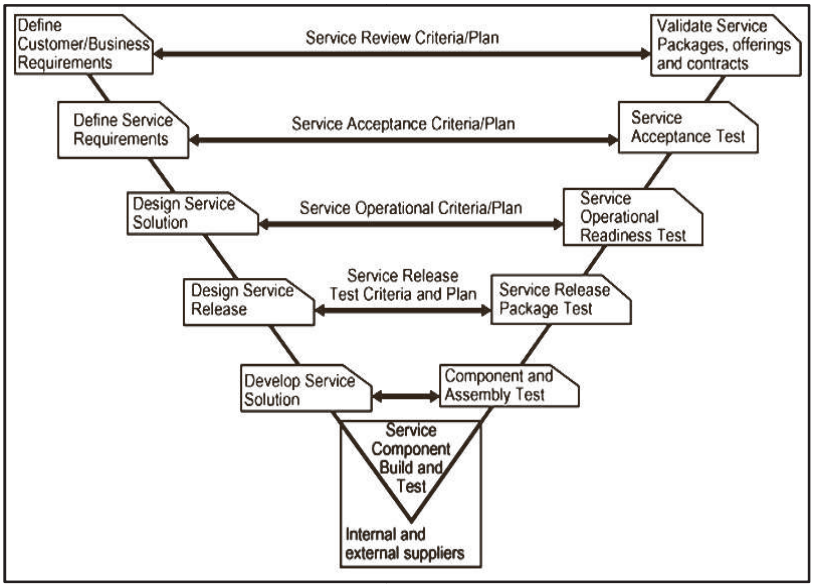


Illustration 5.1: Service Transition V-Model (source: http://learnitilv3.blogspot.com/2012/03/basic-steps-in-release-deployment.html 08.12.2018)

On the left side there are the activities definition, design and development which have their corresponding validation activities on the right side. Starting point is always the definition of customer and business requirements. Then service requirements are defined and solutions are designed. In the next step service releases are designed before a service solution is developed. As a last step service components are built. In each phase there are tests before the next step is taken. V-models are used for developing IT systems. They are usually similar to the model above. Chronologically a release and deployment process starts with the planning. Then the solution building, testing and deployment are prepared. In the next step service and pilot tests are made. In the first case study a test user group had been established which was to test the new processes and applications. They gave feedback and thought about further requirements. In the next phase the actual deployment is authorized, planned and prepared. After the deployment the early-life-support of the solution begins and in the context of a deployment post implementation review the results are evaluated in order to see to what degree the requirements have been met (Kresse & Bause, 2011, 155). This is exactly the way the wiki was designed, developed, implemented and improved. Release and deployment management has to ensure that releases and rollouts are made according to service design and stakeholder requirements (Kresse & Bause, 2011, 157) and thorough service validation and testing ensures a high level of quality. In order to prevent errors that result from a lack of understanding of the interdependencies of service items tests based on the requirements are essential. Once a service has been rolled out it is much

more difficult to identify the source of an error. Costs would be higher if errors had to be fixed in a productive environment. The essential activities of service validation and testing are (Kresse & Bause, 2011, 159-161):

Planning and design of tests: Tasks have to be planned and designed. The scope and the type of tests have to be determined as well as test users and a time frame. Furthermore, the required infrastructure needs to be established.

Test design verification: The essential elements for successful testing need to be mapped. It is important to check whether the time planning of a test suits the available resources. The tasks must cover the business requirements in order to see whether a service is fit for use. Furthermore, reporting must be enabled.

Preparation of test environment: The required infrastructure has to be established before the actual tests can begin. A test environment is set up that mirrors the productive environment. Test users are granted access to the functionalities and configuration items that are to be tested. In the first case study test users were allowed to complete test items whenever they had time for it for several weeks.

Execution of tests: Tests are executed under different aspects. Functionalities are tested as well as the integration of release packages into the overall infrastructure of a service. Required interfaces to other services should be tested as well. In the case study the integration of release packages such as the Word2Wiki and the Excel2Wiki macros were tested by the project team and the test users, however, after the rollout problems with the macros occurred when larger documents were uploaded.

Documentation of test results and test reporting: All tests are to be documented in a standardized way including test results and information about the test users.

Evaluation of exit criteria and report: Actual results are compared with projected results.

Clean up and closure: It should be ensured that the test environment is cleaned and that it is learnt from previous experiences, which leads to the identification of areas for improvement before the rollout is started. In the case study the test

environment was much more flexible and the tests were less standardized than ITIL would propose. After a certain time test results and feedback from the test users were presented and discussed in meetings of test users with the project team and team leaders.

Validation and testing enhances the chances that in the end a service is both fit for purpose and fit for use. The quality of a service is improved, errors are reduced, and the costs of service support are minimized. Besides, the integration of the users helps to enhance user acceptance. The Word2Wiki example, however, has shown that a higher degree of diligence could have prevented a lot of extra work.

Whether a service is productive or not is evaluated in a standardized process. The expected post-roll-out productivity is compared to the current productivity. The evaluation process uses the plan–do–check–act method (PDCA), developed by Deming, which is an iterative four-step management method used in business for the control and continuous improvement of processes and products. Furthermore, it can be applied in costumer oriented project management. Every activity is seen as a process and can thus be improved (Masing, 2007, 264f). Plan means that objectives and processes that are necessary to deliver results in accordance with the expected output are established. The status quo is analyzed and methods for improvement and criteria for a check are determined. The completeness and accuracy of the specification is also a part of the desired improvement. Do stands for the execution of the processes of the implemented plan. If necessary, employees are qualified respectively. Check is required for analyzing the results respectively the data that has been collected. It is compared against the expected results to search for any differences in implementation from the plan. At the same time both appropriateness and completeness of the plan to enable the execution of processes are checked. If necessary act is applied to mitigate detected differences and problems by corrective actions after a root cause analysis has been executed. The whole cycle is iterative until the results are satisfactory.

Interestingly knowledge management is an important aspect of ITIL as well**.** It has become an essential part of the ITIL collection of best practices. ITIL specific objectives of knowledge management are the improvement of service quality and the reduction of costs. This leads to a higher level of customer satisfaction. A homogenous understanding of the benefits of services is established. Besides, a good knowledge

management provides appropriate and actual information on topics concerning services whenever needed at all times.

During the service transition phase knowledge is especially important in terms of experience deriving from past cycles. This experience helps to raise awareness of problems that are to be expected. Furthermore, knowledge management plays a super ordinate role for the entire service lifecycle because during all lifecycle phases, data, information and knowledge are both generated and retrieved. In ITIL there is no clear distinction between information and knowledge, however.

5.4.4 Service Operation

The main objective of service operation is the realization of the utility of a service or service components by means of operation and support. This includes infrastructure, applications or any other configuration item. Service operation consists of methods and processes of managing the operation of services. Instructions and manuals are provided in order to grant the warranty and efficiency of services, thus creating the required value for customers as defined in the service strategy phase. In the case of the wiki, for example, manuals were written. All processes and activities of service operation are to provide a specific service level in a constantly changing environment. Keeping the balance between maintaining the status quo and adaptations to changes in the business environment or in technology is one of the major responsibilities of service operation. Main objective with regard to IT services is a good performance and availability of the systems. Reliability is, of course, essential for all kinds of services. With regard to the question, how to deal with changes or problems coming from the provision of services ITIL distinguishes between two approaches, a reactive and a proactive approach. A reactive organization puts emphasis on reacting to business changes, new or improved technologies or problems with customers. This approach increases the costs, time and effort for reactive activities which cannot always be prevented and, furthermore, the stability of services is put at risk (Kresse & Bause, 2011, 177). When a problem has to be dealt with there is a certain risk that a solution is not found within an appropriate time frame. This may lead to a complete failure of services and the resulting costs can be enormous let alone the loss of trust between service provider and customer. In the worst case customers are lost and it usually costs several times as much to get customers back than keeping them. Therefore, Kresse & Bause argue in favor of a proactive approach which puts emphasis on the permanent search for improvements of the current situation. It is essential to anticipate possible changes or disturbances that may have a

negative effect. However, this approach requires resources such as time and money. For that reason, a healthy balance between the proactive and the reactive approach is recommended.

Processes of Service Operation

The major processes of service operation are event management, incident management, problem management, request fulfillment and access management.

Event management is responsible for any event that is important for either infrastructure or service delivery (Service Operation, 2011, 58ff). Possible events range from the simple login of a user into a system to technical breakdowns. Event management is responsible for the reporting and filtering of events. After an event occurs a report is generated and the event is perceived. In a next step events need to be filtered in order to distinguish between relevant and irrelevant events. An example taken from the first case study would be the problems with a macro called Word2Wiki which will be explained in detail in the next chapter. It would be classified as an “exception event” which required immediate actions as it had the capability to lead to a total failure of the wiki implementation.

After a successful distinction decisions in favor of counter-measures have to be made and it is determined which unit of a service organization will be responsible. This could be change management or incident management, for example. Incident management itself records, categorizes and prioritizes all disturbances in order to eliminate them as soon as possible (Service Operation, 2011, 72ff). This is important because as long as a service cannot be used work that requires the respective service cannot be done. Therefore, incident management is essential for keeping effects of disturbances on business as low as possible. Whereas the term event includes all sorts of events, both harmful and harmless, the term incident is only used for events that impair the quality of a service such as the breakdown of a server, for instance. In the case study incident management during the test phase helped to prevent errors and demotivation of the users after the department wide rollout. Incident management begins with the identification of incidents. Users contact the first level support, for example a project team during a rollout, or reports come from event management. Detailed information about incidents is recorded so that all employees who are involved in the solution finding process will be able to cooperate. As well as in event management incidents are categorized. Categories help to find the best support team for a specific incident. Prioritization is the next step. The categories here are urgency and impact. Then

incidents are analyzed. The objective is to find out why an incident has occurred, however, the focus lies rather on a quick restoration than on a profound causal research (Kresse & Bause, 2011, 183).

The users of a service are at the center of attention in service management. Therefore, it is essential not just to provide services but, furthermore, to offer support as well. While users work with services or tools additional requirements come up. This could be software extensions as well as requests for more information. It comes in useful to establish a standardized process to respond to these requests, especially because certain requests occur repeatedly. In ITIL this process is called request fulfillment (Service Operation, 2011, 86ff).

While the focus of incident management is on the restoration of services problem management deals with the deeper causes, the root causes of problems. Problems are defined as the unknown cause of incidents (Service Operation, 2011, 97ff). For that reason, information that is generated by incident management is passed on to problem management. Main objective is to prevent further incidents or at least to reduce their impact. As a result requests for change are made to change management. The core processes of problem management are reactive problem management which reacts to problems that occur and proactive problem management which anticipates problems. Problem management and root cause analyses played an important role in the second case study, too, because it is also an integral part of safety and quality management in airline operations. One example would be the identification of safety performance indicators as described in chapter seven.

Problem management can be a valuable help with identifying the major challenges of the implementation of knowledge management. In ITIL problem management includes the seven processes: problem identification, problem recording, categorization of problems, prioritization of problems, problem diagnosis, problem solution and problem closure.

Access management is responsible for the design and the updating of authorization schemes. This includes the degree and extent of access to both service functionalities and data (Service Operation, 2011, 110ff). The identity of a user is checked before access is granted. This can be done by a combination of username and password, for example. Besides it is checked that someone who requests access is entitled to it. Typical authorizations are reading, writing, changing or deleting. Authorizations should

be reconsidered and updated from time to time. The identity of a user can change, for example in the context of a promotion which may require more rights for a user. Furthermore, as the wiki implementation has shown it is essential that users understand the authorization scheme preferably right from the beginning of any implementation process.

5.4.5 Continual Service Improvement

The main objective of continual service improvement is the maintenance and the improvement of services in order to maximize the added value of services for the customers and all other stakeholders. This applies to both IT services and service management processes (Continual Service Improvement, 2011). As mentioned before rapidly changing business requirements cause continuous adaptations of services. The actual service level is reviewed and analyzed. Recommendations for improvements are developed for each phase of the entire service lifecycle. Both return on investment and value of investment, which deals with strategic aspects, are the basis of these service improvements. Improvements result in benefits. For example, the reduction of costs for service failures would be a benefit. The added value created by non-monetary benefits, also called value of investment, may be more difficult to evaluate similar to the evaluation of knowledge management but Kresse and Bause give a good example of how useful they can be nonetheless. They mention the establishment of a change management process that reduces the number of failed changes. Thus, the ability of a company to adapt to changes in the markets is improved. The use of resources for changes may be optimized which either reduces costs or renders resources more useful and the use of them more efficient. That is to say with the same amount of resources a larger number of tasks can be fulfilled (Kresse & Bause, 2011, 213f).

In order to reach a certain quality it is essential to have a precise idea of what is desired to be accomplished. This leads to clear and straight objectives. The following question needs to be answered: What are the goals of service management in relation to the general business objectives and IT strategy? An analysis of the current state of a business, an organization, of processes, services and technology, also called baseline assessment, is the starting point. Then objectives and priorities are defined and milestones are determined. These targets must be measurable. In the next step the question how to reach these targets needs to be answered. A detailed plan of service and process improvements is set up. In order to be able to determine whether the desired improvements have been made measurements and metrics are established which enable

an objective analysis of what has been reached. However, only when improvements are established and accepted and have thus become part of services all measures have been successful. In the first case study the project team monitored the acceptance of the wiki after service improvements and whenever problems were solved by measuring the increase in activities as seen in the next chapter. Kresse and Bause put special emphasis on all controlling and monitoring activities (Kresse & Bause, 2011, 216). Their main functions are the validation and justification of decisions, the directing of activities, which they give as the most important reason, and the possibility of intervention at pre assigned points. In the context of knowledge management justification may be the most interesting aspect because knowledge management sometimes still has the reputation that is has no return on investment for it is, as seen, difficult to be measured.

They suggest a process consisting of four phases for choosing an application. These four phases are: analysis of the current state, to-be-concept, acquisition of information and decision. These phases are very similar to the phases during the process of finding an appropriate application that would be the core of the knowledge management activities in the first case study. In ITIL several aspects are considered in each phase.

In the first phase a survey of the individual situation is made. Most important in this context is a survey of the existing applications. This includes both such applications that support the processes that are at the center of attention and those applications that support the general IT infrastructure. The strategy of an organization with regard to their IT infrastructure needs to be considered. For example, a company might focus on SAP products or on open source applications. Another question is what these applications are being used for. The employees, respectively the users of those applications have most likely developed a certain proficiency in the use of these tools. Therefore, it makes sense to take their know-how of a specific type of IT systems into consideration as well. A new application that is very different from what users are used to, may result in efforts and costs for user training lessons. The amount, the location and the type of data that will be processed by a new application definitely must be considered and analyzed as well. And finally it makes a difference whether IT services are provided by an external or an internal provider. At the end of the first phase the survey is documented and thence can be used during the following phases (Kresse & Bause, 2011, 230).

The focus of the second phase lies on the individual requirements on an application. A survey of requirements is made and requirements on functionalities are prioritized. This evaluation will be the basis of the following selection process. Kresse and Bause (2011, 231) give a list of possible questions for a survey of requirements:

- Which IT service management processes will be supported by a new application?
- What are the goals of the implementation of an application and which will be the benefits? Goals, in this context, should be measurable and specific.
- What are the frame conditions such as time, budget or resources?
- Which functionalities are required?
- Should all functionalities be part of one single application or would it be acceptable to combine them with more than just one application?
- Should applications be bought or leased or could it be freeware?
- Should ITIL be applied?
- What configurations are possible?
- Is there (a good) support by the producer of an application?
- What are the technical frame conditions? Are there possible interfaces? What technology is used and what type of data?

Similar questions were asked during the project of the first case study. However, there a prioritization of requirements has been made by merely counting the numbers of mentioning individual requirements. Another option would be having the interviewees prioritize requirements intellectually. In ITIL the result of this phase is an evaluation scheme derived from an individual catalogue of requirements and their evaluation. It will be the basis of further decisions.

In the third phase service providers and applications that may come into consideration for the customer are preselected. A good number would be between three to five applications as was done at the beginning of the project in the first case study.

Finally, a decision in favor of an application is made based on the results of the evaluations. The customer needs to support the decision.

At the time of the implementation of knowledge management and a wiki at the information management of an airline ARIS was widely used for IT services. The decision of the project team to apply some aspects of the upcoming standard ITIL helped with many problems that came up during the implementation and rollout of the wiki and other aspects of knowledge management. The project began with phase one. Existing applications and processes/tasks were evaluated, then requirements were surveyed. In a next step five different applications were characterized and compared with the requirements before the decision in favor of a wiki was made. It was not as easy as ITIL would suggest, though, which will be seen in the next chapter because company politics and other challenges played an important role, too.

6 First Case Study
(Implementation of Knowledge Management at the Information Management Department of the Financial Division of a German Airline)

The implementation of knowledge management in the information management department of the financial division of a large German airline was based on the intranet and Web 2.0 applications. In the beginning of the implementation project there was the optimistic view that the introduction of a wiki containing documentation, tips, tricks and experience would lead to an optimized use of the existing knowledge. At the same time a collaboration tool was introduced group wide. Furthermore, a so-called knowledge landscape was to be developed as a guideline to determine which application was suitable for specific types of knowledge such as tips & tricks, treaties, documentation of processes etc. At this point it becomes obvious already, that no clear distinction between knowledge and information was made by the department. In this case study the information science approach to knowledge will be applied, distinguishing between objective and subjective knowledge because despite the terminological vagueness there was a tendency to define knowledge likewise. In cases of a deviation from this definition it will be explained explicitly.

In the context of the development of an IT strategy for the financial division need for action was to be revealed. The general expectation was the development of modern, integrated, economic and worldwide available IT solutions for the support of the existing processes. A general objective was the development of a flexible IT landscape, thus being an important contribution to the success of the financial department. A clear focus was put on web oriented applications which were expected to be user friendly and with a good cost-benefit ratio. Other important aspects were security and data privacy protection. This implies the political dimension of developing an IT strategy. Knowledge management was to be embedded into the existing IT architecture. The applied strategy was the codification strategy with a few elements of the personalization strategy.

An initiative had been started to find out about the status quo, to reveal potential for further development and to initiate further activities. The following exigencies created a framework for the realization of the vision of the department:

- Qualification of the employees by providing a knowledge basis

- Transparency of processes and applications
- Structured and intensified presentation of information and a simplified and optimized information retrieval
- Quality improvement by an enhanced use of existing knowledge: best practices, for example

The knowledge management project was split into two projects: one for developing a concept and the second for the implementation of the results. In July 2008 the first project was started with the objective to structure the handling of knowledge. A general conception of the implementation of knowledge management was developed.

This was followed by another project with the objective to implement the results. By then the decision had been made that a wiki was to become the core of knowledge management. Furthermore, the idea came up to develop a knowledge landscape. Several tools had been in use already and more were yet to be implemented. This required a concept how to structure both existing and new knowledge. The data that was to be migrated to the wiki had to be defined as well as rules which of the existing applications were appropriate for the various kinds of data, information and knowledge, including handbooks, job descriptions, treaties, general knowledge etc. The focus of this case study is on the processes and challenges of the conception and realization of knowledge management. This includes both technical challenges and problems the project team was facing when it came to motivating the employees to collaborate. Best practices will be presented that have been developed. Principles of IT service management were taken into consideration. In the course of the case study an evaluation will be presented that shows whether the use of a wiki has yielded any additional benefit and if the service measures and the modifications that had to be made have promoted the acceptance among the employees. These modifications will be set in a greater context. The case study begins with the conceptional project.

6.1 Project "Knowledge Management (Conception)"

First of all it must be mentioned that certain aspects of knowledge management had already existed in the past though not clearly referred to as knowledge management. Documentation had been an important part of the job. Knowledge was transferred orally which was facilitated by the fact that there were only 60 employees in the department. Both information and knowledge was developed in projects, seminars and meetings that

were held in order to exchange and discuss experiences. Nevertheless, the following difficulties came up repeatedly:

- Documentation, tips & tricks etc. existed in varying quality in different places such as Novell drives, MSOutlook e-mails, intranet pages etc.
- Knowledge often was difficult to find due to insufficient search engines.
- Documents had been saved in various versions and places resulting in difficulties in identifying the version which was up-to-date.
- Implicit knowledge was rarely made use of.

The knowledge that was needed for the processes and the work in the department already existed, for the greater part in written form. Beside that every team had its own tips and tricks. Nevertheless, it was considered essential to manage the knowledge department wide. Among others the following reasons were given:

- Knowledge was often implicit and not documented (whereas implicit knowledge was confused with what is in fact subjective knowledge according to the information science approach).
- Employees who left the company took their knowledge with them, thus leaving a gap. These employees could not always be replaced adequately which might, in the worst case, have interrupted work processes or prevented assignments from being fulfilled (Probst et al., 2006, 189ff).
- Illness or holidays might put work processes at risk.
- Job training of new employees required an intensive knowledge transfer.
- The search for information was estimated to require more than 30% of working time.

Project Kick-off

The starting point of the project to develop a concept for the development of a structured management of the intra-departmental knowledge was the building of understanding of the benefits of knowledge management by means of change management and the definition of the extent and the objectives of the project. Content, data and documents, had to be defined. Based on scientific literature, such as “Wissen Managen” by Probst, Raub and Romhardt, PowerPoint presentations were created, presented and made available for all employees. Moreover, the idea came up to involve

some of the employees especially the leaders of the six teams of the department. This happened in accordance with Probstet al.:

> 1. Effektive Wissensmanager geben gezielt die besonders wichtigen Akteure in der Organization an und stimmen die Beiträge verschiedener interner Partner aufeinander ab. 2. Effektive Wissensmanager bauen auf bereits bestehenden Initiativen auf und fördern den Aufbau von Netzwerken, die eine Eigendynamik entwickeln. 3. Effektive Wissensmanager kommunizieren den Sinn von Wissensmanagement und fördern so die Transformation zu einem wissenszentrierten Unternehmen (Probst et al., 2006, 261)

which can be translated as follows:

> 1. Effective knowledge managers indicate specifically the particularly important people in the organization and coordinate the contributions of various internal partners. 2. Effective knowledge managers build upon already existing initiatives and support the formation of networks that develop momentum. 3. Effective knowledge managers communicate the purpose of knowledge management and thus promote the transformation into a knowledge based enterprise (own translation of Probst et al. 2006, 261).

This means that knowledge managers should focus on important participants and base their activities on existing structures. Networking plays an important role as well. Knowledge managers should communicate purpose and significance of knowledge management.

Not only the added benefit of knowledge management was communicated throughout the entire department, the individual employee was asked to reflect about the meaning of knowledge management. The next step included interviews in all six teams.

Interviews

The teams were interviewed about their understanding of knowledge management and about possible expectations with regard to the processes, products and services. The following aspects were taken into consideration:

- understanding of knowledge management
- benefits from knowledge management
- status quo

- expectations regarding knowledge management
- expectations regarding a knowledge management application
- critical success factors

The answers were extensive. In the following a résumé of the answers will be given. In order to determine the relevance of the individual requirements multiple mentions are taken into account. A ranking of the mentions of the aspects as displayed in chart 6.1 – 6.3 show their importance for the group that was interviewed. Similar answers have been summarized.

Understanding of Knowledge Management

First of all it was asked which understanding of knowledge management the individual employee had. A distinction was made between knowledge in general and knowledge management.

Knowledge

- Anything that is necessary for a successful completion of an assignment.
- Knowledge consists of information, personal experience and documentation.
- Knowledge means to know how to apply information.
- Knowledge changes and ages.
- A distinction between basic knowledge, competence and expertise can be made.
- Know-how is available from the mind and media. It enables to draw conclusions.
- Skills are the sum of competence and applied knowledge, for example: language writing or reasoning skills.

The interviewees did not make a clear distinction between knowledge on the one side and information, documentation and personal experience on the other. They rather considered these as defining parts of knowledge. In contrast to Kuhlens (1995) “Wissen in Aktion” the third statement implies that this was seen the other way around. They also distinguished the quality of knowledge. Three levels were identified: basic knowledge, competence and expertise. This might be interesting in the context of a knowledge landscape since it was a first distinction between different types of knowledge.

Knowledge Management

- Knowledge management is a process of developing, saving, structuring, administrating and distributing knowledge. It combines know-how and knowledge is developed on the basis of experience.
- Knowledge is shared and handed down (back-up, on-the-job-training etc.)
- Knowledge is available at a central point.
- It is not necessary to know everything but to know where to find knowledge, be it in databanks or from colleagues.
- There is a mutual benefit from knowledge sharing.
- Information is edited in a standardized way and easily retrieved.
- Access to information is facilitated.
- Knowledge management enables the identification of knowledge that already exists in an enterprise.
- Knowledge management combines general knowledge and individual experience.

Special focus was put on centralized knowledge repositories and knowledge retrieval. Similarities with the knowledge building blocks of Probst et al. (2006) are evident.

Benefits of Knowledge Management

On top of finding out whether the employees knew about knowledge management in general it was desired to know if there was an awareness of the benefits of knowledge management. These were the results:

- Work based on useful knowledge is more valuable.
- An important aspect is the independence from individuals in cases of on-the-job-trainings or holiday replacements. The loss of knowledge in case of fluctuation is reduced.
- Knowledge is found faster and more easily.
- Experts and contact persons are found more easily.
- Back-up for colleagues.
- Helpful with topics or assignments that recur sporadically only.
- Reduces redundancy when it comes to solving problems. An existing solution can be used and improved.

- Less is forgotten.

It can be said that there was a high awareness of both usefulness and necessity of knowledge management.

Status Quo

In order to reveal the need of knowledge management an analysis of the status quo comes in helpful. The answers show how the teams were seeing themselves. A distinction was made between the various tools that were already being used for managing knowledge and documentation in general. Both the usability of the tools and their content was taken into account.

Tools

- Tools are used already: intranet, document management systems, MS Outlook, a desktop search, an application guide (from which the knowledge landscape was developed) etc.
- The directory structure is insufficient.
- A SAP specific data bank is used: use of OSS for details with reference to SAP ERP/BI.
- Intranet search has been improved and delivers better results.
- The filing system of Novell only allows for a search via file paths and file names.
- With the group wide implemented collaboration tool Web 2.0 technology is available.
- One team uses a databank for tips & tricks.
- Repeatedly recurring processes are documented including screenshots and references which enables colleagues with basic knowledge to stand in for someone.
- Some colleagues have their own individual tips and tricks.
- Personalized organization is possible with MS Outlook which results in a large amount of data in Outlook, including PDF files.
- E-mail traffic is archived.
- Existing tools have different aspects, priorities and functions.
- The tools are not used consequently and in an optimal way.

Using a variety of different tools led to complaints about a lack of transparency. Existing applications failed to be user friendly and were, therefore, neglected. Retrieval functions of the applications were considered insufficient despite the improvements of the intranet search.

Documentation

- Information exists, partly unstructured, in varying quality, as well as documents and tools.
- Some documents exist as hardcopies only.
- Some documentation is not maintained.
- During job training of new colleagues knowledge is passed down.
- Knowledge and experience is shared orally.
- Experts can be found in an expert databank used by the entire affiliate group.
- A large variety of topics complicates documentation.
- In case of technical changes existing documentation is updated randomly.
- In the context of projects there is more time for documentation.
- A more professional knowledge management would be desirable.
- It is considered a bad habit to distribute information randomly via distribution lists in Outlook.

Concluding it can be said that documentation was lacking a systematic approach and that information and knowledge often did not reach those people who needed it or for whom it would have been useful.

Requirements Concerning Knowledge Management

A demand analysis consists not only of an analysis of the status quo but also of an investigation of the requirements. This is a summary of the requirements of the teams concerning content and design of knowledge management and knowledge management applications. As the survey of requirements was of great importance for the project and is very important for improving acceptance of knowledge management, as seen in chapter 4.1, the incidence of the respective statements is given in brackets and is illustrated.

Content and design of knowledge management

- Approach and solution should be pragmatic. (4)

- It should be considered that people have to work with the solution. (1)
- A set of rules is required. (6)
- A platform was required which meets the requirements of /lives up to the various work fields of the teams. (10)
- Various kinds of content from the teams must be integrated as well as knowledge that is used by several or all teams. (1)
- Above all documentation is provided for the specific teams but access to the information of the other teams is desired. (6)
- Knowledge which concerns everyone must be provided in a structured way. (12)
- Everyone is responsible for his/her own topics. (3)
- A high up-to-dateness and quality of the documented knowledge is expected. (23)
- Content should be a purposeful support of the work. (2)
- Application manuals and application flow plans of the specific teams are to be mapped. (1)
- Process oriented illustration of individual experience is expected. (1)
- Established processes are to be documented. (15)
- In projects parallel documentation should be possible. (1)
- Not everything needs to be documented. Only whatever cannot be understood intuitively needs to be written down, i.e. complex topics. (18)
- Prominent placement of content including links to the existing project portal. (2)
- Important information must be provided suitably. (27)
- Less is more when it comes to documenting and publishing information. (23)
- The need for knowledge varies. Therefore, basic information plus the possibility to refer to further information would come in useful. (2)
- The following aspects are considered as key aspects of knowledge management in the department:
    - Projects, further development/enhancement, routine operation, platform for a structured documentation operation manual of one of the six teams (between 300-400 documents). (8)
    - A common knowledge platform for SAP-topics: general topics, back-ups, release information etc. (3)
    - Topics concerning the intranet. (14)
- Short descriptions and catchwords are preferred, less prose. (5)

- A good search engine is essential. (36)
- Content should be accessible, if necessary as well for colleagues from other departments. (11)
- Possibility of integrating customers and suppliers is desired. (8)
- Custom-fit solutions for target group are wanted according to the respective need. (29)
- Knowledge should be editable right there where it is created. (1)
- Extra work should be avoided. (29)

Obviously there was a large number of requirements. Therefore, special attention was paid to the top ten as seen in illustration 6.1. However, in the context of a service oriented approach less prominent requirements should not be neglected if capacities allow for it depending on the service level agreement.

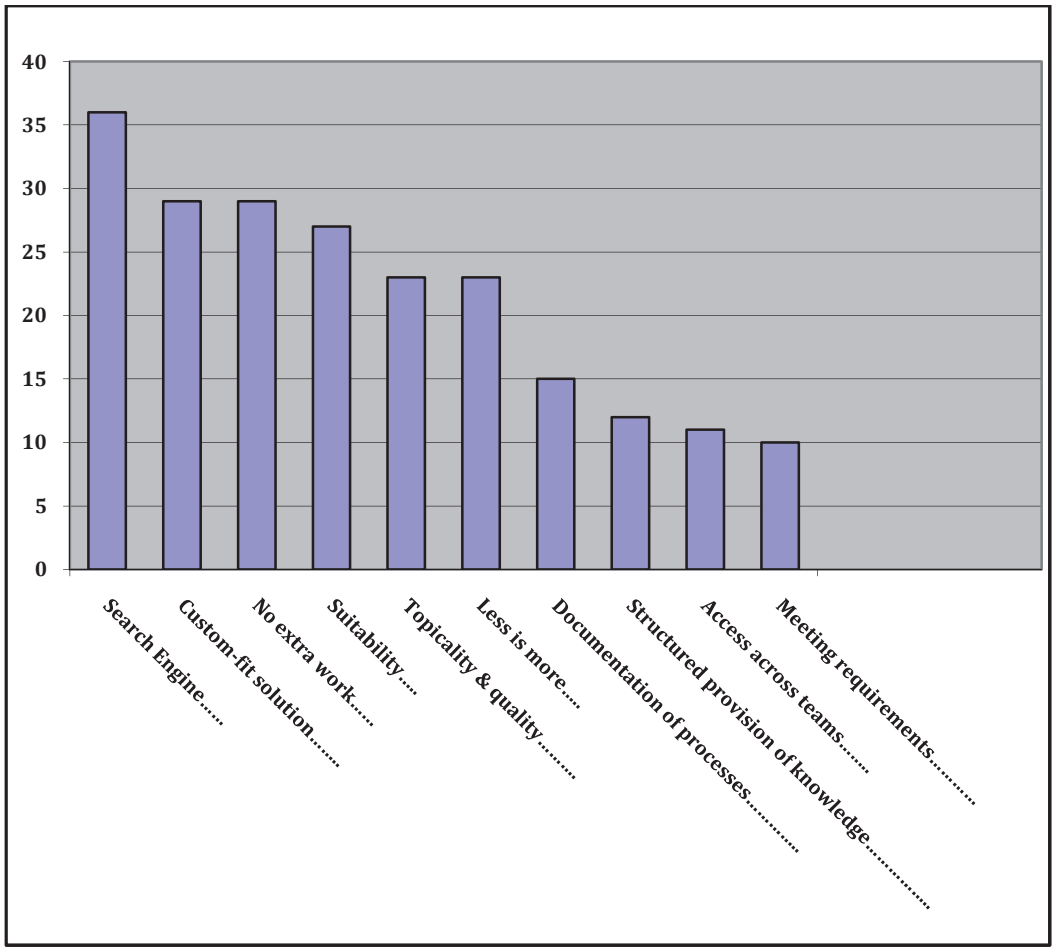


Illustration 6.1: Requirements Concerning Content and Design of Knowledge Management (own representation)

Obviously a good retrieval function was an essential requirement. The same holds true for a custom-fit solution, suitability, topicality and quality. The aspects “no extra work” and “less is more” imply that acceptance would depend to a large extend on the extra workload created by knowledge management activities. This delivers a powerful argument for a service oriented approach where a large amount of the work is done by knowledge managers respectively the project team in this case. Another important aspect was a structured knowledge management which became even more evident during the implementation of the wiki when so-called category trees were created.

Requirements Concerning a Knowledge Management Application

- An interactive system with a good performance which can be operated easily and intuitively is desired. (20)
- A user should be able to operate it even in case it has not been used for months. (1)
- The filling and the administration of a knowledge databank must be as effortless as possible. (29)
- A good and decentralized editing function for text, images, and PowerPoint presentations is expected. (10)
- Possibility to add information to existing files quickly. (4)
- Teamwork on a document should be possible as well as contents which cannot be changed by everyone such as decisions for example. (6)
- A simple organization of content, for instance via categories, is required. (24)
- An exchange of experience is to be promoted, for example by a category including tips and tricks. (8)
- A feed function is desired. (17)
- A search, easily used, which allows for syntactical retrieval is essential. (5)
- Relevance of search results is important. Ranking is required. (10)
- Good headlines enable users to decide whether a topic is relevant or not. (1)
- A high precision is expected which can be achieved with only a few search terms. As an example Google is given. (1)
- Social networking is wanted in order to be able to access the knowledge of colleagues and to find contact persons. (10)
- A quick data input without mandatory fields is desirable. (1)

- Templates are to be developed and used. (22)
- Structures should be rather topic oriented than hierarchic. (1)
- It should be indicated how helpful a document is. Page views could be counted. (1)
- Worldwide access is wanted. (12)
- An authorization concept is required which defines the rights of individuals or groups. (21)

Once again it can be seen (see illustration 6.2) that extra work was to be avoided. Instead the teams wished for a system that could be operated intuitively. Structures, such as categories and templates were considered important. The same holds true for a good retrieval function including relevance ranking and a high precision of the results. A third of the interviewees wished for an authorization scheme. Collaboration and social networking were desired although these aspects were given up later.

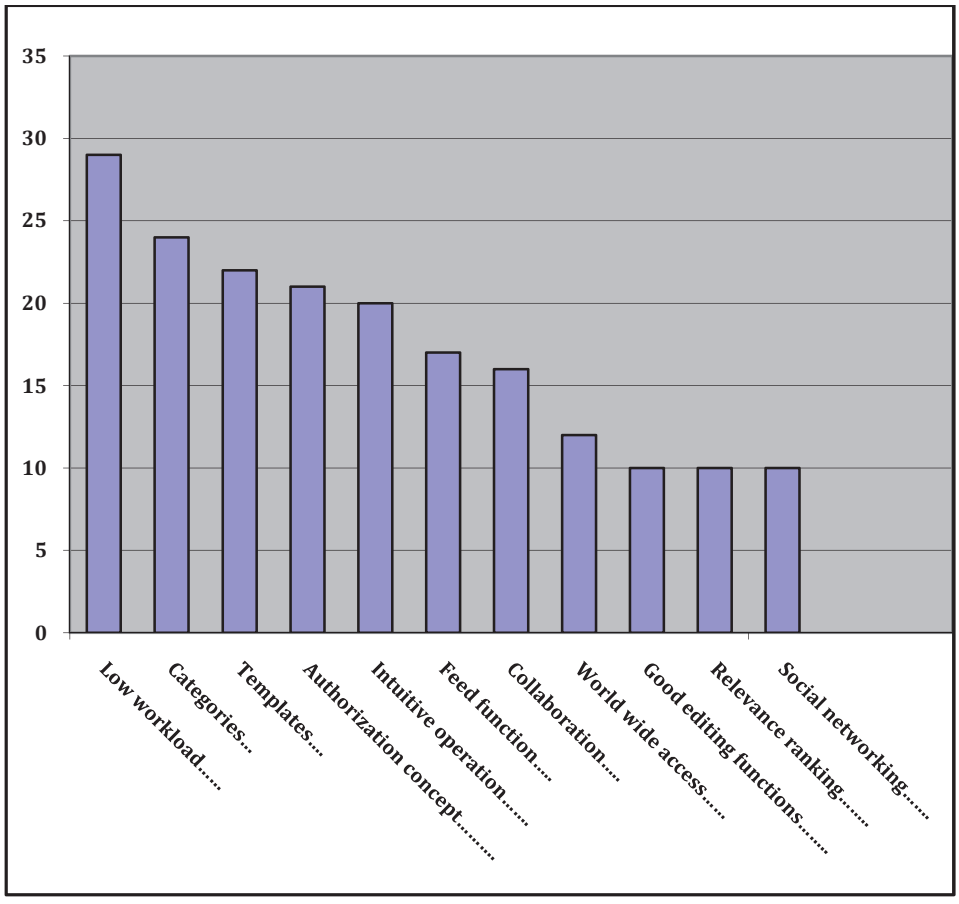


Illustration 6.2: Requirements Concerning a Knowledge Management Application (own representation)

Critical Factors

Eventually the project team wanted to find out about possible risks of implementing knowledge management processes and applications in order to be capable of planning and developing counteractive measures. The results were substantial. A distinction was made between commitment, general conditions and acceptance.

Commitment

- Knowledge management must be accomplished consequently.(6)
- Too much discussion, for example because of differing needs of the particular teams, must be prevented.(10)
- The process must be accepted by both management and all teams.(11)

General conditions

- Discipline is important.(18)
- A consumer attitude would be impedimental.(1)
- Corporate culture plays an important role.(7)
- Transparency is sometimes unwanted.(19)
- A lack of time for entering information due to the fact that no extra capacities are granted.(24)
- The quality of the existing documentation is, to some extent, insufficient.(18)
- Knowledge management „lives“ only if there is someone who takes responsibility for it but not if it is up to the teams to deal with it.(2) (Good justification for a knowledge manager)
- A knowledge management process may come to an end without constant monitoring and motivation.(2)
- Rules might not be followed.(1)
- A homogenous process prevents confusion about what to do and how to do it.(11)
- Responsibility for up-to-dateness and quality must be taken. (3)
- Redundancy is to be prevented.(6)
- Not one single solution for all teams. Focus should be on the needs of the particular teams.(4)
- High complexity and a poor usability of tools keep people from using them.(32)

- An authorization concept must be defined including customers and suppliers.(21)
- Often individual experience is not documented and difficult to explain to others.(1)

Several of these critical factors imply the necessity of a knowledge manager who monitors knowledge management activities and keeps them going. He or she would have the time and capacity to motivate others and to ensure the quality of knowledge, information and documentation as well as the stability of the supporting IT systems. Usability is seen as an important critical factor as well as an elaborate authorization scheme.

Acceptance

- A solution will not have a long life if it does not acquire wide acceptance. An application must be convincing. (4)
- A solution must not be too academic, nor too big, nor too much nor too perfect. (18)
- Too many applications exist already. (22)
- A concept must be convincing, it´s value must be obvious. (3)
- Knowledge management should not be too complex. A bottom-up-solution is preferable. (18)
- The workload resulting from the data/knowledge migration must not be underestimated. (32)
- Employees might begin to feel replaceable. (1)

Here, the workload as well as usability and transparency play an important role again. Complex solutions or systems are considered as a risk for the acceptance of any solution with regard to both complexity and number of applications.

Conclusions

A certain understanding of knowledge management existed already. This is not surprising since the focus of the department was on information management. Besides, some of the employees used to work for management consultancy firms where both information management and especially knowledge management often are an essential part of the work. There was a high rate of consensus concerning the benefits of

knowledge management. Knowledge and contact persons can be found more easily and faster. Less information is forgotten. On-the-job-training and holiday replacements are realized more easily. Nonetheless, the focus was on more efficient work processes. Individual benefits were scarcely mentioned. The same holds true for the process of generating new knowledge. High demands on knowledge management and respective applications were made. Among these there were clear structures, an efficient and fast retrieval of knowledge and a good usability of applications. Therefore applications were expected to have an efficient search function. The solution was expected to be custom-fit and easy to use. There was a high consensus on the statement that knowledge management must not produce a higher workload due to the fact that working time was limited and it was not expected that extra time or extra capacities would be available.

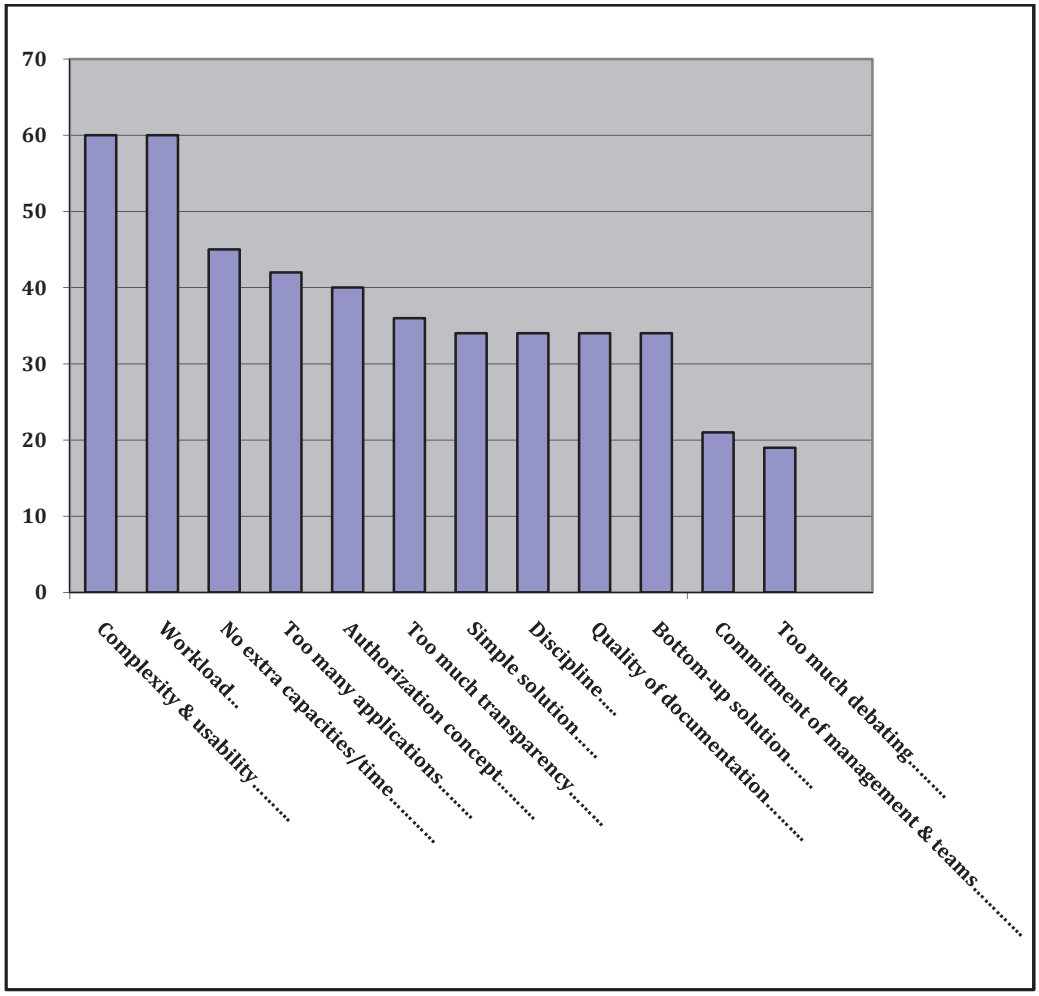


Illustration 6.3: Critical Factors (own representation)

Emphasis was put on the topicality and the quality of knowledge which was to be provided and organized in a structured way, for example by creating categories and

using templates. This would result in a lower workload because it would help to find and migrate information. Besides, the interviewees wished for collaboration and access to knowledge both across teams and across departments as well. A world wide access was required. An authorization scheme was considered both essential and critical. The question was, who would be able to access certain information and who would be able to edit existing documents? With regard to an application, beside the aforementioned retrieval functions, several features were required. Among these there were feeds, good editing functions as in MS Word, relevance ranking and the possibility to convert documents into PDF files and to print them.

The employees were asked to think about critical factors. Once again the complexity and usability of an application was stated several times. In the past applications that had been too complex for an intuitive operation had suffered acceptance problems. For example, an application had been implemented that allowed for a semantic search. However, the operation of this application was too complex and after a while it was not used anymore. Therefore, a bottom-up solution was required. Department members, respectively the future users of the solution were invited to participate in every step of the implementation process. The decision on a course of action was taken by everyone concerned. The advantage of this approach was that it empowered team members to think more creatively. They felt involved in the project development and knew that their initiatives were appreciated. This increased the team members' motivation. Individual members of the teams got an opportunity to come up with solutions that were focused more on practical requirements than on abstract notions. The planning process was facilitated by a number of people. Another critical factor in this context was the number of applications that already existed. Later in the course of the project many questions came up concerning the correct application for certain knowledge. An authorization scheme was required but there was only a vague awareness of the necessity to consider which information would be available for whom. During the pilot phase of the implementation of the application a better understanding of the consequences developed which led to discussions and adaptations. Especially the requirement for transparency was reconsidered several times. Due to a good IT change management and request fulfillment the respective requests for change were implemented quickly, thus avoiding a loss of acceptance. As further critical factors discipline, the quality of documentation and the commitment of management and teams were mentioned. Furthermore, it was

apprehended that too many discussions about the solution would constrain its implementation and efficient use.

Objectives of Knowledge Management

To keep the topic of knowledge management manageable, the objectives of the project had to be defined as well as the limits. A conception for the implementation of a practical knowledge management was developed. An easier access to the already existing knowledge about processes, products and services was to be created.

Based on the knowledge cycle created by Probst et al. (2006) the knowledge building blocks knowledge goals and knowledge identification as well as knowledge distribution (by means of a technical infrastructure), use of knowledge and knowledge storing (by selecting, saving and updating) were taken into consideration. The individual skills of the employees, the acquisition of new knowledge and the development of the employees via vocational training were not part of the project.

Results of the Conceptional Project

Inquiries for possible knowledge management solutions were made both internally, across the group and externally. A process for a permanent knowledge management was to be designed and the results of the conception were meant to be the basis for decision-making concerning any further actions. After the responsible boards had given their approval a project order was designed for the implementation of these actions.

In order not to get lost in the complexity of the matter the following factors were taken into account:

- Incorporation of knowledge management into the processes of the department
- Organizational embedding of knowledge management
- Local embedding and central coordination
- Implementation of individual and user-friendly applications
- Corporate culture: willingness to learn and a positive error culture (open communication, lessons learned)
- Homogeneous understanding of knowledge management
- Incentive system to promote the willingness to share knowledge

Emphasis was put on processes and user-friendly applications. In consequence an approach was developed and it was suggested to implement a wiki as the core of

knowledge management in the department. As a too large number of applications was not desired, it was considered to abandon certain other tools where indicated. Beyond this it had to be defined if and how the existing applications were to be distinguished. A knowledge landscape was to be created that would determine which application was the ideal environment for specific knowledge. Isolated applications were to be integrated into an overall structure. It was also pondered to use web databanks, for example those of Wikipedia or Google. In order to evaluate the benefits of the existing applications their characteristics were outlined. Thus, it was made obvious which functions were still missing. Furthermore, the idea of an extensive service oriented user support came up due to the failure of the aforementioned application with semantic search. The employees were of the opinion that they had not received enough support during its rollout.

A Wiki as the Core of Knowledge Management

There were several reasons for the decision to implement a wiki as the core of knowledge management. On the one hand in the past bad experiences had been made with a semantic based content management system which was poorly accepted due to its complicated handling. Therefore, this time an application was desired that would be operated easily and intuitively.

On the other hand it was expected that the project would benefit from the use of the MediaWiki software which is also used by Wikipedia and the resulting similarity of the enterprise wiki with Wikipedia. This was expected to help the employees to identify with the application and to learn how to use it faster. The enterprise wiki would profit from the positive image of Wikipedia. In the beginning it was intended to use the discussion function for the exchange and the creation of knowledge. However, this idea was abandoned later. A major advantage of a wiki compared to the Novell directory is the direct accessibility of information by offering a search function and categories. The search for best practices in the entire affiliate group was successful. An example of a wiki that had been used successfully for quite a while was found. This wiki was widely accepted and being used on a regular basis.

Last but not least the MediaWiki software could be downloaded and used for free and there was and is a large community which develops further applications for wikis based on the MediaWiki software. Along with the implementation of a wiki it was also decided to redesign the virtual workspace of the department in the group wide intranet.

Developing a Process for Knowledge Management

The next step was the development of a process for knowledge management. As mentioned before a common understanding of knowledge management had been developed by using PowerPoint presentations and information events. Interviews had been made to reveal need for action and to find out about requirements. Furthermore, the teams had been asked to specify their particular fields of knowledge including their respective relevance and the location of this knowledge. Characteristics of the existing tools and of further known knowledge management tools were analyzed and listed. Finally the results were discussed by the team leaders in a workshop. The idea was to continuously determine which application was to be used for specific knowledge which would eventually lead to the creation of a knowledge landscape. The responsibility for specific fields of knowledge was to be given to selected persons. Others were intended to be responsible for editorial processes and for the quality of content and knowledge that was going to be edited and updated in the wiki. Finally the necessity that every employee was responsible for content was realized and accepted. At the same time redundancy of information was to be prevented. The project team was expected to develop a service oriented approach especially with regard to the implementation of IT applications or changes in existing applications that might require user support. These services were meant to be offered to other departments of the financial division later on. The next step was the initialization of a follow-up project dealing with the realization of the concepts that had been outlined.

6.2 Project "Implementation of Knowledge Management"

After the decisions concerning a knowledge management process and application had been made another project was initialized. The goals were to expand the competences and qualifications of the employees by providing a knowledge basis, to accomplish transparency of processes and applications and to provide structured information. At the same time, time and effort of information retrieval was to be reduced. Thus, an improvement of the quality of work by means of a better use of existing knowledge was expected. The aforementioned wiki was to become an essential part of both the project and of a knowledge landscape that was to be created.

The wiki would be embedded into the intranet that was being used group wide and accessible for every employee of the entire group who was entitled to enter the areas of the intranet that require a password. Single-sign-on was realized which made it a lot easier to access the wiki from the intranet.

Based on access management an authorization concept was developed which determined who was able to read and edit content. The editorial process was kept simple. Every employee of the department was entitled to read and write new articles and to edit articles of colleagues according to the individual authorization.

Although there may be wiki software which is more suitable in a business environment the project team abstained from a product comparison. A much bigger issue was the group wide implementation of a collaboration tool, a Web 2.0 tool used for group wide collaboration. It was discussed whether a wiki was necessary at all. Simultaneously with the implementation of a wiki it was worked on the construction of a knowledge landscape in order to determine which application was best for specific sorts of existing knowledge and knowledge that was still to be generated.

Wiki versus Collaboration Tool

The collaboration application had been implemented in late 2008. It is a Web 2.0 application which serves as a platform for the exchange of information. Knowledge can be exchanged across hierarchies and department borders. It includes blogs, discussion forums, simple polls, profiles of employees, a simple milestone planning tool for projects, a search and simple wiki functions, for example the editing of single wiki pages and versioning of documents. It enables contacting colleagues and project groups are able to collaborate and exchange knowledge. However, at the time of the wiki project it could not be used for storing complex documents. Besides single wiki pages could not be linked to other articles. Neither did categories exist. The wiki on the other hand allowed for capacious documentation, for example the editing of manuals. Categories could be used to structure the content. Word and Excel files could be converted into wiki content. It was possible to generate PDF files from wiki articles and content could be exported in HTML. Templates were used to edit new pages. They provided fields to fill in project numbers, contact persons etc. Summaries could be generated from the information that was entered into these fields which comes in handy during researches because of the time saving potential. For example, a summary of all projects including contact persons could be displayed. At the same time templates were part of one or several categories which all articles edited with the assistance of this template belonged to. As the collaboration tool did not meet all expectations the decision was made to implement a wiki. Due to the additional functions of a wiki the permission was given for the implementation although the other application had been established as the group wide standard application for collaboration and knowledge

sharing. In case of an evolution of this application to the point that it would meet all requirements the content of the wiki was to be migrated there. Till then the wiki would be the first choice for documentation and the department wide exchange of knowledge. The collaboration tool on the other hand, would be used for collaboration with other departments, thus becoming part of the knowledge landscape of the department, too.

Implementing a Wiki

Before the actual implementation, goals were defined. The technical requirements had to be defined in a workshop based on the results of the interviews as well as categories and templates. Organizational aspects had to be dealt with such as the responsibility for quality assurance. The individual teams were asked to make statements concerning the information, documentation and knowledge they would provide for the initial input. An interdepartmental marketing in order to promote the acceptance of the new application was to be developed, too.

Workshop

In a second workshop a frameset for the wiki was defined. The goals were the definition of categories and an authorization concept. Further functions that were expected from the application could be required. Drafts of templates had been developed and were introduced and wishes for more templates were expressed. A first separation between the wiki and other applications was made. The categories were predicted to evolve based on a common learning process.

An authorization concept was defined in order to protect certain content from being edited or accessed by unauthorized persons. It consisted of four groups:

- **Group wide general:** after logging in with the intranet password reading of general/public content was enabled.

- **Department wide general:** after logging in and with the respective authorization every employee of the department was able to read and edit all content.

- **Individual teams:** namespaces for each team were created and after logging in and with the respective authorization all articles of that specific protected domain could be edited by the respective team and read by all employees of the

department, yet not necessarily by all group employees, depending on the requirements of the team.

- **Additional:** after logging in and with the respective authorization all articles in that specific protected domain could be edited by both team members and employees of other departments. The content of these domains could be read by all department members.

In the department varying roles were assigned, from simple users who were entitled to read and edit to administrators. Every team was to choose a so-called power user with extended rights for team intern quality assurance. Authorizations were administrated centrally by the very team that was also responsible for the whole project.
In addition to the standard functions of a wiki based on MediaWiki there is a large amount of extensions. Among the extensions that were required, there was an editor similar to the one in MS Word, an editor everyone was familiar with. The decision was made in favor of the FCK Rich Editor. Furthermore, the implementation of a PDF creator was required in order to be able to convert wiki articles into PDF files and print them. An extension for template summaries was desired as well as a fold-out category tree as a general survey of the existing categories.

The aforementioned templates had to be programmed. In this workshop though, it was not yet clear which templates would be needed in the end. Therefore, a first decision was made in favor of templates for projects, reports, jobs and operational concepts. Further needs would be detected in the course of time. Concerning the content it was expected that expert knowledge was going to be edited. This included, among others, the following document types: operations documentation, process documentation, program documentation, job documentation, user and administrator documentation, interface descriptions, FAQs and a glossary.

Milestones and Delays

As is common for projects a time schedule was set up. Within a given time subgoals, so-called milestones, had to be reached. Certain goals were not reached in time, though. An analysis of the delays might give a hint on some of the challenges the implementation of knowledge management is facing in general. The implementation of the wiki was subdivided into three phases. Phase one was dominated by the technical

implementation. In phase two the migration of content was started. In phase three the wiki was rolled out department wide. Parallel to these phases the knowledge landscape was designed and developed, although it became clear at an early point that it would be an ongoing process.

An external IT company was responsible for the setup of the wiki including all necessary configurations, plug ins and extensions. The project team edited a homepage. This homepage was very different from the corporate design at first for it was desired to create something new. Later the design was adapted to the corporate design, though, in order to help the users to identify with the application more easily. The project team edited comprehensive help pages based on the experiences made while using the application. A workgroup of so-called *category-godparents* was founded. This workgroup designed the first two levels of the category tree. Categories of a deeper level were to be created and edited by everyone more freely.

In phase two a group of up to two test users of every team started with the migration and import of content. Thus, these users were able to provide their coworkers with support after the department wide rollout. A major advantage of this pilot phase was that problems and challenges were detected and partly solved before everyone became aware of them. Besides, an application which already contains a certain amount of data is accepted more readily.

In the third phase the wiki was rolled out and extensive user support actions were taken. Particularly during this phase the service oriented approach played an important role. Requests for changes were taken into consideration and problems were solved by means of incident management. First level support played an important role with enhancing the acceptance of the wiki.

In the following an overview of the milestones and the respective delays is given in three tables in order to identify the challenges the project team was facing more easily:

Technical Implementation (Phase1):

Milestone	Start	Scheduled Completion	Actual Completion
Regulatory framework • Approval of the wiki by the works council	24.02.09	30.04.09	Approval after removal of time stamp (06.05.09)
Technical implementation • Set up of MediaWiki software • Configuration of application including plug-ins and extensions • Realization of authorization scheme	02.03.09	13.03.09	The configuration was accomplished by the end of March; the authorization scheme was adjusted several times until end of year
Structuring of the content • Workshop • Design of a wiki homepage • Categorization and linking of content • Design of first templates	09.03.09	20.03.09	Completed as scheduled
Compilation of product documentation • Security requirement analysis • Help pages • Operational concept, acceptance protocol	24.02.09	31.03.09	Completed as scheduled

Table 6.1: Technical Implementation

Structuring of Contents (Phase 2):

Milestone	Start	Scheduled Completion	Actual Completion
First content is imported by an exclusive group of users	23.03.09	29.05.09	Completed as scheduled
Import of team specific content • Import of existing documents and „new“ knowledge (ongoing process)	23.03.09	31.12.09	Completed as scheduled

Table 6.2: Structuring of Contents

Roll Out and Use of the Wiki (Phase 3):

Milestone	Start	Scheduled Completion	Actual Completion
Department wide rollout • Presentation of the wiki • In-house-training of the users	04.05.09	29.05.09	Training was completed by 30.06.09
Department wide use • Support of wiki authors • Quarterly workgroup for quality assurance, guidelines and standards, adjustments and enhancements of categories and templates.	01.06.09	31.12.09	Ongoing process

Table 6.3: Roll Out and Use of the Wiki

The development of a knowledge landscape was not part of the wiki implementation. It accompanied all knowledge management activities almost from the beginning of the project and would be an ongoing process. Besides, before being able to finally determine the suitable tool for specific types of knowledge, the new application had to be implemented and used first before the project team was able to evaluate the wiki with regard to its place in a knowledge landscape.

Table 6.4 gives a brief overview of the respective milestones of the creation of a knowledge landscape.

Development of a Knowledge Landscape

Milestone	Start	Scheduled Completion	Actual Completion
Knowledge landscape • Definition of the whereabouts of specific information and of its status • Prevention of redundancy, where applicable data is to be linked		20.03.09	Creating a knowledge landscape is an ongoing process and was, therefore, not completed as scheduled
Presentation of the idea of a knowledge landscape and of recommendations for action	23.03.09	31.03.09	As scheduled
Adjustments in other knowledge management tools that were being used already.	Realization outside the project	No scheduled completion but process was monitored	ongoing process even after project closure

Table 6.4: Development of a Knowledge Landscape

Above all it can be stated that there were only very few major delays. In the first phase the approval of the work council took a little longer than planned. The implementation of new management processes and applications can be a political process. Employees often fear to become dispensable after having shared their knowledge and a regular wiki based on MediaWiki software allows for retracing date and time of the editing of an article. The work council considered this inacceptable for this would mean too much labor control. A change in the coding had to be made and the time stamp that would show when articles were being edited was deleted before the implementation of the wiki was approved. The technical implementation took three weeks longer than originally planned. The duration of the setup of the wiki, the configuration of extensions and the programming of the authorization concept could not be foreseen exactly. Later the authorization concept had to be changed several times due to a growing understanding in the teams of what it really meant that everyone was able to read articles even those with a critical content. It is an important part of the creation of a knowledge landscape to evaluate knowledge with regard to several dimensions. Discretion or confidentiality is one of these dimensions. Delays in the setup are very common with all sorts of

software, though. They are not limited to the implementation of knowledge management applications. Getting aware of the possible consequences of an open authorization scheme on the other side is very typical for knowledge management processes. In fact, openness is essential for the success of knowledge management (Probst et al., 2006, 160ff). It may take time to get used to this new openness, though and a knowledge landscape can help building trust by allowing for discretion where it is essential while all other kinds of knowledge can be shared freely. Categories were set up in time although there was a great deal of discussion about the naming of the categories. The complexity of categories of a wiki caused some confusion about how to categorize articles appropriately. Nevertheless, the setup of the general category structure was finished in time. In a later phase many new categories were established that were not integrated into the overall structure, thus making it difficult to find the articles via the category tree. Therefore, in the process of quality assurance many of these new categories had to be deleted and the respective articles had to be embedded into existing categories. One of the main goals of implementing a wiki was a fast information and knowledge retrieval ensured by a search function. As people seemed to have a tendency to think in categories, though, a lot of time was spent for organizing and structuring categories. It took some time to get used to the idea that wiki pages would, above all, be searched for with the search function which does not require any categorization. Categories are rather a bonus for it is possible to search in certain categories only instead of the entire wiki.

Another challenge was the development of templates. It was easy to create a template for projects but for some other documentation it took much longer to realize whether or not a template would come in useful. The project template was rather simple. It had fields for project names, contact persons, year of accomplishment and a description of the project and the objectives. The development of other templates took much longer for there was a lot of debating about the fields that were needed.

In the second phase the upload of Word documents containing images was a major challenge. The Word2Wiki macro is basically capable of converting text into wiki text and of uploading images. However, as the browser opened a new tab for every image that was uploaded the capacity of the random access memory was overloaded frequently. In consequence images were missing. Depending on the size of the document and on the number of images only about 60% of the images were uploaded in average. This was considered unsatisfactory by the test users because the missing

images had to be uploaded manually which takes some time. This problem could not be solved before the third phase and the department wide rollout of the wiki and it emphasizes the importance of a good incident management.

In phase three it took a month longer than expected to instruct the employees in the use of the wiki due to schedule difficulties. Most functions were learnt easily. Using links, though, was a challenge, especially when articles linked to files on the home server because the paths often were very long. The FCK Rich Editor caused some troubles, too. The development of that editor had been stopped at some point and not every bug had been fixed. Sometimes images were not put at the right place, for example. Using HTML can also cause problems. Eventually several hundreds of documents were uploaded and some tips and tricks were documented, although a higher number of the latter would have been desirable. Especially in the case of the three above mentioned major problems a service oriented approach to solving them came in very useful as shown in the following statistics. Every other week the project team had a close look at the activities within the wiki. As seen before the wiki software allows for an extensive statistic of its use. The project team counted the numbers of both reading accesses and edits in order to monitor the activities and to find out when special support was necessary. There were six peaks of activities within the whole year five of which were closely related to service activities provided by the project team. The first peak was due to the fact that, as a special service, the project team had filled the wiki with a large number of documents before the actual rollout. This had the effect that there was a lot of content that could be read and edited already. Furthermore, the existing content served as an example that made any other editing easier for the users. Besides, the motivation to put more effort in using the wiki was improved as well. One of the six teams that was responsible for the project functioned as a role model. The second peak was reached when the Word2Wiki problem was solved. After that hundreds of documents were uploaded. This example showed how important a reliable service is (compare the aspect “fit for use” in ITIL). The malfunctions had had a severe impact on the motivation to use the wiki throughout the department. Only by means of an extensive user support the problems could be solved resulting in a great enhancement of user acceptance. Beside personal support this also required the development of workarounds and the search for technology that helped to solve a great part of the problems. All this required measures of service management as described in the ITIL chapters. Demand management was important because at the beginning of the project not everyone had a clear idea of what

to expect and often the users would find out new needs by using the new knowledge management infrastructure. The project team always tried to be up-to-date by means of a good demand management. A good change management according to ITIL was important because in the course of the project numerous requests for changes occurred. Incident management had to deal with problems deriving from the used macros and extensions. Emphasis was put on first level support of the users at all times. Furthermore, a monitoring process was established to assure the quality of the knowledge management tools and that of the information and knowledge. The illustrations 6.4 and 6.5 show the positive impact some of these measures had on the project. The challenges and the solutions are taken from table 6.5 in the order of their actual occurrence. The respective service management actions are given in table 6.5, too. The graphs in the illustrations show the respective increase in activities with regard to reading and editing wiki pages. The monitoring was performed once at the end of every month. The graphs start two months after the beginning of the implementation of the wiki. That was when the first survey concerning the use of the new tool was made in the context of quality management. These surveys were also used in a newsletter in order to promote the use by presenting a success story. In the illustrations the x-axis displays the number of wiki pages/page views and on the y-axis there are the monthly surveys and the respective events from table 6.5 in order to show the impact of the measures taken by the project team. Every number stands for the end of a review period.

After an initial period of editing a large number of wiki pages and migration of documents there were around 100 wiki pages at the end of period one. During the first month the project team was responsible for filling the wiki with basic content. This included help pages, category pages, tips and tricks and others. The intention was to improve the motivation to use the wiki right from the beginning because with some content it would become useful to a certain degree already. A strong increase occurred after solving the problems with the Word2Wiki macro which happened after the end of the second review cycle. At the end of the third review cycle more than 600 articles had been edited. The implementation of a more powerful search engine and especially a workaround to facilitate the migration of documents led to another strong increase from little more than 600 to almost 1200. From the sixth month on the number of wiki pages became more stable. The main reason for this was the fact that most of the important documents had been migrated. Another increase of around 100 articles can be seen after the changes in the authorization scheme as part of access management and consequence

of several requests for change. After more privacy had been granted, the readiness to edit articles with content that was considered more critical increased. It became quite clear that service management activities improved the acceptance of the wiki enormously. It must be mentioned, however, that in the first weeks the majority of the articles was edited by the test user group. However, other team members also began to edit content and to upload documents as soon as they had acquired the necessary know-how.

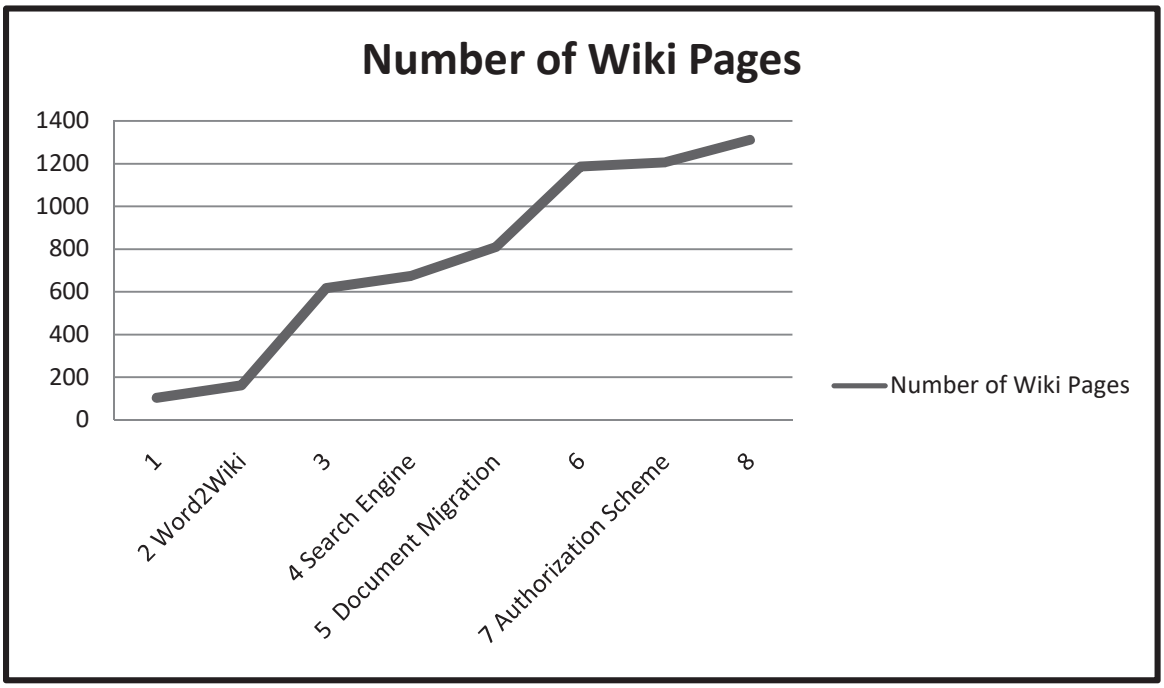


Illustration 6.4: Increase of Wiki Pages (own representation)

Especially the large number of documents and the poor performance of Word2Wiki were a major threat and it was mentioned several times by some of the team members that those problems might lead to the failure of the whole wiki project which cannot be shown by the graph. However, the graph shows that problem solving and workarounds, which were part of the service management activities, led to large increases in wiki pages.

While the increase in wiki pages allows for an interpretation of the data it is more difficult to do the same for the data concerning the number of page views. The graph in illustration 6.5 shows the increase in page views from month to month. While the total number of page views increases constantly with a higher increase in the third, sixth and eight review cycle the monthly numbers even decrease after a half year and increase slightly after the changes in the authorization theme which is surprising because the new scheme banned more potential users from reading certain pages. This might lead to the

conclusion that the vast majority of readers were members of the department. It can be assumed that members of the team double checked more often whether the new authorization scheme really had the effect of providing more confidentiality. The high number of page views at the beginning of the implementation process can be explained easily. The project team edited many new pages and viewed them many times in order to eliminate errors and to create a first good impression of the new application. When the teams began to edit pages they were uncertain in the use of the wiki and, therefore, double checked whatever they edited more often. With growing confidence they looked at their own pages increasingly less often. This might also be another explanation for the slight increase in the eight month. Those users that had hesitated to use the wiki due to privacy concerns also began to edit more pages. The large increase in page views in the third review cycle can be explained by the fact that the edited articles had to be checked several times because due to the Word2Wiki problems many images were missing.

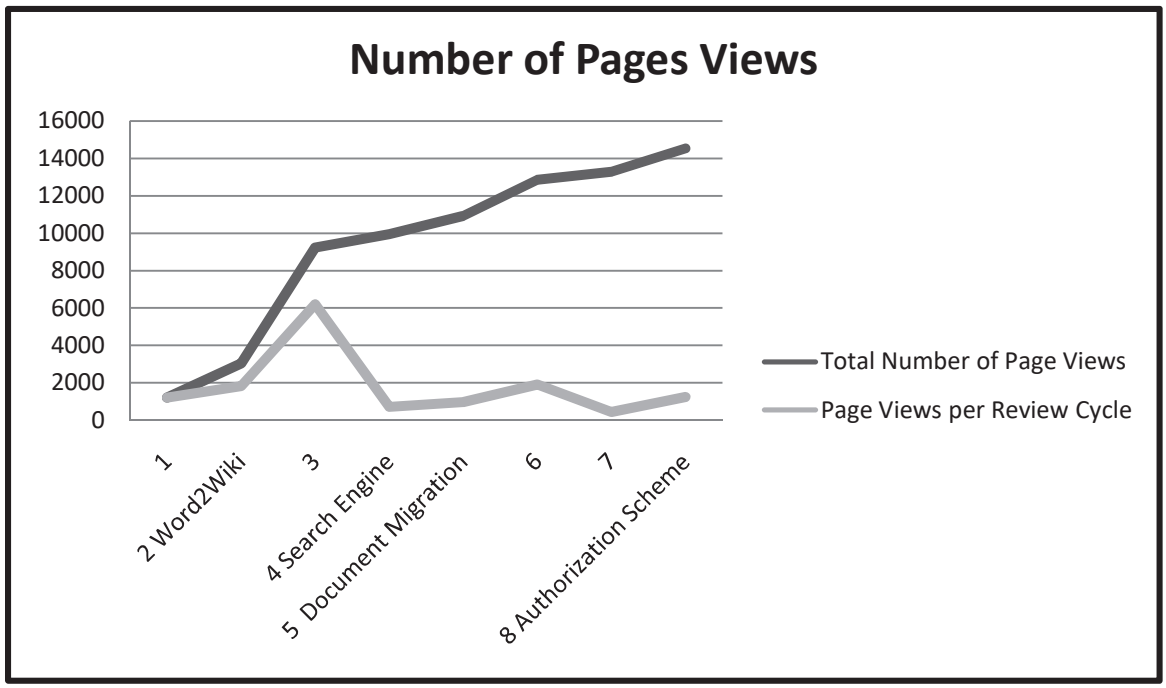


Illustration 6.5: Number of Page Views (own representation)

During the following months the number of page views stabilized around four hundred per month. This would be about seven page views per month and per user in average. Taking into consideration absence times and the fact that one team rarely needed the wiki it can be said that the average user used the wiki at least twice a week.

Another important question remained unanswered, however. The evaluation of the question which would be the best application for a specific sort of knowledge could not

be finished during the project and it can be said in general, that it was and is not easy to reach a common consensus on it. The fact that the migration of content was handled in different ways by the individual teams led to further complications. One team, for example, uploaded entire documents, whereas another team simply linked wiki pages to documents on the Novell server. A best practice was developed to copy the index of contents of a document and paste it into the wiki page so that a search for keywords produced relevant results. The actual document itself was linked to from those pages. Another team decided to leave existing documents where they were and just to use the wiki for new documents for reasons of quality assurance. One of the most important requirements was the avoidance of too much extra work and all these workarounds helped with that. However, it made the knowledge landscape far more complex and emphasized the importance of a guideline that took into consideration the different ways of storing and retrieving knowledge.

Challenges of the Implementation of Knowledge Management

The implementation of knowledge management resulted in a variety of challenges, both technical and organizational in nature. The most essential challenge was the motivation of the 60 employees to go along with the project. In the following some of the major challenges are described briefly beginning with the technical challenges.

Technical Challenges

In the course of time the project team was confronted with various technical difficulties brought about especially by extensions of the standard software while the actual software was quite stable (fit for use). In order to convert Word documents into wiki text a macro called Word2Wiki was used. It comes with many advantages enabling the conversion of headlines, tables, fonts and images into wiki text. In the case of images links are created as place holders. The images are filed in a folder on the local computer and then it is possible that they are uploaded to the wiki. Then they appear wherever a respective links is set. In the case of documents with a large number of images this led to an overload of the random access memory of the user's computers. Many images got lost in the process. The fact that the development of the macro had been stopped at that time was another challenge. The project team had to develop a stand-alone solution.

The FCK Rich Text Editor was implemented due to the fact that an editor similar to the one of MS Word had been required. The use of the editor, however, generated a serious of problems in different contexts.

Furthermore, an extension was implemented which converts wiki articles into PDF files. However, in combination with the use of the Rich Text Editor the conversion would not deliver the expected results. In the following table an overview of the technical problems and their respective solution, developed by the project team is given. These solutions are matched with the applied ITIL service management measures. The overall goal was to achieve both utility and warranty. The impact of the solutions of the bigger problems on the acceptance of the wiki is shown in illustration 6.4 and 6.5.

In the course of the project a service catalogue used by the project team was designed. The main components were, as seen in table 6.5, incident management, change management and first level support. After the initial survey of requirements demand management accompanied all further activities as well. Due to the problems with the authorization schemes and requests for change access management was added to the service portfolio. Beside the empiric data that has been collected there was a lot of positive feedback from the employees following services and support.

Description	Solution	Related Service Management Concept
During the upload of documents with many images with Word2Wiki the RAM was overloaded because a new tab was opened for every image resulting in missing images in the wiki article. The rate of uploaded images was in average below unsatisfactory 60%.The missing images had to be uploaded manually resulting in a big and inacceptable workload.	Images were uploaded via WebDAV (Web-based Distributed Authoring and Versioning) which is an open standard for providing data in the internet based on the Hyper Text Transfer Protocol. Data is accessed from a server. Files can be displayed in a browser window. This meant that files did not have to be uploaded by Word2Wiki any longer. A directory was established including a folder created by Word2Wiki which contained the images of a Word document. From there the images could be copied into the WebDAV folder. Via an established interface they were uploaded on the server which contained the wiki and thus displayed on the wiki pages.	Incident Management Problem Management First Level Support
Tabulators are perceived as tables in a Word document which can destroy the layout of a page.	The Rich Editor had to be deactivated when a document that had been transformed by Word2Wiki was pasted.	Incident Management First Level Support

Description	Solution	Related Service Management Concept
If an article is added to a category with a special character (for example *Projekte /Vorhaben*) with the assistance of the Rich Editor the article is alphabetically sorted in the letter that follows the special character. In the example above it would be the letter V.	Avoidance of special characters.	First Level Support
Special namespaces appear before the actual name of a page.	A change in the program code would be necessary to prevent this.	Demand Management Change Management
Wildcard search at the end of a search term possible, yet not at the beginning. *Wild** would find every page beginning with “wild”. *card, though, would not produce any results and the standard MediaWiki search is not capable of searching terms in uploaded documents such as Word documents or PDF-files etc.	Implementation of the full text search engine Lucene which is used by Wikipedia as well. There are further options but Lucene is freeware. (http://lucene.apache.org/java/docs/index.html06.02.2018).	Demand Management Change Management
The conversion of complex wiki pages into PDF files sometimes led to poor results. Images, for example, were overwritten with text.	The problem was the result of the use of the Rich Text Editor when documents that had been converted with Word2Wiki were copied to a wiki page. Therefore, the editor needed to be switched off.	Incident Management
Links to files on the Novell server were very long and, therefore, not user friendly.	This problem was not solved.	Change Management

Description	Solution	Related Service Management Concept
One of the teams did not want to spend the time required for migrating hundreds of documents.	A workaround was developed by the project team. Characteristic keywords of a document were written on the wiki page to make it retrievable and at the end of the page there would be a link that led to the respective document on the Novell server.	Demand Management Change Management
A time stamp indicated the exact time of editing processes.	The program code was changed and the time stamp was removed.	Change Management

Table 6.5: Technical Challenges

Organizational Challenges

The design and implementation of a knowledge landscape turned out to be one of the greatest challenges, beside that of motivating the employees to support and live knowledge management. The plan was to develop the knowledge landscape or at least recommendations for action until March. The various applications that were being used for documentation and storing knowledge were expected to be used and combined in an optimal way with as little overlapping as possible. During the rollout of the wiki many users gave the feedback that they still were not sure which knowledge had to be migrated to the wiki. The ideas of a knowledge landscape differed considerably. There was a long-lasting dispute whether the wiki should be used as the core application via which all knowledge would be found, be it in articles or by means of links to knowledge that was stored in the data banks, as had been intended in the beginning. In the course of time the approach to a knowledge landscape as a guideline for the storing of knowledge and for knowledge flows in contrast to an IT landscape describing all existing IT applications prevailed. Another challenge was the motivation of the employees to use the wiki on a regular basis. Many of them still preferred to write a text document with MS Word because the performance of the Word editor was better than the performance of the Rich Editor. The long paths for links to documents on the fileserver turned out to be a challenge, too. In the beginning the users had to install and configure the Word2Wiki macro, the Excel2Wiki add on and WebDAV themselves. Although extensive help pages, another ITIL recommendation, had been edited they were often not found. If the project team had taken care of the installation and configuration at an

earlier stage some of the frustration and discouragement caused by the process could have been prevented.

Development of a Knowledge Landscape

As seen before the goal was not the description of an already existing knowledge landscape that included applications, tools, types of knowledge and knowledge carriers. The goal was rather to develop a guideline that would provide all department members with an orientation guide when it comes to the handling of different types of knowledge. A sophisticated IT landscape already existed but the employees were not sure what to do with it. The applications had many features but not all of them were known to everyone. Therefore, instead of searching for the appropriate application, e-mail and the Novell server were used in most cases for reasons of simplicity. For that reason, the potential of the existing tools and that of new tools needed to be unfolded.

	Tool Mapping
Builder	Workshops, Questionnaire, Interviews
Identification	Analysing Tools, Knowledge Maps, Yellow Pages
Access	Virtual Teams, Distributed Project teams, Groupware, Document Management Systems, Lessons Learned, Search and Retrieval
Distribution	Knowledge Brokers, email, Multimedia Databases, Web Based Training
Storage	Document Management Systems, Lessons Learned Databases, FAQ, Organizational Memory Information Systems, Handbooks
Evaluation	Knowledge Score Card

Illustration 6.6: Mapping of Knowledge Management Processes with Knowledge Management Tools (source: based on Stefanidis et al. 2002, 6)

Stefanidis et al. (2002, 4ff) describe a method to develop an organizational knowledge system similar to the knowledge landscape. Their approach is based on business processes. They define knowledge management processes and map them with knowledge management tools, which can be seen in illustration 6.3. These knowledge management processes consist of: knowledge model building processes, knowledge identification processes, knowledge access processes, knowledge storage processes, knowledge distribution processes and knowledge evaluation processes. At the starting point of this approach there are processes. In a further development of their organizational knowledge system (Karagiannis & Woitsch, 2005, 576) they, too, include different types of knowledge by means of categories such as sophistication, abstraction, relevance, applicability, dynamic expression and others. In this case study

the categories criticality and confidentiality are of special importance. In contrast to their theoretical approach to an organizational knowledge system, the design of a knowledge landscape at the airline in the first case study is a practical approach and realization based on actual needs and requirements. Not only tools are mapped with knowledge management processes and types of knowledge. The tools are broken down to their individual functionalities and then matched with the partly very individual requirements, which was possible because of the limited number of department members. By the way, Karagiannis et al. (2005) argue in favor of a service oriented approach to knowledge management, too. However, they consider the knowledge management tools as services according to service oriented programming while service orientation in this context means a service minded support of the implementation of knowledge management.

The development of a knowledge landscape included several steps:

1. Identification of existing knowledge and information.
2. Listing of existing tools and their functions or their potential subdivided into applications used for documentation, applications used for collaboration and hybrid systems uniting both.
3. Analysis of the current use including the frequency.
4. Evaluation of similarities and differences of applications and of their use.
5. Design of a core knowledge landscape consisting of the most prominent applications plus satellites.
6. Identification of the strengths and weaknesses of the individual applications. Usability tests would be a good option for this but have not been part of the project. The usability was determined by the users based on experience.
7. Development of a summary which was available for everyone.
8. Development of a guideline which helps to choose the best application for a specific sort of knowledge or an assignment in general.
9. The design of a knowledge landscape is a permanent process.

Suresh and Mahesh write about knowledge management components and architectures:

> KM must design and deploy a technology architecture with the right mix of central systems, services and distributable components that prevents knowledge fragmentation and enables ready integration with all present and future information systems (Suresh & Mahesh, 2006, 102).

In the context of decentralized knowledge management, as was the case in this case study, an architecture consists of core components and satellites (Suresh & Mahesh, 2006, 87f). Illustration 6.4 is an example thereof with a wiki and eTeaming as core components and several satellites. Some tools were used group wide and others only in or by specific departments. In addition interfaces are highlighted and rules are added on how to handle knowledge, thus providing a guideline.

At the beginning of the project the individual teams were asked to write down the types of information and knowledge that existed in their teams. Furthermore, they were to evaluate whether the respective knowledge was critical, which means that work could not be done without it, or non-critical. They also were to define whether it allowed for transparency or required confidentiality. Among the results there were many handbooks, job descriptions, process descriptions and tips and tricks. Some of the knowledge was needed on a regular basis while other knowledge was rarely used. For example, there was a lot of knowledge that was needed for the annual reports in December only and, therefore, rarely used and yet essential. The goal was to find tools that suited these characteristics in every individual case, be it for critical knowledge in a rarely used handbook or for noncritical knowledge in an often used process description and so on. Therefore, descriptions of potential applications were made.

The following overview shows a first attempt to generate a knowledge landscape based on the existing knowledge management tools. The idea was to determine when to use which tool respectively how to recommend the best solution for specific types of information and knowledge. In a first draft a distinction was made between the following applications i.e. the intranet, group wide collaboration tool, classic e-mail, the wiki and a tool for collaboration with externals. Later an application that can be freely described as “knowledge management repository” was added subsequently. Descriptions of these tools were made with regard to their functions, the suitability with specific types of information, accessibility (range), editorial processes, interactivity, commitment, structure, and authorization schemes (see table 6.6). In the following a

survey of the results will be given in present tense because most of the tools are still being used.

Intranet

The group intranet was analyzed and the following conclusions were drawn:

- Practical for both content (data, information and knowledge) and applications (which themselves contain data, information and knowledge)
- Accessibility: group wide
- Editorial process: designated editors are responsible for structured information for employees of the group, partly target-group-specific
- Interactivity: no interaction between users
- Commitment: high degree of commitment, content is (politically) correct.
- Authorization scheme: editors are responsible for content. Ordinary users are not allowed to change content. They need to make a request for change. Visible content is partly user specific depending on function and department of the user. The user interface, however, can be adjusted by every user according to individual needs to a certain degree.

Collaboration Tool

The group wide collaboration tool has the following characteristics:

- Suitable for communication and collaboration. It contains blogs, discussion groups, communities, data files, wiki documents, user profiles etc.
- Accessibility: group wide
- Editorial process: users generate unstructured content for other users.
- Commitment: the degree of commitment needs to be estimated by the users. Content is not necessarily (politically) correct and reflects the user´s opinions.
- Authorization scheme: varies, according to the scheme implemented in specific communities and groups.

E-mail

The features of e-mail are widely known. Some of the most important are:

- Can be used for communication and the exchange of information, knowledge and data files (text, graphics, hyperlinks etc.)

- Accessibility (range): intranet and internet, worldwide
- Editorial process: users write mails and thus communicate with recipients
- Commitment: content reflects writers´ opinions.
- Authorization scheme: anyone can write e-mails, certain mails can only be read by means of an entrust client, a software that decodes encrypted e-mails.

Wiki

- Meant to be the application for storing the department internal knowledge plus additional tips and tricks. At first forums were intended to be used for direct knowledge exchange but have been discarded later.
- Accessibility: group wide/department wide
- Editorial process: users generate content structured by means of pre-defined categories and in some cases by templates for certain types of documents that were to be transferred to the wiki.
- Commitment: the degree of commitment is estimated by the users. Content is not necessarily (politically) correct and reflects the user´s opinions, however, it is possible that other users intervene. Every department has "super-users" chosen by the team leaders that can edit articles and overrule the other users.
- Authorization scheme: varies according to the scheme implemented by the six teams of the department from open to everyone to closed articles available for team members only.

External Collaboration Tool:

- Web based data repository that is suitable for collaboration with external service providers, suppliers and clients. It also contains discussion forums.
- Accessibility: intranet and internet
- Editorial process: multichannel publishing
- Commitment: high commitment because whatever is published has an effect on important stake holders.
- Authorization scheme: according to collaboration group.

Knowledge Management Repository

- Suitable for the structured and web based storage of data, information and knowledge. All different versions of documents are available. Documents can be exported.
- Accessibility: group wide via intranet
- Editorial process: anyone can write and read.
- Commitment: users are responsible for editing correct information.
- Authorization scheme: individual authorizations can be given for specific documents.

The knowledge management repository was a special case which shows the absolute necessity of a knowledge landscape. Some day one of the colleagues made a discovery in the intranet which might have concerned the implementation of the wiki. While he was surfing the intranet he remembered that he had heard of a knowledge management application. A closer look at the application made him suspicious so that he requested a further analysis of the application. Hence the application was examined thoroughly and the results were a surprise. It had been developed and implemented in the intranet for knowledge management activities. A comparison with the wiki showed many similarities with regard to the range of functions. It had been designed with the capability to store large amounts of information. An efficient search had been integrated and documents could be found by means of a categorization scheme as well. The application allowed for versioning. Documents could be converted into PDF files and the migration of documents seemed to be uncomplicated. Thus, the knowledge management repository met some of the most important requirements of the teams that had been evaluated at the beginning of the knowledge management project. After the reservations with regard to eTeaming had been overcome, a new debate about the whole purpose of the wiki began. It was probably due to the fact that a lot of time and effort had already been invested in the wiki project that the knowledge management repository was decided to be neglected department wide in favor of the wiki. The whole situation had an impact on the motivation concerning the knowledge management project. Some people had the feeling that a lot of the work such as the migration of hundreds of documents to the wiki had been in vain. What lessons can be learned from this experience? At an early stage of the project several applications had been analyzed with regard to their functions and usability. A first draft of a knowledge landscape had

been made consisting of descriptions of existing tools. Besides, a search for best practices in the entire affiliate group had been made. When a wiki was found that had been implemented successfully and that was being used frequently the majority of the decision-makers was convinced that a wiki would be the appropriate application for a department wide knowledge management. As the solution was found quickly and easily further investigation was neglected. A closer look at the intranet and the existing tools might have facilitated the entire implementation of knowledge management. At least there was an alphabetical list of applications in the intranet which could, or should have been searched. Occurring problems had to be solved by the project team which required time and resources. This shows the importance of the planning phase of a knowledge management project. A thorough analysis of all existing knowledge management activities and a guideline for further action (knowledge landscape) can help to save time, effort and money. This concerns existing applications as well as existing informal networks or knowledge management activities and applications that are not easily identified as such. Therefore, it can be said that the creation of a knowledge landscape as a guideline should be initialized at the beginning of the implementation of knowledge management activities. Especially in larger organizations with manifold applications, activities and processes useful existing tools are missed easily. After an evaluation of requirements, followed by the design of a strategy and an analysis of tasks, processes and the types of knowledge that are to be managed, starting with a knowledge landscape helps to avoid such incidents. The idea of developing a knowledge landscape had been there from the beginning but a deeper understanding of what a knowledge landscape can be and of its potential had to evolve in the course of the project. Activities and application functions that might come in useful for the handling of knowledge can be identified more easily and integrated into the knowledge management concept. In the case described above the knowledge management repository might have become useful especially in combination with the group wide collaboration tool which covered functions the knowledge management repository was missing. Together they would have met all requirements the department members had mentioned in the survey. Illustration 6.3 shows a draft that had been made at the beginning of the process of analyzing the tools used by the department.

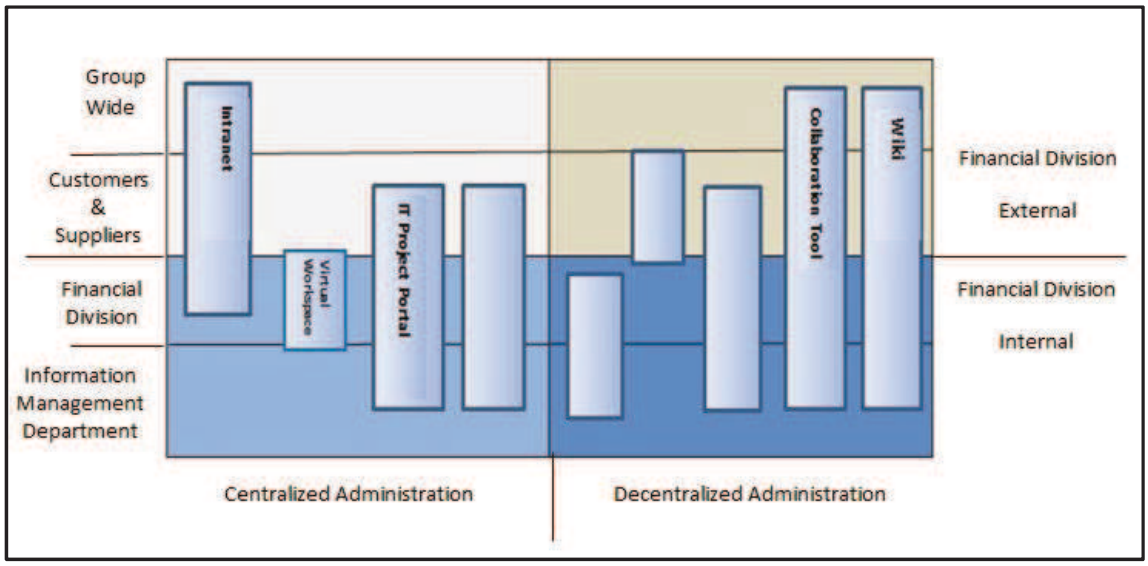


Illustration 6.7: First Draft of a Knowledge Landscape (own representation)

This first attempt proved insufficient, however. It was based on assumptions only which tools would be used by which department within the group. Furthermore, the distinctions were not specific enough. Range and use of applications are shown and it was only distinguished between department intern, division intern, company wide use and access and collaboration with external stakeholders. Dimensions such as accessibility, confidentiality and criticality still had to be integrated. Therefore, the next step of the design of a knowledge landscape was the comparison of the different tools in a table as shown below. Applications were matched with defined criteria based on the tool description and the additional aspects frequency of use and criticality of content. For these aspects the distinction was made between low, medium and high. Criticality of content in this context meant the importance of knowledge for work processes. A high criticality would imply that work could not be done without it. A low criticality would mean that the respective knowledge was “nice to know” but not a “need to know”. With regard to the authorization scheme the required degree of confidentiality of specific knowledge was considered. Some knowledge, for example, was not meant to be published for people outside of the department and some knowledge was even meant for a specific team only. The tools were evaluated with regard to their capability to guarantee confidentiality. Table 6.6 gives an overview of theses applications. Not all tools are mentioned, however.

Another criterion could be the available budget. A low budget, for example, would prefer freeware solutions. Capacities and the educational status quo might be considered as well. This would also include the general workload which has an enormous impact

on the readiness for extra work. In any case complex solutions require more training and user support than simple solutions resulting in the necessity of more and more elaborate supportive service concepts.

Criterion	Intranet	Wiki	Collaboration Tool	E-mail	Knowledge Management Repository	External Collaboration
Content	Data, files (Word, Excel, PDF, images, videos and others, information, knowledge and a large number of applications	Knowledge and documents (Word, Excel. PDF, images), tips & tricks	Blogs, discussion groups, communities, data, wiki pages, documents, user profiles etc.	Data, information, knowledge documents (Word, Excel. PDF, images, videos etc.)	Data, information, knowledge, documents (Word, Excel, PDF),	Collaboration groups with externals, discussion forum
Functionalities	Search, personalization, integration of applications, (news) feeds, employee self administration etc.	Versioning, document export, simultaneous editing, categories, templates, namespaces, user statistics, search etc.	Communication and collaboration, blogs, wiki pages, polls, forums, closed groups, user profiles, social networking, search etc.	Sending and receiving of mail.	Versioning, document export, file structure, search of and in documents etc.	Collaboration, discussion, exchange of documents, versioning commenting etc.
Accessibility	group wide	group wide/department wide	group wide	intranet and internet, worldwide	group wide via intranet	intranet and internet

Criterion	Intranet	Wiki	Collaboration tool	E-mail	Knowledge Management Repository	External Collaboration
Editorial Process	Designated editors	Every user can edit according to authorization scheme	All users	Every employee with e-mail account can write and receive mails	All users according to authorization scheme	Multi-channel publishing
Commitment	High	Varying	Low	Low	Medium	High
Authorization Scheme and Confidentiality	Only designated editors can publish, all employees can read with certain restrictions Medium level of confidentiality	Varying schemes Medium level of confidentiality, after alterations in the PHP code high level of confidentiality	Varying Medium to high level of confidentiality, users need an invitation for groups in order to be able to read or edit content	Everyone can write, all recipients can read (individual) Medium to high confidentiality, encryption possible	Individual authorizations Medium to high confidentiality	Varying, according to collaboration group Medium to high confidentiality
Criticality of Content	Low to high	Low to high	Medium	Low to high	Medium to high	High
Frequency of Use	High (every day)	Low at first then medium to high depending on the team (from a few times every month and several times a week)	Low (once a month or less)	High (every day)	None at first because tool was unknown then low (now and then)	No use to high frequency depending on individual work processes

Table 6.6: Survey of Applications

Next, existing documents and specific types of data, information and knowledge had to be analyzed in order to determine whether the applications in table 6.6 were suitable. A main distinction was made between communication and documentation. A large amount of documentation existed throughout the department. It comprised knowledge about the

applications of the information management as well as job or process descriptions, among others. A distinction was made between criticality, confidentiality and frequency of use. Handbooks and instruction manuals, for example, were rated highly critical with a medium to high degree of use and high confidentiality. This evaluation helped to match this knowledge with one or several of the above mentioned applications. However, this proved insufficient. The project team realized that these three dimensions of criticality, use and confidentiality were essential but some contexts also required a specific handling of documents. The conversion into PDF files was an example. Therefore, additional criteria with regard to further functionalities had to be considered. Interdependencies between applications were another important aspect. For example, it was possible to store knowledge in one application and create links to that data base from another application. The basic idea was that the wiki was to become the core application by which the entire knowledge of the department could be found. This included the possibility of linking to other knowledge applications, which, of course, did not reflect the original philosophy of wikis, however, it proved to be a pragmatic and widely accepted solution.

Illustration 6.8 shows an intermediate status of the knowledge landscape, as it had been developed at the end of the implementation project, including the interactions and relations between the applications. At the top the main distinction between documentation and collaboration/communication can be seen. The collaboration tool was the only communication tool while the wiki is at the center of the documentation tools. Relevant knowledge is transferred from MS Outlook and the collaboration tool to the wiki. The wiki contains wiki articles which are handbooks, tips and tricks, process descriptions etc. It also links to the Novell directory and to the intranet and others. Furthermore, it links to the virtual workspace which itself links to the collaboration tool which can also be used for the collaboration with externals. Before the creation of a knowledge landscape all tools had been on the same level. The knowledge landscape defined that at the first level there was MS Outlook, the wiki at the core of all documentation activities, the virtual workspace and the collaboration tool. New internal knowledge was not to be stored with the applications on the second level anymore whenever possible, which was not always the case. It was intended, though, to find the existing knowledge either in the wiki or by means of links from the wiki. Especially all critical knowledge was made available via the wiki. This draft of a knowledge landscape led to some difficulties, however. The distinction between the collaboration

tool and the wiki was quite clear. Being a collaboration tool the first could be used for limited documentation but it was not suitable for extensive documents. These would, therefore, be stored in the wiki, in Novell or in the virtual workspace. It only made sense to use the collaboration tool for storing documents in the context of collaboration with colleagues from other parts of the group and even in this case the virtual workstation would be an appropriate application. The challenge was the use of the other applications. Due to their limited use they were less important in this context, however, they were being used by the teams and had some practical features people would not want to give up because they were used to working with them. In the end each team had to choose specific types of knowledge that would be dealt with in the intranet, Novell or some other application only used by them. That was allowed on levels of collaboration that included a small number of people only. Confidentiality played an important role in this context. Everything concerning the whole department, which, therefore, was critical for work processes, had to be available via the first level applications. Thus, a guideline had been created that assisted the employees with the handling of different types of knowledge and knowledge management activities. The development of a guideline was not supposed to end with the project of course. A much more refined and considered knowledge landscape can be expected as time goes by and experience is collected.
An extension of illustration 6.8 would be a virtual design in which anyone searching for the appropriate application would click on one of the tools and a list with suitable types of knowledge or information would fold out as can be seen under “wiki articles”. This does always require an intellectual analysis of knowledge with regard to criticality, confidentiality and usability and functionalities of matching tools by a knowledge manager or someone likewise experienced. Restrictions are another aspect that could be added, especially if applications have been used incorrectly in the past. They would make clear that a collaboration tool, for example, is not appropriate for the storage of large documents.

Illustration 6.8 does not take into consideration the human factor and the exchange of implicit knowledge, though. Analog to the analysis of technical applications social methods of knowledge management could be evaluated and displayed in a similar way as well. Another dimension in this context could be company culture. A possible extension of a knowledge landscape by social aspects of knowledge management will be introduced in the second case study.

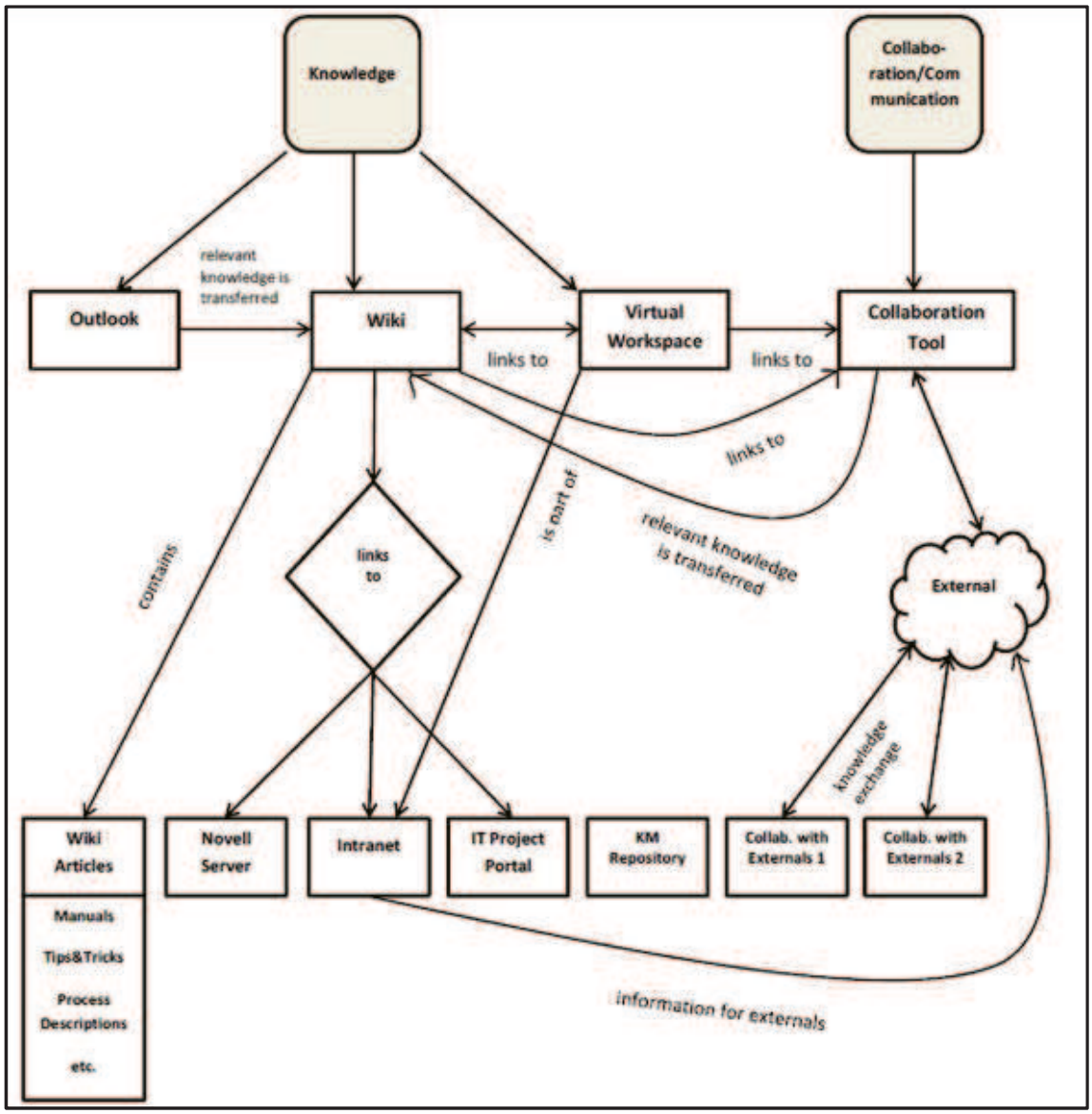


Illustration 6.8: Knowledge Landscape (own representation based on the project work)

The development of the knowledge landscape as a guideline was a great help for the teams and yet the project team hat to take additional measures to motivate everyone to use the knowledge management applications. As mentioned before service management was of great use. In the following additional measures are presented that helped to promote knowledge management.

6.3 Marketing Knowledge Management

The knowledge landscape made it a lot easier to find the suitable tool for knowledge, information and documentation and, thus, increased the acceptance of knowledge management substantially. In order to further promote the acceptance of the wiki measures were developed and taken. Among these there was the publishing of a newsletter concerning the wiki and knowledge management in general. The newsletter

included technical aspects, presented some of the best and most interesting wiki articles as well as success stories of knowledge management in other companies. With every newsletter a statistic concerning the use of the wiki was presented. The illustrations 6.1 and 6.2 are based on these statistics. This included the numbers of registered users, written articles and of how often specific articles had been viewed. This last aspect implied the usefulness of the wiki content. The project team intended to create a positive connotation so that the wiki would not be regarded as mere extra work. Individual support was offered especially in the beginning. If required, a member of the project team helped with the editing of the first articles. A so-called *Wiki Day* was organized. Everyone was invited to come by to discuss open questions and unsolved problems. In addition the project team attended some of the team meetings to promote the knowledge management process whenever necessary. All this required a certain intuition because it had to be prevented by all means to overstrain the colleagues with the innovations. Back and Heidecke warn explicitly that too many Web 2.0 elements result in an excessive complexity which overburdens the user:

> …dass mit zu vielen Web-2.0-Elementen ein Übermaß an Komplexität erzeugt werden kann, welches den Nutzer überfordert (Back & Heidecke, 2008, 4)

which means:

> …that too many Web 2.0 elements might create excessive complexity that overstrains the user (own translation of Back & Heidecke, 2008, 4).

Therefore, the virtual workspace was adapted to the needs of the users, too. The intention was to make it more attractive. As an interesting side effect of the implementation of knowledge management some useful functionalities of the virtual workspace which had already been there have been discovered. The above mentioned knowledge management repository was a good example which showed how easily existing functions are overlooked. Furthermore, it became quite obvious that the implementation of knowledge management and of new applications had and has political dimensions. Whenever Web 2.0 applications are implemented it is essential to consider both internal and external factors such as the work environment as well as the collaboration and participation culture and, where necessary, to carry out corrective actions when it comes to errors (Back & Heidecke, 2008, 5). The immense support of the project team in order to enhance the acceptance of knowledge management processes and the wiki implies the importance of a service oriented implementation of

knowledge management. Furthermore, some of the major problems could have been prevented by extending the provided services to installing and configuring the extensions at an earlier stage.

A Paper Chase and an Advent Calendar

At the end of the year with the project coming to a close the wiki was used throughout the department and many documents had been uploaded or linked to. Numerous measures had been taken to motivate the potential users to become actual users. The principles of change management had been applied and the implementation of the wiki in particular and knowledge management activities in general had been accompanied by activities based on (IT) service management. The fact that only very little time was left before the project ended end the implemented knowledge management tools were to be used on a regular basis without further support and the upcoming celebration of Christmas brought up two last ideas to promote the various applications: a paper chase and an advent calendar. A paper chase is a game which includes a list that either defines specific items, which are to be sought by the participants or requires tasks to be fulfilled. The goal is usually to be the first to complete the list. In this case the rules were adapted to the local needs. The participants were to find a word in one of the applications and follow a track laid by the project team throughout all those existing knowledge management applications that everyone had access to. The first hint was given by the project team. The participants had to find a Word document in the department´s virtual workspace of the intranet. This document contained further instructions. The next step was to visit the collaboration tool. This application had a tag cloud for all topics and groups and the participants had to identify the most prominent tag. This tag had been the eponym of a wiki page created by the project team. The wiki page included a hint to a specific version of that page where a contact person was mentioned which was to be asked for the solution word. In order to reach that person the companies yellow pages had to be consulted. Thus, the participants had to work with several knowledge management applications. Given the fact that out of 60 department members approximately one third was on winter vacation a total number of ten participants may be considered a success. The winner received a present. Furthermore, the game attracted a lot of attention in favor of the knowledge management activities once again.

Another important knowledge management tool was the personalized virtual workspace of the department in the intranet. As many employees preferred not to use it as a source

of information a project group was formed the assignment of which was to redesign and promote the workspace. At the end of November the idea came up to implement a Christmas countdown calendar. Everyday there was a new surprise. There were poems, sketches, stories, beautiful or funny images, recipes for cookies or Christmas dinner and other interesting or useful gimmicks. As said before the workspace was not being used frequently but in December almost everyone was talking about the content of the calendar. At the same time new and useful functions as well as a user friendly design were introduced so that everyone had the chance to get familiar with the improvements.

In summary it can be said that a playful handling of applications can have a positive effect on acceptance and motivation to use them.

6.4 Lessons Learned

Knowledge had already been managed in the airline group before the project was started. Yellow pages existed and experts could be found group wide. A collaboration tool had been developed in order to promote the group wide exchange of knowledge. Virtual workspaces existed but were not used equally by every department. Professional training was offered. The information management department of the whole group, which was a different department than the one at the financial division, intended to promote the exchange of knowledge and motivate all employees to share their individual knowledge with their colleagues.

During the implementation of knowledge management scientific publications such as “Wissen Managen” by Probst et al. were consulted with the intention to implement the latest state of the art techniques. Yet, there were also differences between scientific theory and practice. Implicit knowledge, for example, was seen as all knowledge that exists in people´s minds and not according to Polanyi who describes implicit knowledge as personal and context-dependent knowledge which is difficult to explain (Polanyi 1985). What was understood as implicit knowledge is rather subjective knowledge. The head of department should have been integrated more effectively in order to motivate the employees. He might have written some wiki articles to give a good example, for instance. The signaling effect of this should not be underestimated.

The elaboration of a knowledge landscape has established connections to other knowledge management initiatives in the affiliate group.

Due to technical difficulties quick wins could not always be made immediately. The project team should have taken better care of the technical aspects before the department wide rollout of the wiki in order not to overburden the employees with installing macros, add ons or WebDAV. This shows the importance of service oriented knowledge management, especially when the activities are based on technical applications.

The search of the standard MediaWiki software at that time was suboptimal. It became necessary to implement the search engine LUCENE to search for terms in uploaded documents which was considered essential by many of the users. Beyond this LUCENE enables a relevance ranking.

It has been mentioned before that at the technical division a wiki had been implemented successfully and that it was accepted quickly and was being used frequently. This shows that even within the same affiliate group the acceptance of Web 2.0 applications varies. While the application of the technical division was a success almost right from the beginning the wiki at the information management department required an intensive use of measurements of change management and service management. Fair enough to mention that the information management department had much more documentation to migrate which needs a lot of time and can thus be an enormous psychological barrier. This should be considered in the planning process of implementing a new application in general. It is important to know all the requirements in advance in order to be able to make a decision whether an application meets the requirements to an acceptable degree or not. Furthermore, users hadn´t better be bothered by too many and too complex technical aspects. IT service management provides helpful guidelines how to deal with that.

The conclusion can be drawn that a hasty implementation of knowledge management may lead to a loss of acceptance. A thorough preparation will prevent problems at a later stage.

At the end of the year the wiki was widely accepted. Statistics showed that wiki articles were read more and more frequently.

About “Knowledge Islands”– a Special Case

The information management department of the financial division consisted of 60 employees and several interns divided into six teams. One team, responsible for key

account management, however, was outstanding for it consisted of one person only. While in most of the other teams a certain dynamic had developed, especially thanks to team members that had been part of a group of exclusive users during the pilot phase and who exerted a positive influence, the success of a team consisting of exactly one member stands or falls with the motivation of that respective person. The challenges of managing the knowledge of an individual differ from those when managing the knowledge of a group of people. People that are members of a larger team usually are substituted more easily and such are their knowledge assets if they are shared. Besides, the motivation of some may trigger more readiness to collaborate in others. In the case of a team comprising one person only, however, a lack of readiness to join the activities, or even worse, the loss of the knowledge of that individual has a deeper impact on the department because there are no other team members that could fill in during vacations, sickness or in case of a resignation of the team member, until someone new is found for the job. Furthermore, implicit knowledge is shared when people work together as was the case with the other five teams. The challenge, therefore, lay in the skimming of the knowledge of one individual. Whereas the other teams imported knowledge into the wiki in order to grant the other team members an easy access to that knowledge the key account management team had different means to store knowledge which were considered sufficiently efficient. Therefore, the project team initiated a series of formal and informal talks with the goal to promote the use of the wiki for all relevant knowledge. As one result it can be stated that informal talks during breaks or at lunch sometimes proved more effective than formal meetings. On the other hand, however, in the course of time the project team came to the conclusion that a single application is not necessarily useful for everyone and that it is very important not to give in to the temptation to force ideas, concepts or tools upon people when the usefulness cannot be made clear. An application for the documents that were created in that team already existed and exchange between that team and the other teams was only necessary in very limited and well defined contexts. For that reason the wiki had no greater purpose for the team than to occasionally read the tips & tricks categories. A far greater concern with regard to knowledge management was the loss of the knowledge of the team consisting of one individual. In the beginning the requirement had come up to share the implicit knowledge in the department. That idea was neglected later, though. With regard to the explicit knowledge the definition and evaluation of the team´s knowledge at least helped to integrate it into the knowledge landscape which would make it easier to access for successors in that position. Although the managing of the explicit

knowledge of that team, therefore, required no further actions a focus on the implicit knowledge might prevent the loss of valuable skills in the future.

Politics

There are underlying structures in organizations that have a great impact on the success or failure of a project. Among these there are relationships between people or the status of certain individuals who have more influence than others. The implementation of new concepts or applications can easily become a political issue in an organization. The bigger a company is the more complex politics can be. A project team has to deal with several stakeholders. There are the sponsors of a project, project leaders and team members, project customers, resource managers, line managers, user groups, test groups and, in some cases, the management as well. Other departments may be concerned, too. The idea of implementing knowledge management was a consequence of a workshop initiated and attended by parts of the top management that had decided that knowledge management was to be promoted throughout the affiliate group. Projects were developed and the necessity of knowledge management activities was communicated. The department that was responsible for information management in the entire company then initiated a project for the development of a collaboration tool. This collaboration tool was determined to become the standard application for collaboration between both individual employees and departments. When the company information management heard of the plan to establish a wiki at the information management department of the financial division it was pointed at the decision of the top management in favor of the collaboration tool. Redundancy was to be avoided. This started a debate between the two departments and the fate of the wiki depended on the skills of the project team to find arguments that would support the implementation of the wiki. Therefore, the lists of the requirements of the teams were searched for desired features the wiki possessed and the collaboration tool did not. One of these features was the conversion of documents into PDF files. Another one was the possibility to view different versions of a document. Besides, the collaboration tool was meant to be used for collaboration above all, whereas the teams needed an application that was capable of storing knowledge and provided efficient information retrieval functions. After all, the collaboration tool included very basic wiki functions only. However, as further functions were planned to be integrated in the future the compromise was made to start with the wiki and use it until the collaboration tool would provide the same functions.

Being able to present a basic concept of a knowledge landscape at the time also helped with arguing in favor of a wiki.

Another challenge was to convince the worker's council to accept the implementation of the wiki. According to German labor law some changes in the operations of a company require approval of the worker's council. Especially when projects have an impact on the workload of the employees the worker's council often has the final say. In the case of a new application which generates an enormous extra workload such as the migration of a vast number of documents the implementation requires approval. In the case of the wiki the process of co-determination included the presentation of the application and its advantages for the employees. The workers council's responsibility on the other side was to find weaknesses and downsides of the project. At the end of a negotiation process a final decision in favor of respectively against the wiki was to be made. Therefore, a tactically prudent proceeding was advisable. One of the team leaders who had been working for the company for decades and, therefore, had strong ties to many people throughout the administration was chosen to be the negotiator. Based on the good relations and his profound work experience he was able to convince the worker's council to approve the implementation of the wiki during a number of meetings. Especially the presentation of a service oriented approach where the project team was responsible for the life cycle of all knowledge management applications, the consideration of the employees' requirements and extensive user support helped to convince the worker´s council in the end because all these measures would reduce the workload for the employees. However, one weakness was found, nonetheless. A wiki indexes the time a wiki page is generated or changed as well as by whom it is done. Theoretically this would enable the management to check the activities of the employees with regard to time and duration. The workers council would not tolerate this, however. After the function had been removed the implementation of the application was approved.

This example shows how important it is to identify those people that are able to provide the optimal support for a project and how useful service management can be.

What about implicit knowledge?

In the beginning of the knowledge management project the handling of implicit knowledge was an inherent part of the concept. However, whereas applications were being considered to handle the vast amount of documentation little thought was spent on

classical methods to pass on implicit knowledge such as mentoring etc. During the implementation of a wiki workshops were held to determine the future contents. These workshops revealed an understanding of implicit knowledge that did not correspond with implicit knowledge as defined by Polanyi. In fact implicit knowledge was understood as “the knowledge that exists in the minds of the employees”. After it was made clear what the term implicit knowledge really stands for (in Polanyis sense) as knowledge that can be neither articulated nor written down and which can only be passed on by observation and imitation of observed actions, the intention to handle implicit knowledge was given up and the focus was put exclusively on explicit knowledge. It would be interesting for further investigation how implicit knowledge could be integrated into a knowledge landscape and although the second case study does not answer this question sufficiently it might at least give a hint. Different aspects of a knowledge landscape will be developed and highlighted that deal with interactions between knowledge carriers and the intensity and importance of these interactions, thus displaying possible ways of passing on implicit knowledge along with explicit knowledge. Furthermore, the second case study shows how useful a service oriented approach to knowledge management can be because the knowledge manager had originally been intended to be a service provider which will be seen in the next chapter.

7 Second Case Study
(A Knowledge Manager as Interface between two Airlines)

This case study is about a knowledge management project that involves two companies that are part of the same affiliate group which started a collaboration in order to reduce the unit costs for flights to destinations that are too price sensitive for the classical flight program of the bigger company. Cost reductions were realized by making contracts with the stake holders that helped to reduce the production costs of technical maintenance, airport fees and all kinds of labor costs etc. In order to achieve these goals agreements with unions had to be made that reduced the cabin crew complement and the costs for the operating pilots. The latter proved rather difficult. Therefore, the collaboration was started. The cabin crew was provided by the bigger company, henceforth called company A, and the cockpit crew by the smaller company, henceforth called company B the costs of which were lower. As a result of requirements of the Federal Office of Civil Aeronautics (Luftfahrtbundesamt, henceforth referred to as LBA), an interface and coordinating body was established in order to ensure an unobstructed collaboration of both companies with regard to all relevant cabin issues that concerned the operation. The interface had to meet the following requirements:

- Employed as a flight attendant or purser (senior cabin attendant)
- Active assignment on the Airbus 340 fleet, the aircraft type that was used for the collaboration flights
- Comprehensive knowledge of the operational organization
- Extensive knowledge of air law with a focus on cabin operations
- Organizational skills

With regard to all operational issues and all other relevant topics the interface was the immediate local contact person and responsible for the coordination between the two cabin management departments and the respective interfaces in other departments that were involved in the processes. The following list is a survey of the general tasks of the interface which will be followed by a more detailed description of the assignments that emerged during the project. Above all the interface was responsible for:

- Ensuring the operational authority of company B to give directives towards company A in all matters that concerned the joint operation in the AOC (Air Operators Certificate) of company B. The Air Operators Certificate allows a

company to conduct civil flights. Flights in the AOC of a company are those flights operated by that company.

- The coordination of the collaboration between the cabin management of company B and that of company A at the head office of company B.
- Operating as an immediate contact person for the flight operations department of company B at its head office.
- The checking of operational issues with the respective interfaces.
- Provision of access to all documents and certificates of qualification that were required for the operation.
- Regular briefings of the cabin management of company B about all relevant operational issues based on information and regular quality reports derived from the operation.
- Immediate briefings on topics of the co-determination in the context of the operation.
- Proactive propagation of all relevant issues that resulted from the operation.
- Knowledge transfer between both companies.

With the exception of the first task, the aforementioned tasks are clearly knowledge management activities which became even more obvious in the course of time. However, the required activities were not considered as knowledge management in the beginning and, therefore, knowledge management skills could not be found among the requirements for the position. It will be shown however, that along with process management knowledge management was the main task of the coordinating body.

Although being part of the same affiliate group, there were some significant differences in corporate culture, structures, processes and terminology. While company A was an incorporated company, company B was a limited liability corporation and a subsidiary of company A. Originally independent B had been acquired by the affiliate group of which A was the dominant and name giving part. While A consisted of tens of thousands of employees B only had little more than 2000 employees. This meant that the administrative departments were much smaller. The exchange of knowledge would

often happen on a personal level due to the fact that most members of the administrative departments worked at the same place and, of course, due to the relatively small number of people in contrast to A which had several dependencies in different cities with a relatively large number of employees in the administrative departments and a way more distinct organization. While A operated more than half a dozen of aircraft types with destinations on five continents B was specialized on European flights only with their two aircraft types. Therefore, the organizational structures of A were more complex than those of B as well as their processes and products. Knowledge management was partly provided by a service company that was part of the affiliate group. But there were also many knowledge management activities in the various parts of the group. An intranet, collaboration tools, blogs, wikis etc. were being used widely partly by both A and B. In the course of this project MS SharePoint was used for file sharing, for instance. Furthermore, they were using the same intranet, however, employees of one company did not always have access to documents of the other company. The coordinating body was to fill that gap and provide B with all necessary information such as legal information or operation manuals in addition to what was mentioned before. Seufert et al. (2002, 129) quote Badaracco (1988, 73) when they write:

> Genuine sharing of authorities takes place. Firms are neither fully independent nor is one wholly dependent on the other. They do not lose their legal identities; they retain their own culture and management structure and can pursue their own strategies. But they do reduce their autonomy, share decision making, interconnect their organization structure, manage jointly some activities or operations, and open their company culture to outside influences (Badaracco, 1988, 73 in Seufert et al. 2002, 129).

Seufert et al. conclude that knowledge creation and knowledge exchange will take place rather in social networks than in traditional organizational structures. Badaracco further speaks of knowledge that is embedded in a web of social, administrative, economic and contractual relationships. This describes appropriately how knowledge was managed in this case study.

Applications and technology as means of managing knowledge were an essential part of the project, too and will, therefore, be mentioned in this case study. The focus, however, will be on personal interaction, the creation of social networks and processes as in contrast to the first case study a totally different approach to knowledge management

was required. The core activities could be subsumed under the terms communication, information and process design respectively adjustment of processes (process harmonization). This required the extensive use of social knowledge management strategies. First of all it was important to create a sense of shared identity. Luckily being members of the same affiliate group helped a lot. There was no competitive spirit that had to be overcome first. On the contrary, in the course of the project a sense of achieving something together developed. All participants had either similar or the same objectives. For company B the collaboration offered the chance to gain more importance and respect within the group. The odds were good that knowledge management activities would be accepted and, therefore, more likely to be successful, especially given the fact that company B along with the LBA had required an interface and coordinating position. The collaboration was based on mutual trust and understanding and the morale was thusly that ideas had a chance to be developed and realized. This case study will give examples of the collaboration, of challenges and solutions as well as of the lessons learned. The objective is, as is one of the goals of the entire paper, to show how useful knowledge management proved to be thus creating good arguments for the position of a knowledge manager in future collaboration projects. Furthermore, an extension of the concept of a knowledge landscape is developed.

The following summary of the activities of the interface is divided into several categories for a clearer understanding and a better analysis. It will be shown how knowledge was managed in practice. The categories are: law and rules, organizational matters, documentation, quality management, information and knowledge sharing, cabin equipment, further education.

7.1 Law and Rules

Compliance with laws, including national and European law in accordance with international regulations is essential for operating aircraft. Furthermore, there are collective agreements and works agreements that must be taken into consideration. An understanding of and knowledge about these laws and regulations was essential for the interface and, therefore, one of the requirements for the position. In the following some of the most important legal aspects that had to be dealt with in the context of the collaboration will be explained.

Flight and Duty Time Regulations

The first request at the very beginning of the collaboration was about the regulations concerning flight duty times. One of the flights had a delay and although the legal regulations were well known at company B they did not know anything about the regulations of collective agreements of company A. Therefore, a table including all maximum duty times with respect to the different circumstances that had an impact on the maximum duty times such as time zones etc. was created and provided to B. Whenever the maximum flight duty time is exceeded the pilot in command must make a decision based on interrogations of the crew members whether or not they feel fit to fly, if the flight takes place or not. Which was not known, however, was the fact that the crew members of A had the right to refuse working on the respective flight when they did not feel fit enough as long as the flight begins at one of the home bases in Germany. Thus, misunderstandings, conflicts and breaches of rules could be avoided.

Another issue came up when crews had to be exchanged which led to the fact that one crew would not be back home for Christmas as originally planned. Some crew members argued towards the pilot in command that they were entitled to be brought back home before Christmas at the company's expenses. That was not the case, however, and could be figured out via the interface.

These two examples show that both the companies and the crews benefitted from an accelerated and facilitated exchange of information because in many cases there was not much time and decisions needed to be made quickly.

Process Instructions

During the first six months a large part of the workload consisted of the creation and implementation of process instructions and standard operating procedures. The challenge lay in the fact that they would have an impact on both companies. The implementation of procedures and processes required a well-coordinated collaboration between departments of both companies. Sometimes the successful implementation would rely on just a few people. It had to be ensured that every department knew exactly its responsibilities and the respective partners they were expected to collaborate with. Furthermore, due to ongoing restructurings an important assignment of the interface was the monitoring of the processes, especially in cases of departments being dissolved or in cases when responsible employees left their company. In these cases responsibilities needed to be redefined and/or assigned to new employees or newly

created departments. Without monitoring on a regular basis there would have been a high risk of an interruption of the processes. This task required that the interface was always up-to-date on the organizational structures of both companies and as other departments than the cabin managements of both companies were involved the focus had to be widespread. The following example is intended to show the complexity of some of the processes.

One of the requirements of the LBA was that all work related instructions and regulations had to be available to every crew member at any time during a flight. Therefore, the respective handbook had to be on board. As a general rule redundancy is required for all essential systems and documents. One version could be found on the pilot´s notebook. Another version could have been stowed somewhere in the cabin. The latter, however, was not common for weight reasons; the handbooks were sometimes heavy with many pages. Therefore, a digital solution had been developed. On all long range flights pursers (senior cabin attendants) of company A had a tablet with all important information necessary to perform a safe flight with regard to all cabin aspects. There was a department at company A that was responsible to collect all essential information, knowledge and revisions of handbooks from the responsible departments in order to make them available for download on the tablets. The pursers were then required to update the information on their tablets before every flight. So much about the process at company A. Company B, however, had their own respective handbook and other regulations that had to be made available, in full or partly, to the crew members of the joint flights. Therefore, the interface had to create a new process in order to have deviating regulations and additional documentation delivered to the crew members. A special version of the above mentioned handbook was edited that contained most of the chapters of company A that were similar to those of company B anyway and a couple of chapters from company B that differed substantially from those of company A. For that reason, a far more complex process was created by the interface that had an impact on departments of both companies. First of all it must be mentioned that both companies had a series of corresponding departments for processes, tasks and documentation. As a first step the respective departments of both companies had to develop the “new” handbook that contained all relevant information. In addition further documentation was edited by B. Then the handbook and the documentation was uploaded to MS SharePoint where a workspace had been created that could be used by the departments of both companies that were responsible for the respective processes.

This workspace consisted of handbooks and other relevant documents for the joint flight operation. The cabin administration of company B was then responsible for informing company A about every update or revision that was uploaded to the SharePoint workspace, partly via the interface in cases where an automatic information was not possible due to technical restrictions of SharePoint. At company A the responsible department was the one that provided the information for the purser tablet. They had to download the updates from SharePoint and then made them available for download to the pursers. In a last step the pursers were responsible for downloading the handbook as well as all other relevant information and knowledge including tips for specific flight routes. Further details of the process will be described in subchapter 7.3 (File and Document Sharing). This example shows that several departments in both companies were responsible for generating and distributing information. A challenge for the interface lay in finding the appropriate contact persons and putting them in charge for process steps. A precise and reliable cooperation was essential for successfully fulfilling the federal authority´s requirements which was important to maintain the permission to conduct flights. A risk to this and the other processes was or is reorganization, i.e. changes of responsibilities and the loss of employees and, thus, of their knowledge. Personal cross-company-ties might be cut in case someone quits their job. Therefore, the interface had to look through the cabin related joint processes repeatedly in order to identify changes in responsibilities in both companies, to brief new colleagues about the processes and to update the process instructions. Illustration 7.1 shows the process that had to be developed to ensure the availability of the handbook and the other documents on all joint flights.

Other process instructions defined the processes that were developed to ensure that the correct cabin emergency checklists and the correct passenger safety instruction cards were on board. Another process instruction defined the tasks and responsibilities of the interface. The creation of the process instructions was a good example of the usefulness of a knowledge manager who keeps the overview on processes that involve more than one organization. The time span required for identifying and engaging process participants and then for writing down and implementing the cross-company processes was several months followed by regular quality assuring measures by the interface.

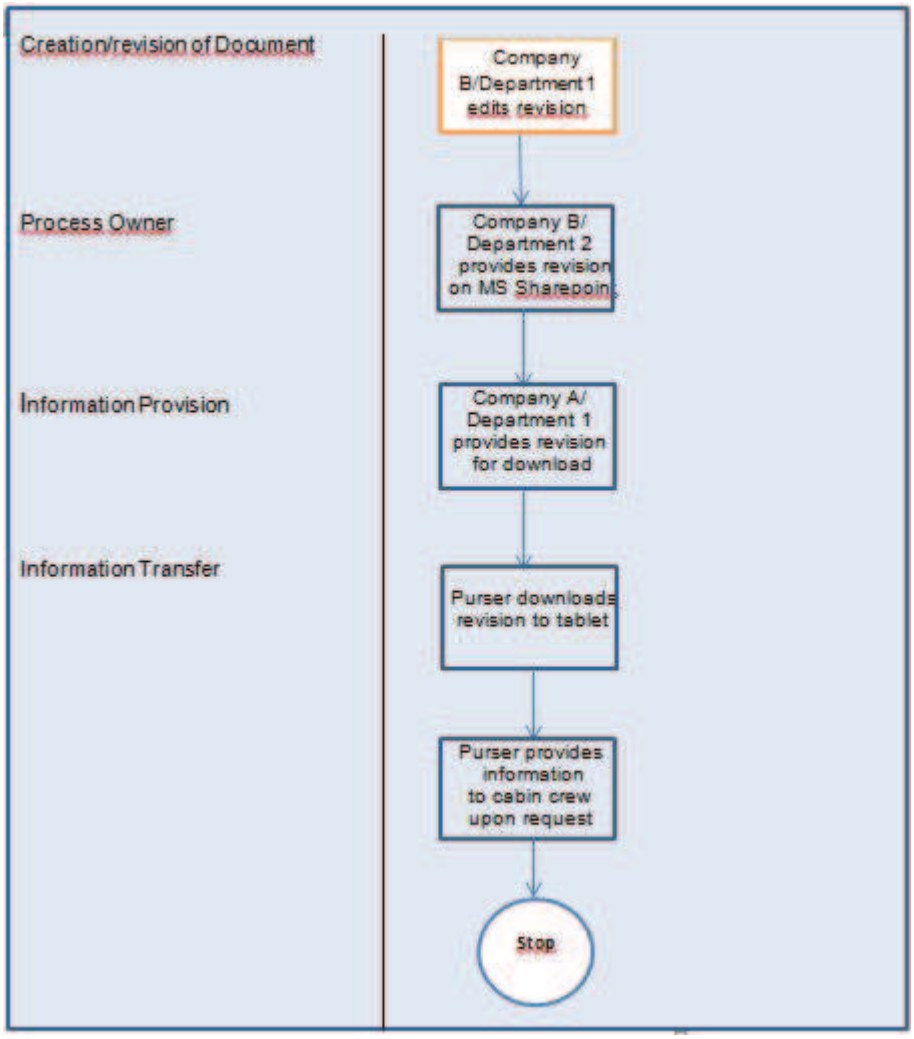


Illustration 7.1: Cabin Documentation Process (own representation)

7.2 Organizational Matters

As this kind of collaboration was somewhat new it had to be determined first how the cooperation should be organized. There had been a service contract already which defined that company A was a service provider for B under certain circumstances. For instance, there had already been cooperation for the inflight catering. Based on this service contract further agreements were made with regard to the transfer of aircraft, specifically a certain number of Airbus 340, from A to B. Therefore, B became legally responsible for the operation of this A340 fleet. Most of the services, however, remained with A, such as technical maintenance, ticket sales, marketing and inflight services. The cockpit crew was provided by B and the cabin crew was lent to B by A by means of a personnel leasing. The cabin crew members had to sign an additional contract and received further instructions and documentation. For the duration of the flights they were employees of B. As shown an interface respectively coordinating unit was established at an early phase that consisted of mainly one person and two

substitutes. With regard to organizational matters the transfer of aircraft from A to B, which included an aircraft certification process in close cooperation with the LBA, was an important task.

Aircraft Certification Process

A legal requirement for the transfer of aircraft from one airline to another is the certification process. The entire aircraft needs to be checked for its airworthiness, which means whether it is fit for a safe operation. This happens under the condition of close cooperation of the aviation authorities, i.e. the LBA in Germany, and representatives of the airline that receives the aircraft including technicians, pilots and, in this case, cabin crew members. The experience and knowledge of these participants was essential in order to ensure that all damages, errors and safety hazards would be identified. Therefore, expansive checklists are usually issued and gone through. Within the cabin, for example, all emergency equipment had to be checked such as life vests, torch lights, work stations, safety instruction cards, safety belts, the interphone and cabin communication systems and many other things. Experience as a cabin crew member on that specific type of aircraft helped to identify safety hazards that were not covered by the checklists. At the end of the process an authorized person would sign the completion of the checklists and the LBA would grant the Aircraft Certificate for B. The support of the interface was very helpful because no one at B had had sufficient experience with the Airbus 340 before. By working together useful knowledge could be shared and transferred from A to B. One of the applied knowledge management tools in this case was mentoring.

Fatigue Risk Management System

New regulations of the European Union Aviation Safety Agency concerning the challenges of fatigue in flight operations made it necessary to establish a fatigue risk management system (FRMS) that dealt with fatigue and helped to reduce the risks coming from it. B had started to establish FRMS earlier and intended to extend it to the Airbus 340 operation. The problem was that A was just about to implement FRMS. Therefore, the concept was unknown to the cabin crews provided by A. The interface had to observe the progress of the implementation process at A and inform B in due time so that the implementation on the A 340 fleet could be synchronized with the company wide implementation at A. Furthermore, the goal was to adjust both fatigue risk management systems to one another, which was supported by several interfaces.

Crew Contact

Sometimes certain problems require an informal approach. Due to data protection regulations information about crew lists could only be exchanged in a non-digital format by means of a printer at B that would receive the crew lists of A every morning for each flight of the day. Crew members, both cockpit and cabin, were not able to get information on the crew composition, of the respective other company, before they actually met in person. Therefore, an unofficial group was founded in a social network by those cabin and cockpit crew members that were part of the group that worked for the A 340 operation of B. There people were able to get in touch with each other before their actual flight. It should be mentioned that the spirit in that group was very positive and harmonious which reflected the smooth collaboration on the administrative level. In special cases information on crew members of the respective other company could be requested via the interface.

7.3 File and Document Sharing

Another challenge was the sharing of relevant documents such as handbooks, process descriptions, personnel leasing documents and documents on quality and safety management. MS SharePoint was decided to be the solution. A common workspace was established along with a process that was meant to ensure that everyone would have all relevant documents at all times. The following process was established in close cooperation of both cabin administrations and the interface, which coordinated the collaboration and, in the end, was responsible for the quality assurance of the process description.

B provided documents relevant for cabin crew members with a personnel leasing contract to the cabin administration of A by means of a common workspace. This SharePoint workspace was available in the shared intranet for a defined group of persons. All necessary access rights were granted by B. The documents were structured as follows (translated from the German original with further explanations):

Library

→ Important Documentation

- Interface Agreement Cockpit
- Interface Agreement Cabin

Documentation for A

→ Operational Documentation (Company B)

o OM-A (relevant for B only; OM stands for Operations Manual and A for the specific version)

o OM-D (relevant for B only; OM stands for Operations Manual and D for the specific version)

o SMM (relevant for B and A)

o QMM (relevant for B and A)

→ Personnel Lease Cabin

o A340-300 Cabin Crew Info – General -

o OM-A (of company B) Chapter 0 – 3

o Personnel Lease Confirmation Form

o A340-300 Cabin Crew Handout

B ensured the quality of all documents in SharePoint and their topicality for the printing process. The defined group of persons of the cabin administration of A received an automatic e-mail whenever the documents were updated.

In the cases of the SMM (Safety Management Manual) and QMM (Quality-/Compliance Monitoring Manual) A was informed about the respective revisions by the interface via e-mail. Due to technical reasons automatic information by SharePoint was not possible.

A provided these documents to the cabin crew members as follows:

a) Immediately after each update of the documents SMM and QMM, these documents were published in the Crew Portal of A. Furthermore, they were uploaded to the tablets of the pursers of the fleet.

b) All documents were sent to new members of the personnel lease group. This required the following steps:
    a. Human resources of A informed the communication department of A about the number of persons that needed to get the relevant documents.
    b. The communications department instructed the printing of the relevant SharePoint documents adding a personal letter for each recipient.
    c. The print shop delivered the documents to human resources.
    d. Human resources sent the personnel lease documents, the contract and the personal letter to the employees via mail.
c) Employees who were in the personnel lease group already, received the updated version of OM-A chapter 0-3 as well. This required the following steps:
    a. The communications department of A downloaded the latest revision from the SharePoint workspace.
    b. Then the printing shop was instructed to print the revision.
    c. At last the printed documents were distributed to the (physical) crew mailboxes.

This process reveals clearly the challenges that derived from the fact that several departments across both companies had to cooperate and to ensure that always the latest versions of documents were available. As a means of quality assurance the interface checked the documents of both the SharePoint workspace of B and the ones provided in the crew portal (a kind of intranet just for flight and cabin crews) on a monthly basis.

7.4 Quality Management

Quality management was an important aspect of the work of the interface in various contexts. This included not only the quality assurance of the documentation but also some of the equipment of the aircraft and audits.

Audit Preparations

As a means of quality assurance and compliance monitoring audits are an integral part of flight operations. During an audit an auditor asks questions from a defined catalogue concerning various aspects of flight operations. The goal is to determine whether an airline meets all legal requirements of the European Union Aviation Safety Agency (EASA) and the International Air Transport Association (IATA). In this context three different types of audits were relevant: internal audits, so-called IOSA audits (IATA Operational Safety Audit) and audits of company A by company B. In the first case the

cabin administration of company B was audited by the internal air safety and quality-/compliance monitoring department of B. In the second case external IATA-approved auditors audited the entire airline respectively all parts that were dealing with or had an interface with flight operations. In the third case the air safety and quality-/compliance monitoring department of B audited the cabin administration department of company A. In the first two cases the support of the interface was required for it had all the information (handbooks etc.) and knowledge (experience) to answer the audit questions with regard to the Airbus 340 fleet and the cabin related services of A. If the administrative department had had to do all the research itself that would have taken weeks because they would have had to request the necessary documents and handbooks first and then they would have had to familiarize themselves with the documents, which consisted of many hundred pages, before being able to answer the audit questions. In this case years of experience of the interface accelerated the process immensely. In the third case the interface supported A. The interface was thus auditee on both sides.

Quality Assurance

As mentioned before the process instructions had to be updated based on organizational changes. An in depth knowledge of both organizations was a valuable asset for achieving this goal. In some cases B would have never known of personnel changes or organizational changes without an interface with the consequence that the process instructions would have become incorrect which in the worst case could have led to legal consequences. Furthermore, the interface had to assure the topicality of all relevant documents of B that had to be published in the crew portal of A and thus on the purser tablets as well because B had no access to the crew portal.

Another important assignment of quality assurance was the identification of so-called Safety Performance Indicators (SPI). These are key figures for safety related incidents during flight operations. An example would be accidents during turbulence. B had identified their SPIs. Now that they were responsible for a fleet of Airbus 340 they had to figure out the SPIs on that type of aircraft. Therefore, the interface analyzed hundreds of reports coming from the flight crews of the Airbus 340 operation that were provided by A in order to identify the SPIs. This helped to increase safety on flights. Only a person with flight experience on long range Airbus 340 flights would be able to identify all relevant SPIs. This came in useful when, as a consequence of the IOSA audit, an Operational Risk Evaluation (ORE) had to be made. The interface was able to identify, together with colleagues from several departments, the risks and hazards of the joint

A340 operation with regard to cabin matters and to determine mitigation actions for the detected risks.

A general aspect of quality assurance was the detection and mending of defective processes. An example would be the transfer of up-to-date flight crew lists on a daily basis. It took months to identify a problem with these lists being incomplete. They were, at times, lacking names and at other times the wrong lists were sent from A to B. A future assignment of an interface could be the mapping of all processes that deal with the transfer of information from A to B and vice versa with the goal to monitor these processes on a regular basis and fix them whenever necessary. While quality assurance departments are responsible for compliance with all kinds of processes a knowledge manager could focus on knowledge intensive processes.

7.5 Information and Knowledge Sharing

Among the most important tasks of the interface the sharing of information and knowledge was an ongoing process. The means used were briefings, e-mails, meetings, jour fixes, written summaries and the forwarding of questions and requests in both directions. Resulting from the operation various kinds of information had to be passed on to the cabin administration of B. This concerned the flights, safety issues, staff conduct and matters of co-determination. A was to provide all necessary information about their cabin crew members such as training certificates and personnel files upon request because in the end B was responsible for all this while A took care of the respective processes and the storage of the documents. All this was realized through the interface. Instead of searching the appropriate contact persons each time B would ask the interface who was familiar with the organizational structures of A to do the research. This saved a lot of time and increased efficiency. Furthermore, the interface was responsible for updating the cabin administration of B on the progress of the project, planning processes with regard to personnel planning and route planning. Technical information about the transfer of aircraft from A to B was given through different channels by the respective technical departments. An interface came in very useful with regard to the following aspects:

- The interface had a profound knowledge of organizational structures of both companies and was, therefore, able to find the perfect matches for collaboration on various hierarchy levels.

- The interface was able to identify important information that needed to be passed on to the respective departments of both companies.
- The interface was able to filter information. Thus, an information overload was prevented and the focus lay always on relevant information.
- The interface enhanced the sharing of knowledge and experience especially with regard to long distance flights and cabin topics of the Airbus A340, before the project started B had had no experience with these at all.
- The interface moderated and mitigated in cases of possible conflicts.

The working week usually started with a short briefing of B about operational topics that had emerged and about updates concerning the project. During these briefings the interface also received information from B that was to be passed on to the cabin administration of A. Besides ideas on how to improve the collaboration emerged as well. One of these ideas was the writing and editing of an online article for the group wide magazine in order to promote the project and to show the significance and usefulness of an interface and thereby of knowledge management in a context of cross company collaboration.

7.6 Cabin Equipment

The interface was familiar with the cabin equipment required for the flight operation. This included both service items and safety items and the interface was, therefore, able to support the cabin administration with quality assurance. All safety items had to be on board at all times due to legal requirements. During the plane checks in the context of the AOC transfer from A to B the interface assisted the cabin administration in assuring that these requirements were fulfilled which was essential for getting the permit to operate the aircraft. Furthermore, the interface knew the standards for service equipment that were expected by the passengers. No remarkable differences should be noticeable for the passengers. Both long distance fleets (of A and B) were intended to have the same standards with slight deviations only.

7.7 A Knowledge Landscape for Social Networks

Overall it can be said that in the beginning the concept of an interface respectively a coordinator was rather vague but in the course of time it became clearer that an interface and thereby knowledge management was an important aspect of cross company collaboration for the majority of tasks that emerged. Without an effective knowledge and information sharing as well as information quality assurance the collaboration

would have been more difficult and less efficient. Illustration 7.2 shows the social network that has evolved with the interface at its core. It contains aspects of collaboration and knowledge transfer by means of externalization, internalization, combination and socialization. For the sake of transparency only those departments with the highest level of involvement are depicted. All other departments are subsumed under “Other Departments”. The black arrows symbolize connections via the interface and connections that have been established between employees of different departments that had been initiated by the interface in the course of time. Red arrows show connections that developed or had already existed independently. Each arrow is associated with one or several of the knowledge management aspects that have been applied. The size of the arrows shows the intensity of the respective collaboration. As the collaboration between the interface and the cabin administrations was by far the most intense and important the respective arrow is by far the thickest. In some cases there were differences in the structure of the departments. While at B the administration department was also responsible for all documentation concerning work instructions, product quality assurance and the management of the cabin teams at A these functions were further subdivided with other departments in charge. As a detailed account of all these departments would lead to too much complexity illustration 7.2 rather provides a general overview based on the functions that were relevant for the cooperation. Furthermore, only cooperation across both companies is illustrated. Within each company various connections had already existed before according to operational requirements. An IT solution of modeling the interdependencies of illustration 7.2 could furthermore enable users to click on the arrows in order to get more information on the underlying aspects of knowledge management, whether internalization, externalization or socialization played an important role etc. This would be more than a regular knowledge map as described in chapter 4.3.5 because it could also describe underlying processes reminding of KMDL (compare respective chapter). It is rather an advancement of what Weller et al (2007, 4) suggest with regard to building a social network in science. Their concept includes metadata on the members of that network, for example interests, expertise and specializations, thus making it possible to find possible partners for scientific cooperation. This concept also takes into consideration contacts and acquaintance with one another. If a knowledge landscape is complemented by all these aspects a virtual representation is highly recommended due to its complexity. However, it might be a useful way of integrating social aspects and tools of knowledge management into a knowledge landscape. The question here is not which

application suits what type of knowledge but rather which social tool and/or which aspect of the knowledge spiral leads to an optimal exchange of knowledge on the one hand and on the other hand it can be determined which persons need specific knowledge and to what extent as well as how successful knowledge transfer can be achieved. In the case of the AOC transfer of aircraft from one company to the other, for instance, both explicit and implicit knowledge was transferred via socialization and, to be more precise, also by mentoring. Clicking on the arrow between the interface and the cabin administration and documentation department of B might reveal that information.

Due to the fact that the interface was mainly responsible for the coordination of the cooperation and the knowledge transfer between the cabin administrations of A and B many of the other essential connections had almost no points of contacts with the interface, as, for example, was the case with the collaboration of the two cockpit administrations or with maintenance. Some cockpit activities, however, were supported by the interface, too, because the cockpit administrations only had their own interface agreement but no particular contact person who served as an interface and coordinating unit. The training department as well sometimes consulted the interface as well as the quality management department. The collaboration with the latter was at times quite intense especially in the context of audits or general safety and security related issues that came up.

Collaboration with the authorities is neglected in this case in order to avoid too much complexity but of course knowledge flows to and from external stakeholders may play an important role as well and would then be integrated into a knowledge landscape. In the case of the authorities this would be easy because the cooperation is already defined by law to a certain degree which includes the exchange of information.

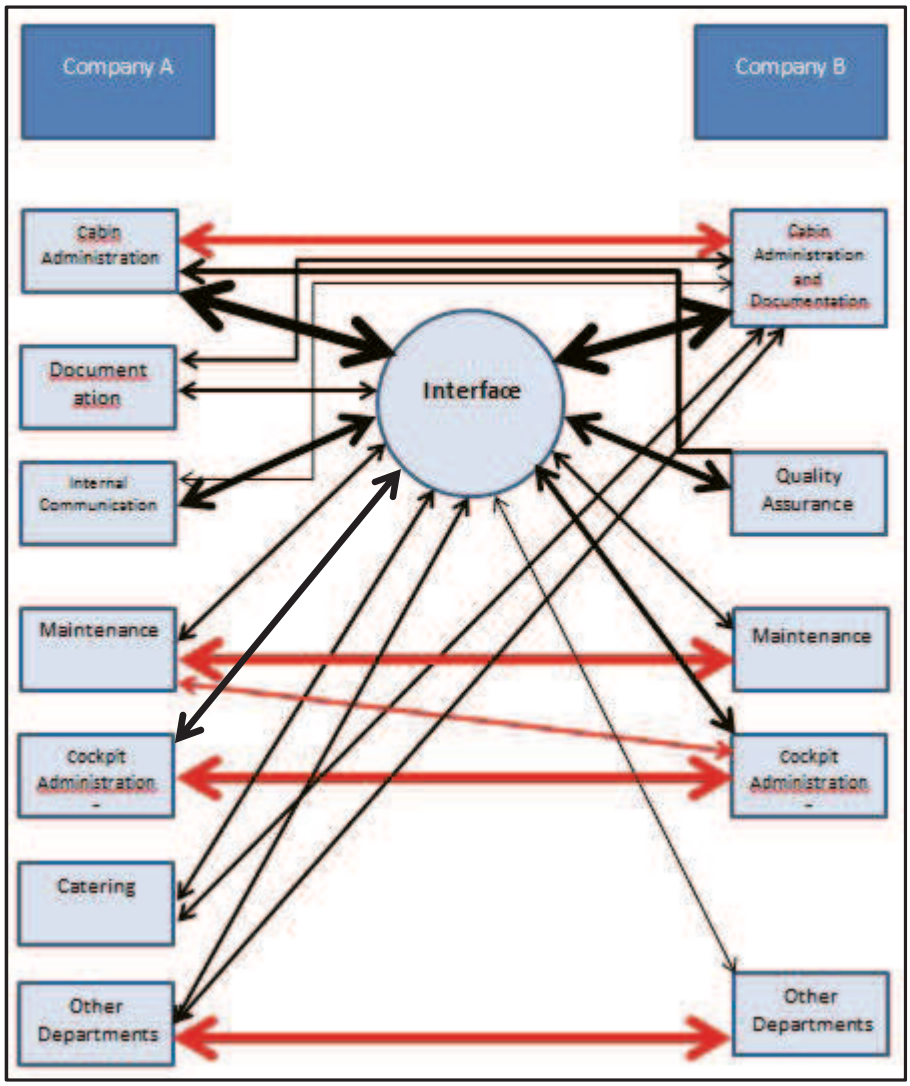


Illustration 7.2: Knowledge Landscape for Social Networking and Collaboration (own representation)

This also proved the usefulness of a knowledge manager as a cross company collaboration coordinator. Other connections were initiated by the interface at first but then established themselves independently. As illustration 7.2 is complex it is recommendable to use a virtual representation of this part of a knowledge landscape. The same suggestion has been made before with regard to the knowledge landscape developed in the first case study. A virtual representation could always add further dimensions. In real something similar to illustration 7.2 was used developed from a table that gave an overview of the collaboration including knowledge flows and additional information on what knowledge was passed on, and how.

Knowledge Provider	Knowledge Recipient	Tool	Actions
Interface	Cabin administration and documentation department of B	Transfer of explicit and implicit knowledge by means of mentoring and observation (internalization and socialization)	Interface teaches members of the respective department during joint checks how to check the cabin of the Airbus 340 with regard to all safety relevant items.
Interface	Cockpit administration of B	Transfer of explicit knowledge via e-mail and talks (combination)	The interface created a table with all relevant information considering flight time regulations of cabin members of A in comparison to the flight time regulations that were being applied for cockpit members of B.
Quality assurance department of B	interface	Seminar and web based training (combination)	Tutorial of aviation law and in-house quality management

Table 7.1: Knowledge flows between A and B

Table 7.1 is just a small excerpt of a large table that was developed from to-do-lists, taking into account knowledge management aspects, suggesting tools that suited the situation. Sometimes those tools were predetermined as was the case with the aviation law and quality management seminars. The examples of table 7.1 are rather simple. With regard to the process instructions the knowledge exchange was a lot more complex

and sometimes the table became a bit convoluted, and even more so when the intensity of collaboration was integrated, thus providing another argument for a virtual representation which could be subject of further investigation. A knowledge landscape as described in this paper is not a conventional knowledge map. It can also be used to find specific knowledge faster but its main purpose is to serve as a guideline for building knowledge management structures of an organization and then to navigate them. Ideally it improves acceptance of knowledge management in management and employees. In this case it would be interesting to consider the following question: when does it make sense to connect experts and under which circumstances would it be better to transfer knowledge via an interface/knowledge manager? A click on the arrows in illustration 7.2 might also reveal the types or fields of knowledge that should be transferred. The department “Cabin Administration and Documentation”, for example needs different knowledge from the interface than the quality assurance department. A successor as interface or knowledge manager could see at one click which types of knowledge need to be passed on to respectively from whom. Thus, a knowledge landscape provides a useful guideline for knowledge managers to develop the knowledge infrastructure. In case there is no more knowledge manager it might even function as a substitute providing an intellectually designed guideline for employees showing them how to handle their knowledge although the solution including a knowledge manager using a knowledge landscape is always to be preferred. Sometimes certain knowledge needs to be translated and filtered. A translation may be required in the case of a differing culture or different wordings in two organizations. It can be doubted that this can be done without a real person. “Filtering” of knowledge that is to be transferred may become necessary due to political reasons. In a knowledge landscape these aspects can be identified and knowledge can then be categorized accordingly. Too much complexity must be avoided. Therefore, it should be predefined what sorts of knowledge need to be passed on and how that should be done respectively who is the appropriate recipient. A very obvious example would be the transfer of critical knowledge that needs to reach a certain department in a company but must not reach anyone related to the companies workers council because it might lead to greater political disturbances within a company. A knowledge manager might serve as a translator and filter on the one hand; on the other hand, however, one single interface would be a critical weakness, because if this person leaves the organization, substantial expertise is lost and the knowledge landscape must be rearranged even though it might substitute a knowledge manager to a certain degree. Among the main tasks of the

interface was networking. People had to be brought together and be connected, thus establishing and strengthening networks. In the illustration above that would mean to establish arrows and then have them grow thicker. The thicker the arrow the more intensive is the collaboration. This would be in accordance with Seufert et al. according to whom relations can be categorized into content, form and intensity (Seufert et al. 2002, 132). It would be possible to underlay the arrows with names or denominations of organizational units, whether the connections exist of a restricted number of people or a department. The possibilities are numerous and might be subject of further investigation.

8 Conclusion

Due to the fact that the usefulness of knowledge management is often doubted based on numerous implementation failures it is essential to develop concepts and means to overcome these doubts by reducing the probability of failure. A guideline helping with choosing the best strategy and appropriate tools, a knowledge landscape, and the consideration of IT service management principles have proved to be capable of making the implementation of knowledge management successful. Those who are expected to fill knowledge management activities with life should be seen as customers with all kinds of potential mental barriers such as needs, wishes, fears, lack of experience, bad experience etc. Useful services include information need and requirement analyses, strategy consulting, tool analysis, design of a knowledge landscape, training courses and user support on a general scale. Furthermore, ITIL concepts such as demand management, change management, availability management, event management, problem management, access management and first level support, among others, can be useful for a successful implementation of knowledge management applications. In the case of a cross-company collaboration a knowledge manager comes in very useful as a provider of knowledge services responding to information needs on the one hand and proactively providing both companies with all kinds of knowledge and expertise.

A knowledge landscape as described in this paper is a structured approach to knowledge management that helps employees to orient themselves, especially in the complex environment of big companies with a multitude of different applications and concepts used for managing information and knowledge. It has been demonstrated that a service oriented approach has the capability to improve the acceptance of knowledge management activities as well as the development of a knowledge landscape. A guideline has been presented that helps to overcome resistance und further barriers. The first step should always be a survey of information needs and requirements along with an analysis of the status quo. These requirements can be objective information needs, which are the needs defined by the organization, and subjective information needs defined by the individual. Thus, employees are spared the confrontation with tools that they would not accept. Requirement engineering helps with finding appropriate tools which are more likely to be accepted and used. Implemented tools should never be ends in themselves. They had rather support those who have to use them. Then the resources such as money, time and staff need to be evaluated. Before any further action is taken it

is important to spend some time with thinking about the appropriate knowledge management strategy. Ideally it corresponds with the strategy of the organization. A decision needs to be made whether the focus should be on IT applications or on social methods of knowledge management. Whatever the decision is, the other aspect should not be neglected completely. Having to convince the management of a company of the usefulness of knowledge management it is essential to present and explain the benefits. Furthermore, it can be helpful to present a process oriented strategy because the benefits can be explained on the basis of everyday´s work. In order to be able to create a knowledge landscape it is essential to analyze the different types of knowledge that already exist and the knowledge that will be acquired or developed in the future. Existing tools as well as tools that are going to be implemented need to be analyzed with regard to their functionalities, purposes, risks and benefits. Then knowledge and tools are matched. After the implementation an ongoing monitoring is essential to keep up with competition because applications change rapidly and life cycles have become shorter. A service oriented approach ensures support with all these processes and decisions. Due to the complexity of a fully evolved knowledge landscape it is recommended to design a virtual representation which offers more functions. While the original knowledge landscape as developed in the first case study was based on technical applications the second case study has showed that it can be extended by social interactions with a focus on socialization in particular but also on the other three dimensions of Nonaka´s and Takeuchi´s knowledge spiral.

With regard to service orientation employees should be considered as customers, a philosophy that is applied at the aforementioned airlines in various contexts successfully. The first case study has proved that this approach can be successful. In the second case study the position of an interface was a service in itself from one company to another being an extension of a service provider contract. A service mentality was expected and provided. IT service management concepts such as ITIL can help choosing the appropriate measures especially when the core of knowledge management activities consists of IT applications. However, it would be interesting to think about more independent service concepts that can be applied easily to the implementation of social knowledge management tools. Table 8.1 is a summary of the various steps that are required in order to implement service oriented knowledge management, including the development and implementation of a knowledge landscape, based on the experience made in the two case studies. It is an extension of table 5.1 and shows how

requirements are met with services and what actions are to be taken and by whom as well as the outcome, thus serving as a functional guideline. The “service” column describes actions that are either fully or partly “outsourced” to a knowledge manager. The provided services are not restricted to ITIL based service concepts, however, because ITIL is only one of many options. The “actions” column describes the responsibilities of management and employees of a company. Overlaps are possible. Especially some of the actions require further support from the knowledge manager. The survey and evaluation of different types of knowledge is a good example because in the case study it took a while for a deeper understanding to develop.

Services	Actions	Results
Design of questionnaires, interviews, survey of information needs and requirements Demand management as ongoing process	Expression of information needs and requirements	Identified needs and requirements are the basis of further action.
	Evaluation of resources (budget, staff, time) by the company management	Assignment of budget and time and staff capacities
Knowledge manager consults the management of a company on the appropriate strategy based on the business model	Choice of knowledge management strategy	Knowledge management strategy as framework for the implementation of knowledge management concepts and tools
Creating of understanding of differences between distinct types of knowledge (implicit vs. explicit, critical vs. non-critical, confidentiality vs. public access to knowledge etc.)	Survey and evaluation of different types of knowledge	Knowledge categories

Services	Actions	Results
Collection of results	Survey of forms of knowledge (text files, audio, video etc.)	Along with the knowledge categories basis of further decisions with regard to the choice of knowledge management tools
Survey and evaluation of existing tools (distinction between technical and social tools, considering the chosen strategy) This includes both tools that are being used already and further tools	Feedback on the usability of tools that are being used already or were used in the past	Decision template for the choice of the appropriate knowledge management tools ,catalogue of functionalities and risks and benefits
Alignment with requirements	Choice of tools	Knowledge management tool(s) that are to be implemented
Support of implementation	Implementation of tools (possibly by external IT service provider, if necessary)	Tools are implemented and can be used
Matching of knowledge types and tools (if several are chosen), based on the requirements Development and implementation of a knowledge landscape and instruction of employees on how to develop it further, process needs to be monitored		First draft of a knowledge landscape

Services	Actions	Results
User support	Storage of knowledge following the guideline provided by the knowledge landscape Extension of knowledge landscape	Fully developed and usable knowledge landscape
Warranty of stability of applications and further user support whenever necessary Monitoring of knowledge landscape and interventions whenever needed (incident management, event management, quality management etc.)	Working with knowledge and knowledge management tools	Stable knowledge landscape, fit for use Knowledge is managed successfully
Promotion of knowledge management, provision of information about progress and success by means of various possibilities ranging from newsletters, games and success stories etc. Monitoring	Monitoring	Higher level of acceptance Quality is ensured

Table 8.1: Steps of a Service Oriented Implementation of Knowledge Management

The last point rather accompanies all activities during the whole service cycle. The same holds true for the development of a knowledge landscape. Not every aspect may be necessary for the implementation of knowledge management activities and tools. Table 8.1 is based on the first case study and starts from scratch assuming that there have not been any knowledge management activities before, although that had not quite

been the case as seen in the respective chapter. In the second case study the focus was on developing a knowledge landscape with the purpose of helping the interface/knowledge manager to direct the knowledge flows so that they would always reach the correct recipients. There was no need, for instance, to analyze and evaluate knowledge management tools. Based on the degree of the existing knowledge management activities table 8.1 provides a guideline consisting of steps that build on one another and it should be determined at which step one should enter the process. If a company already has a knowledge management strategy and if the requirements are well known and the problem consists of the organization of knowledge, a knowledge manager might start with an evaluation of knowledge types and an analysis of tools in order to create a knowledge landscape. The guideline is not to be seen as rigid, it rather explains steps for an efficient knowledge management that help to improve acceptance among management and employees. Services such as demand management, change management, user support, access management, availability management, continuity management etc. further improve the acceptance of new tools as seen in chapter six. Furthermore, manuals and tutoring can be valuable tools of service management. In the second case study no particular services had been intended but the position of an interface that was considered as a service provider emphasizes the importance of a service mentality when it comes to knowledge sharing.

A knowledge landscape as described in chapter six helps employees to determine how to store and retrieve knowledge in a complex work environment with a variety of tools and applications in a pragmatic way. The extension developed in the course of the second case study, as described in chapter seven, provides a guideline for the directing of knowledge flows, thus focusing on knowledge distribution. Therefore, it can be said that a knowledge landscape is a useful concept for the storing, sharing and distribution of knowledge. Identification and acquisition are neglected. For the identification and acquisition of knowledge, knowledge maps are more suitable because they help to find knowledge assets and, thus, identify knowledge gaps that need to be filled by means of knowledge acquisition. The development of a knowledge landscape is an ongoing process and needs to be monitored in order to make adjustments in case of the implementation of new applications or of changes in the knowledge basis of a company as well as in case of changes in the corporate culture.

Along with change management and project management, service management and the implementation of a knowledge landscape have proved to improve the acceptance of

knowledge management. As mentioned before further investigation on a more universal approach to the support of all kinds of knowledge management activities, including social tools, would be an interesting subject for the future. Building a virtual knowledge landscape could be another interesting challenge. A virtual tool for creating a knowledge landscape might ask for certain parameters such as confidentiality, criticality, relevance and sophistication of knowledge, for example, as well as for it´s form, whether it exists in a Word document or as implicit knowledge in someone´s mind etc. This tool could then suggest the appropriate tool and procedure. In order to do so it must be defined clearly what features and functionalities a tool needs to have to be appropriate. Confidential knowledge, for example, would require an authorization scheme that allows for protected areas not everyone has access to. A cloud solution might not be appropriate. Critical knowledge on the other hand must be accessible from anywhere at any time and, furthermore, be easy to find and retrieve. Knowledge that is shared with externals requires tools with interfaces. Projects with a low budget might favor freeware solutions etc.

In any case one final conclusion needs to be drawn: both case studies have shown that the assignment of a knowledge manager yields a higher chance of acceptance and success of any knowledge management activity.

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