University of Twente
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SevenStars

The User Oriented Knowledge Management Method

A knowledge management method for a small organization with a distributed environment.

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Management Summary

Knowledge plays an increasingly important role in business these days and thus most organizations have already begun, or are considering some level of knowledge management.
This thesis describes a model for knowledge management for a small organization with a distributed environment like Seven Stars, with the focus on the Dot Net professionals. The approach is applied within Seven Stars and evaluated.

The first step has been the study of today's knowledge management methods. There is evaluated where most of these knowledge management methods fail and how to overcome this failure. This results in advice to use a simple to use knowledge management method which has less focus on the technology and more on the user.

In order to overcome the failing derived from the study of today's knowledge management methods a new knowledge management method is designed based on this advice. This newly introduced knowledge management method, the User Oriented Knowledge Management Method, consists of today's knowledge management methods base components combined with building blocks from the User-Centered Design (UCD) method.

The focus of the User Oriented Knowledge Management Method lies on user involvement and infrastructure to create a knowledge environment that supports the business strategy.
It consists of three phases:
1 Initial Information Gathering phase which gains information and understanding with the emphasis on knowledge. This information and understanding is used to create a simple design.
2 Prototyping phase creates a pilot application based on the simple. This application is evolves with every iteration where the application is evaluated by the users and based on this evaluation altered.
3 Installation phase which introduces the resulting system to all users.

The User Oriented Knowledge Management Method is put to practice at the organization Seven Stars. Based on interviews with the users, analyzing the infrastructure and business goal of the Initial Information Gathering phase is concluded that it is important that the professionals accomplish their tasks but that also the tacit knowledge needed for this is sometimes hard to gain. Based on the information gained from the Initial Information Gathering phase a prototype is created and iteratively developed to a real useful and likely to be used solution.
During the third iteration the project came to a hold because an organizational wish could not be applied to the prototype. The organization must take a business decision about this.

Although the User Oriented Knowledge Management Method takes the users at multiple steps into account and the users were enthusiastic and cooperative it must be put more into practice to conclude if the method is a success or not.

Foreword

Having started with this thesis project in 2006, this thesis is long due. When, during the creation of the application, I ran into a problem, it was not clear for me how to proceed with this thesis and when I in 2007 started working, it did not made the challenge easier to finish the last part.
Without the support of my Seven Stars colleagues, family, friends and both my university mentors Pascal van Eck and Jeff Hicks with their most useful guidance, I never would have been able to create this thesis. Thank you!
But most of all, I like to thank my girlfriend Esther who kept on believing in me and helped me by pushing me to finalize this thesis.

Thank you,

Erik van Bloem

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1 Introduction

For some time, the importance of knowledge management has been recognized, but failure rates remain high. Despite the importance, and the high failure rates, as of today there are few standards available to guide the creation of a knowledge management system. In addition to this, the material on this for small organization is especially scarce. This master thesis formulates a knowledge management method for a small organization, with particular emphasis on the users of the knowledge management system. The method will be applied within the organization Seven Stars.

1.1 The environment

Seven Stars, founded in 2005, is an ICT-service organization with three primary offerings: customer management, expert recruitment and selection, and contract management. Seven Stars is a young growing company that places ICT-experts in Zwolle and its surrounding area. At the moment it consists of one director, one recruiter and approximately twenty ICT-experts. The director's focus is on all the services the organization provides, e.g. customer management, experts recruitment and selection, contract management, planning the company's future etc. The recruiter mainly focuses on recruitment and selection of ICT-experts. These experts are placed at different organizations to fulfill certain needs of the customer organizations. Figure 1 depicts the main services provided by Seven Stars.

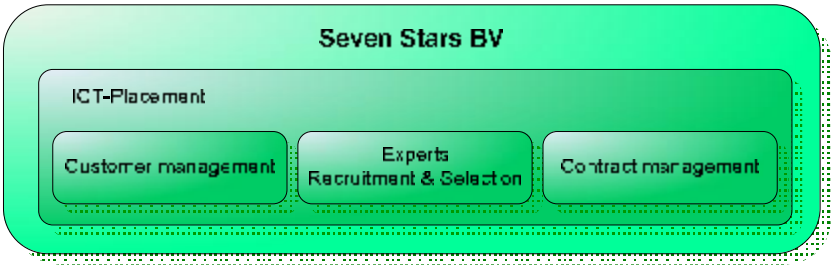

Figure 1: Seven Stars Service

At the moment the organization makes use of experts looking for another job, experts hired from other organizations and freelance experts. These experts have different specializations such as Project Leader, Analysist, Architect etc. and make use of different platforms such as PHP, Java and Dot NET. In the near future the organization additionally wants to create a specialized group, with professionals who will be contracted directly by the organization.
Throughout this thesis these contracted experts are called professionals. These professionals will have much experience with the Dot NET platform. This means Seven Stars will, as depicted in Figure 2, have a group with experts that make use of different platforms, including the Dot NET platform, and a group with professionals that mainly use the Dot NET platform.

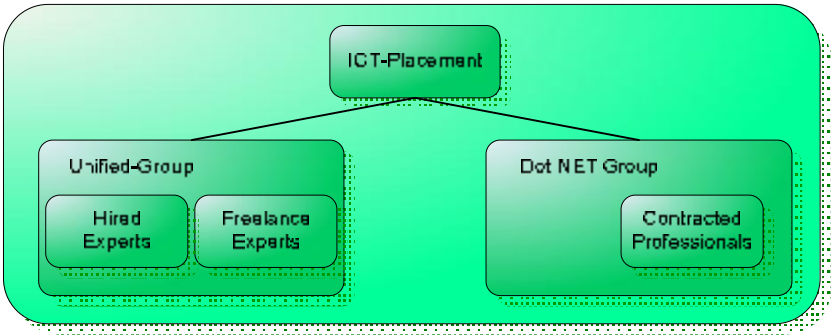

Figure 2: Seven Stars Organization

At the basis of Seven Stars' strategy lays the value discipline: Customer Intimacy [Treacy, 1993].

This strategy is the main thread that runs through the organization and stands for differential and customer-specific solutions. An important factor of a strategy, with Customer Intimacy as a base, is to support our experts that work at other organizations with finding these solutions. This specially applies for the professionals of the Dot NET Group.
Professionals of the Dot NET Group work most of the time within groups at other organizations. These groups will consist of just one or a few members of the Dot NET Group, the rest will be professionals from the customers organization. When creating the Dot NET Group the organization recognized that it is important to support the professionals that are placed at these organizations.

1.2 Research Motivation

Knowledge plays an increasingly important role in business these days and thus most organizations have already begun, or are considering some level of knowledge management. For Seven Stars, every professional has so-called personal knowledge, i.e. experiences, understanding of certain functions and procedures etc. Some professionals have personal knowledge which other professionals do not have and which might be useful for their work. In Figure 3 professional A, working at customer 1, but has information that professional D, working at customer 3, needs. Problem is that professional D does not know professional A very well and does not know that professional A can help him with his knowledge need. This results in professional D having to put in more effort in finding the information he needs. In this situation D might get the needed information from a colleague at the organization where he is placed but this doesn't apply to C.

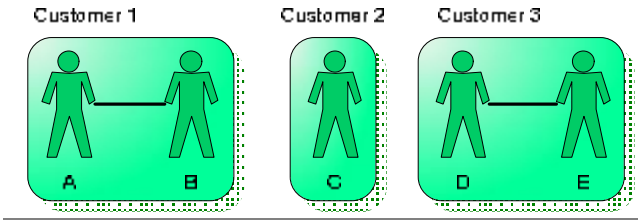

Figure 3: Distributed Situation

Scenarios like the following are not uncommon: A Seven Stars Dot Net professional, who is specialized in user interfaces, needs to know the best way of communication from a Dot Net application to a database, this professional is depicted as professional A in Figure 3. None of the Seven Stars colleagues, professional B, at the customer location know how to do this, nor could the Dot Net professional find the answer on the internet or other known resources. Other Seven Stars Dot Net professionals, professional D and E in Figure 3, do have the necessary database expertise, but are working with a different customer at a different location, and remained unaware of the need. In the end, the Dot Net professional was able to meet the customers requirements, but with much extra effort. Figure 4 describes a possible solution; the Seven Stars Dot Net professional with the knowledge need makes use of the Seven Stars social network, although working at customer location he is still member of the Dot Net group. The professional with the knowledge need, depicted as A, lets in some may know his Seven Stars colleagues of his knowledge need. Professional D, which has the needed knowledge, can then help him gain the needed knowledge.

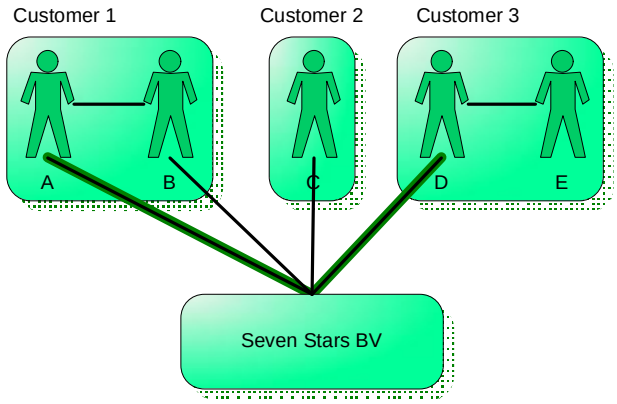

Figure 4: Distributed Situation with Social Network

1.3 Goal

The goal of this thesis is to designs a model for knowledge management for a small organization with a distributed environment like Seven Stars, with the focus on the Dot Net professionals. The approach is applied within Seven Stars and evaluated at the end of this thesis.

1.4 Structure of thesis

The structure of the thesis is as follows:

Literature Review
Some of todays popular knowledge management methods are researched to see how they apply knowledge management. The basic elements of those methods are derived and there is also looked if they go where they go wrong.
Development
The base elements of the knowledge management methods in combination with the elements needed for this case are used to create own method.
Apply method to practice
To really put the method to the test, the developed knowledge management method is put into practice.
Validation
After the developed knowledge management method is put into practice, it is evaluated. There is looked if it successfully achieved its goal, and how it can be improved.

2 Literature Review

In this chapter failure of today's knowledge management methods are elaborated. To overcome these failures in the case, a model is proposed. First of all, however, some basic concepts and terms of knowledge and knowledge management will be introduced to enhance the readers' understanding of the used matter in this thesis. Additional literature research can also be used to widen the understanding on knowledge, examples are literatures such as [Nonaka, 1995], [Davenport, 1998], [O'Dell, 1998].

2.1 Knowledge

There is no single definition of knowledge on which a majority agrees. According to [Fenstermacher, 2005] a common starting point in epistemology is the Socratic dialog Theaetetus, in which Socrates, Theodorus, and Theaetetus discuss the nature of knowledge and conclude that knowledge is "justified, true belief". A more up-to-date definition comes from [Schreiber, 2000] that claims knowledge to be the whole body of data and information that people bring to bear to practical use in action, in order to carry out tasks and create new information. This does not mean that it can only be viewed as part of a person, but it can also be viewed as part of a group, organization or even across organizational levels.
As stated in [Polanyi, 1962] [Tsoukas, 2002], Polanyi makes a distinction between tacit and explicit knowledge. Explicit knowledge is knowledge that has been or can be articulated, codified, and stored in certain media. Tacit knowledge in contrary to explicit knowledge is hard to share. It is too rich and subtle to incorporate in a written report, because of this it is often shared person to person. Tacit knowledge is knowledge that a person carry's in his or her mind, for example the insight a database expert has in the back of his mind about which methods works well together and when to use them.

Knowledge in our context:
As the goal describes the main focus is to support the knowledge needs of the Dot NET professionals at Seven Stars. Those knowledge needs will be work-related. The kind of persons that will form the Dot NET professionals are of high education. Knowledge is closely tied to the person who develops it, and is best shared through direct person to person contacts. This implies that the knowledge will be complex and mostly tacit.
The focus of this thesis is on creating a system that makes the tacit knowledge of the professionals transferable.

Scenario:

Based on the situation of the example described in chapter 1.2, a Dot Net professional, who normally works on user interfaces, must, because he is now working in a smaller team, also work on the inner functionality of the application.
The professional is aware he has to place data in a database and has to make a connection to transport the data. But at this stage the professional has not assimilated the relevant knowledge to design suited database connections. If he now creates the application it probably will take much time and effort and still there is a big change the application creates unwanted results or even creates errors.

A database expert could tell him what is important and how that impacts the application.
For instance, the number of request may have influence on the architecture and used queries, or till what level the ACID properties should be implemented, etc.
The database expert could suggest some reading so that the software engineer can study material so that he, if he is intelligent enough, not only sees the data to be stored but also the rich amount of variables that will determine the best suited database connection.

From the above can be conclude that knowledge in the context of this thesis is:
Something a professional needs to have, to successfully fulfill a task.

2.2 Knowledge Management

The definition of knowledge management changes with the years, but a fairly representative definition is that of the Dutch Van der Spek and Spijkervet [Spek, 1997].

The strife to an optimal use and development of knowledge, now and in the future.

This definition of knowledge management implies that there is more than just acquiring some information and placing it in a database.
A knowledge management strategy has to clearly pursue a goal and address the components:

- the work processes or activities that create and leverage organizational knowledge
- creating and sustaining a technology infrastructure to support knowledge capture, transfer, and use behavioural norms and practices, often labelled “organizational culture”, that is essential to effective knowledge use.

Knowledge management is applied on the definition of knowledge in paragraph 2.1:
Looking to the context of knowledge in the example of chapter 1.2:
One professional of the Dot Net group might have the tacit knowledge another professional of that group needs. The tacit knowledge of the professional, who has the knowledge, needs to be transferred to the professional with need for that knowledge. This converting of tacit knowledge from one person to tacit knowledge of another person is called socialization [Nonaka, 1995].

From the above can be concluded that knowledge management in the context of this thesis is:
Creating and sustaining an environment that successfully supports socialization of the professionals needs.

2.3 Failure

Since the end-nineties knowledge management has attracted more and more attention. To successfully implement knowledge management in organizations, strategies and methods where designed. Many existing knowledge management methods[Aben, 1991][Tiwana, 2000] are there to provide guidance for large organizations with their knowledge management, their literature also comes with examples of large multinationals and how they successfully applied it. The results of these knowledge management methods can include; change in communication, used methods or even change in business strategy but in practice they mainly result in changes to the infrastructure components. This means that organizations create large data warehouses where they store a big amount of organizational knowledge. And when the organizations put their resulting infrastructure component(s) in use, a large percentage seams to fail.

So, despite the knowledge management guidance, many organizations implementing knowledge management fail to successfully implement it. [Fahey, 1998] describes where most organizations did go wrong, and provides advice to overcome this.

The latest trend[Iyer, 2004] of knowledge management are methods that include the business strategies and organizational infrastructure. [Tiwana, 2000], [Gudas, 2007] are such methods, that makes use of the business strategy and infrastructure, that is a well known method. The base components of this method are depicted in Figure 5, it gives an impression on how they relate to each other. The environment impacts the business strategy and knowledge strategy. The business strategy drives knowledge management and the organizations infrastructure components enables knowledge management, resulting in the creation of a knowledge system that is useful for the organization. A knowledge management method that makes use of these components can also be useful for the case, it makes it likely that the resulting knowledge management system fits the organization.

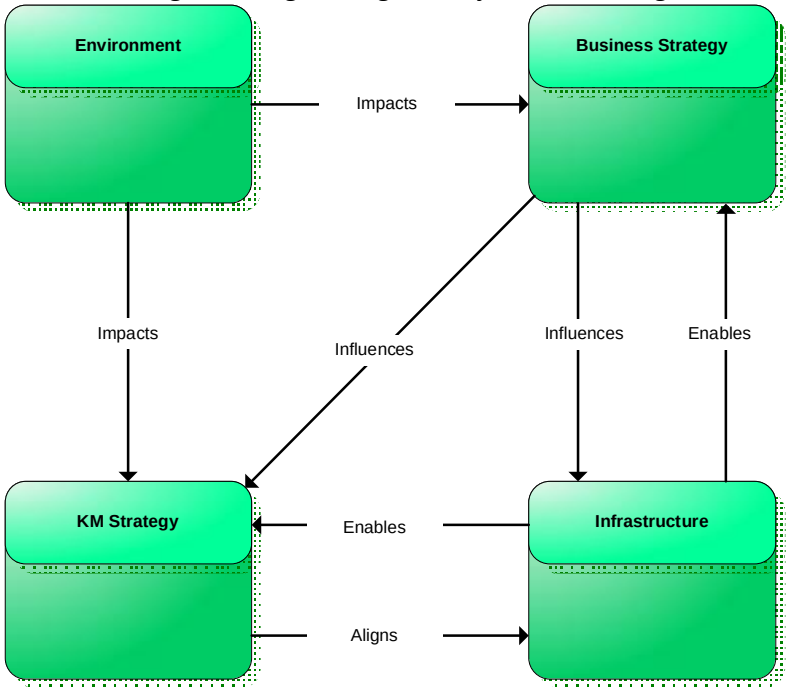

Figure 5: Base Components [Tiwana, 2000]

2.3.1 Not designed for small organizations

Most of today's knowledge management methods are designed for large organizations. Some claim their method can be applied to small organizations as well, but the problem with this is that those methods are unclear as to which operations are useful for a smaller organization and which are not. To which level of detail an operation must be executed is also unclear.

Large organizations also have more resources, money, skills and more infrastructure components, to make knowledge management a success, even though an employee is to knowledge management more important within a small organization than a large organization.

For instance, if a database expert of our example [chapter 2.1] does not like to use the resulting knowledge management system and therefore does not share his knowledge. Within a large organization this is not desirable, but not a mayor problem because there are more database experts who still might share their knowledge. But within a small organization where the database expert is one of only a few database experts or even the only one, this might be a significant knowledge problem.

Because today's knowledge management methods are designed for large organizations and therefore do not take the above problems in consideration, a specific knowledge management method must be designed for the case.

2.3.2 Focus only on technology

Many organizations, implementing knowledge management, have the tendency to focus on the use of technology [Fahey, 1998]. The organizations disconnect the knowledge from its uses, focus on building a technological solution and forget other aspects that are useful for knowledge management like organizational processes and culture. This narrowed focus results in knowledge systems becoming ends in themselves instead of supporting organizational members with their needs.

They view knowledge as something separate from the organizational processes, and independent of organizational culture that helps generate and nurture knowledge[Fahey, 1998]. [Beveren, 2002] has indicated that not only the need to create the right technological infrastructure but also the right culture in which knowledge can be created and shared is important. Although technology infrastructure components may assist creating and sharing knowledge, they will fail to do this without attention to the cultural and organizational context [Clarke, 2001].

2.3.3 Insufficient user involvement

Many organizations fail because the system resulting from knowledge management were not used by the intended user in the way it was supposed to be used or even not used at all. For instance, organizations designed systems with a broad scale of functionalities and then eventually the system was only used for communication via mail. Another example is that some organizations let their employees fill, once a week, a database with data that should, in the management's eyes, support the employees. But almost none of the users made use of this system into which so much time was infested. The problem was that the content was found too general and generic to be useful. The help the users needed to improve their work processes and share learning was not contained in it. Involving the users during the design would have given them more insight in the user's needs, which might have prevented this unwanted result.

2.4 summary

This chapter describes which base components make up today's knowledge management methods, and how they are used for knowledge management. It also describes where most knowledge management methods fail. To make sure to overcome this failing a new knowledge management method will be introduced. This knowledge management method will use the already existing base components in combination with mentioned solutions to achieve the goal, designing a knowledge management method for a small organization with a distributed environment like Seven Stars.

3 Development of Knowledge Management.

In this chapter proposes the User Oriented Knowledge Management Method to make it more likely to succeed the findings of the previous chapter are used to design it to achieve the goal.
A knowledge management method is needed to manage the tacit knowledge of the Dot Net professionals of Seven Stars. Because today's knowledge management methods are likely to fail, as described in chapter 2.3, the User Oriented Knowledge Management Method is introduced.
The main focus of this method will be on user involvement and infrastructure to create a knowledge environment that supports the business strategy. Technology infrastructure components may assist with creating and sharing knowledge, but the focus will lay on the cultural and organizational context.

Chapter 2.3.1 emphasizes that insufficient user involvement, even on a small scale can have big consequences for small organizations. To make sure the to be designed method is more likely to succeed, users should be involved in applied method. In-depth understanding of user behaviour and the reasons that governs this behaviour should be known. This determines if a resulting system, of the knowledge management, will be used. Researching this in-depth understanding of behavior is better known as qualitative research, and can be done by interviewing the users.
Interviewing users should thereby be part of the approach.

One approach where this is the case is User-Centered Design (UCD) [Greene, 2003] which makes use of four phases namely:

- Discovery: gain understanding of stakeholders, goals, problems, and how they may be addressed by technology
- Prove of concept: instantiate and refine understanding in a limited function demonstration system.
- Pilot: iteratively add function to system while it is being used and tested in target environment.
- Deployment: complete and harden system and hand off to operations team

The advantage of this approach is at an early stage a prototype is made which enables the users to work with the system. This has as benefit that, in this early stage, information already can be gathered and user inquiries and evaluations can be used in further development of the system, making it a system that is more likely to be adopted by the users.

3.1 The User Oriented Knowledge Management Method.

The User Oriented Knowledge Management Method is created by combining the base components of today's knowledge management methods with the four phases from UDC. This method consists of three phases as depicted in Figure 6, consists of three phases.

The first phase combines the UCD discovery phase with the business strategy analysis step and infrastructure analysis step of the knowledge management methods. The synthesis step introduces a simple design based on the results of the three previous steps.

The second phase has with the UCD prove of concept and the pilot phase in common that a pilot is created and that it matures in iterations.

The third phase focuses on supporting the user when the system is introduced and keeping up with possible knowledge changes.

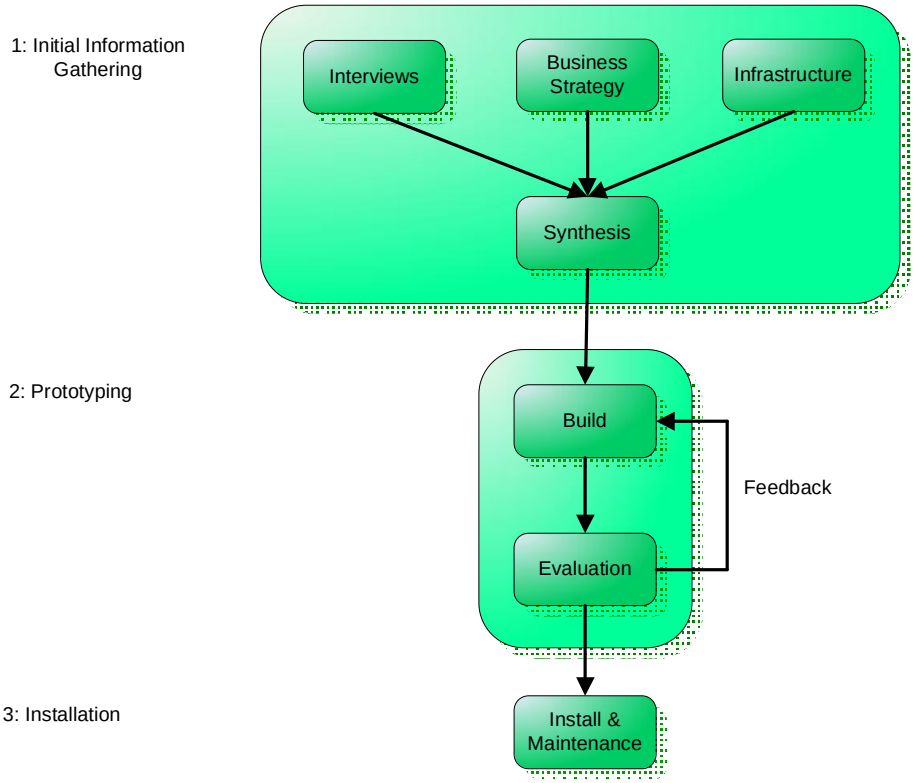

Figure 6: User Oriented Knowledge Management Method

1 Initial Information Gathering

In this phase information is gathered to make the system not only containing knowledge functionalities but also sure to be used by the intended users. Like the UCD discovery phase it's main goal is to gain information and understanding, but with the emphasis on knowledge, that can be used to create a limited system.

The initial information gathering phase consists of four steps; interviews, business strategy, infrastructure and synthesis.

The fist three steps, interviews, business strategy and infrastructure, gather information and understanding about the organization, users, culture, strategies and infrastructure components that is needed to created a knowledge system that not only is useful but also found useful by the users.

The information of the first three steps is used to create a simple design. This simple design will be the base of the, to be created, prototype.

2 Prototyping

This phase starts, like the pilot phase of UCD, with building a simple prototype that through means of iteration evolves in a usable knowledge system.

The prototyping phase consists of two sub-phases; build and evaluation. Based on the design, of the information gathering phase, a simple prototype is made. This prototype is evaluated by the intended users in the evaluation phase, which feedback is then used to create a better prototype. By iterating the prototype phase the prototype will grows into a knowledge system that will be able to manage the needed knowledge and will fulfill the users' requirements and expectations.

3 Installing

Eventually the knowledge system will be ready for use. It will be installed and when put into use, it needs to be maintained.

The following chapters explain the User Oriented Knowledge Management Method, introduced in this chapter in more detail. The method is explained following the sequence of its structure. This means, first the Initial Information Gathering phase is explained, followed by Prototyping, and finishing with the Installing phase.

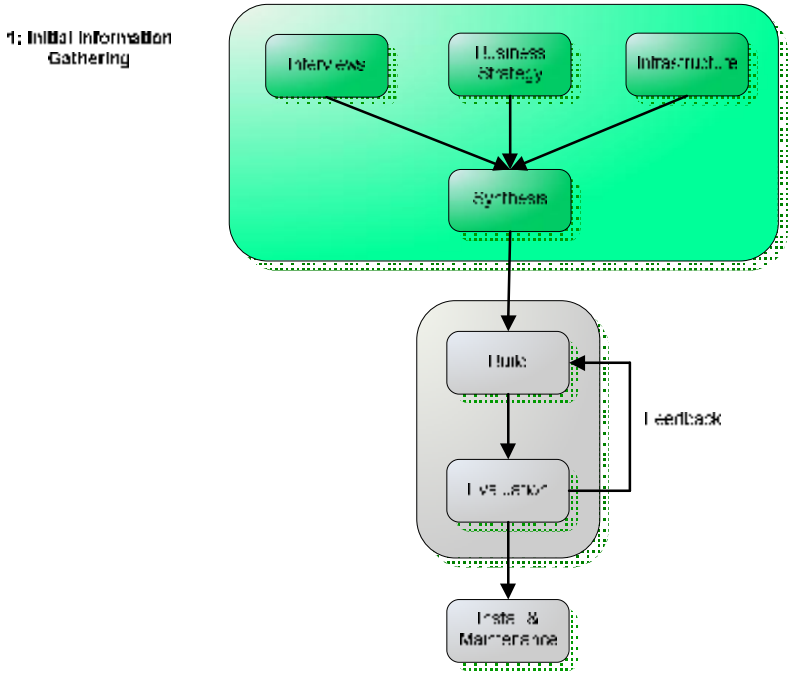

Figure 7: Initial Information Gathering

3.2 Initial Information Gathering

Initial Information Gathering, Figure 7, is the first phase of the knowledge method.
It contains three steps. These are all information gathering steps which gather information that is needed to build a successful knowledge system. The interviews provide user understanding and organizational information which might not be found in organizational documents.
The business strategy step provides information on the business strategy and how it relates to knowledge management. The infrastructure provides an overview of the existing infrastructure components and their properties. There is researched if there are not currently used infrastructure components and how it might be useful for knowledge management.
The information gathered in the Initial Information Gathering phase will be used in the following Synthesis step.
This chapter is ordered as follows: first the interview step is explained, followed by the business strategy and infrastructure. Then is explained how the synthesis step uses the information gained from the previous steps.

3.2.1 Interviews

To make sure the created approach is more likely to be successful, the intended users should be involved in the approach taken. Interviewing the users can provide understanding of their behaviour and the reasons that governs this behaviour. This understanding can help making the resulting knowledge system more likely to be used by the intended users. Besides providing information about their behaviour, the users can provide other useful information for managing knowledge, like information about the organization and infrastructure.

Before interviewing the users it is important to understand them. This chapter is ordered as follows. First, how the user characteristics influence the knowledge system is explained, followed by the case interview. This chapter ends with a short summary and reflection.

3.2.1.1 Users

User involvement is discussed at chapter 2.3.3. At this step user involvement can be implemented by holding interviews with the users. Users are experts of their environment, they know the organization, the methods they use and when, how and why they use it. The involvement of users makes it more likely that the product will be suitable for its intended purpose in the environment in which it will be used. Interviewing the users can help to understand the organization's culture, to know when knowledge is needed, to know what infrastructure components are used to gain that knowledge, etc.
It also helps software engineers manage user's expectations about a new product. When users have been involved in the design of a product, they know from an early stage what to expect from a product and they feel that their ideas and suggestions have been taken into account during the process. [Preece, 1994] argues that this leads to a sense of ownership for the final product that often results in higher customer satisfaction and smoother integration of the product into the environment.

Example:
Looking again to example 2.1, the customers, colleagues at customers location or other stakeholders should be involved with the design, and to what level? A problem might occur if the customer has some concerns, from security to functionality, and not prohibit the use of the system at his location.

The above example shows that other stakeholders beside the future users have influence on the usage of the system. For this reason other stakeholders should not be neglected.
Although the main focus still lays on the user, there can be decided to involve a select few of the other stakeholders or use other means to avoid situations described in the above example.

To make sure the user involvement adds to the development, there must be put some thought about who the users are. Not only look at the infrastructure components they use, and the processes and the activities which support the business. But also look at how and why they do an activity and use, or not use, certain infrastructure components; this is better known as user behavior.

[Long, 1997] states that knowledge management which supports the business strategy must address the organization element 'behavioral values, norms and practices' which is often labeled organizational culture, that are essential to effective knowledge use.

· Values indicate what the user group believes is worth doing or having. They indicate preferences for specific outcomes or behaviours, or what the professionals aspires to achieve. It is important to differentiate espoused values, which are talked about but that don't influence behaviour, from values that truly motivate behaviour in the group.
· Norms are the shared beliefs about how people in the organization should behave, or what they should do to accomplish their work. Norms represent the expected patterns of behaviour. For example, they describe how professionals actually create, share, and use knowledge in their work.
· Practices are the formal or informal routines used to accomplish work. Practices include project implementation processes, team meetings, as well as having conversation at the coffee machine. Each practice – formal or informal – has specific roles and rules (often unspoken) guiding how they are carried out.

Culture impacts the behaviour of the group, depicted in Figure 9. Its values, norms and practices determine if a member of the group will or will not request for knowledge. The member may for instance think that the knowledge he/ she needs is not needed enough to border a colleague. Another example is that the culture of the group may also be competitive, with a result that colleagues are not likely to share knowledge.

Figure 8: Culture and Behaviour Relation [Long, 1997]

These values, norms and practices have influence on if and how the final product is used. By taking these into consideration during the interview stage of the knowledge system model is more likely that the resulting system is to be used in practice.

3.2.1.2 Interview Approach

The main goal of the interviews is to gather information from the users, that is useful for the knowledge management.
One advantage of a young small organization is that it might be possible to interview a large percentage of the employees, which provides a better picture of the organization. If it is not possible to interview a large portion of the organization, it is important to try to make as much use of the different kinds of perspectives by having at least interviews with every kind of stakeholder.

Example:
In an organization there might work 10 professionals, of which 8 are programmers and 2 are project leaders. The developers are young and do not have a lot of experience in contrary to the project leaders. In this case it might be beneficial if it is not possible to interview all of the professionals, to at least interview one person from each group, which is one developer and one project leader.

When preparing an interview it is important to take into account whom you are interviewing. The role a person plays within the organization, their relation towards the organization, their personality, intelligence, etc. all play a role in their feedback.
It might for instance be useful to ask a senior project leader about past experiences with knowledge needs and how was dealt with it.
Most important is to focus on the subjects that probably lead to information that is useful to knowledge management. This means that, based on Figure 8 and 9, the questions can be asked about: the processes and activities, infrastructure and behavior concerning to knowledge.

The method of interviewing does not need to be purely focusing on the questions. Besides a totally structured approach, can it also be lose or semi-structured, although some form of structure is recommended to keep the focus more on the information needed for knowledge management.
One way of guiding the interview is by preparing questions based on the topics and use these as a guide and before starting the interview making the purpose of the interview clear to the interviewee. The latter also helps to create a shared understanding and vision of the work with the user.

Besides interviewing other means to get useful information of the users are videotaping them in their work environment and brainstorming about a topic or possible solution. These methods can be used additionally.

Involvement of the user by means of interviewing ensures that the knowledge system will be better suitable for intended purpose in the environment in which it will be used, especially in the eyes of the intended users who are experts of their environment.
It also helps to create a shared understanding and vision of the work with the intended user and makes the intended user feel involved with the development of the knowledge system.

3.2.2 Business Strategy

It is advisable to have some guidance when trying to successfully implement a knowledge management initiative. By aligning knowledge management to the business strategy, the focus on the most important knowledge needs of the organization is enhanced.

To make sure knowledge management delivers results to the organization, we make sure that knowledge management and business strategy should drive each other.

This is only possible if the two are in alignment. Knowledge management is aligned to the business strategy by connecting the knowledge to actionable goals, depicted in Figure 9 as what the organization must do.

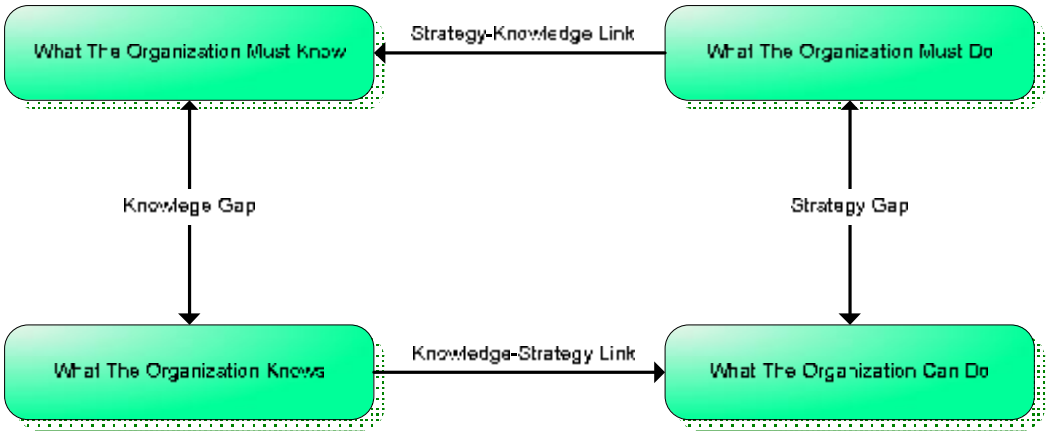

Figure 9: [Zack, 1999]

Members of an organization must have the means to implement the business strategy. One such mean is knowledge. Employees must have certain knowledge to successfully accomplish a task to implement the business strategy. This relation is depicted in Figure 9 as strategy-knowledge link.
If this knowledge is not there, the task can not be executed successfully, it may take to much time or the wanted result stays out. This relation between what the organization knows and what the organization can do is called the knowledge-strategy link.
If there is a difference between what an organization must know and actual knows this is called a gap. When there is a knowledge gap, the organization does not know what is needs to know and therefore can not do what it needs to do. This results in a strategy gap, causing a unsuccessfully implementation of the business strategy, which can lead to not achieving the organizational goals.

Analyzing the business strategy has two main purposes:
1 it confirms the importance of the knowledge needs provided by the users during the interviews.
2 it provides inside in possible knowledge gaps not indicated by the users. These can be addressed during the first contact point with the users.
It provides guidance for knowledge management by focusing on the knowledge needed within the organization. Instead of wandering around and trying to implement solutions to a lot of different kinds of knowledge needs, one more or less important than another.

3.2.3 Infrastructure

It is important to understand the current state of the infrastructure of the organization because the components can be used to support knowledge management. By accurately analyzing and accounting for what is already in place in the organization, an impression is given of what will work and what will not work as part of the knowledge management system. By doing this and by understanding how these components constitute the knowledge management, gaps in the existing infrastructure can be identified and if necessary fixed.
Summarized, the following sub-steps are taken:

- Understand the knowledge management technology framework and its components.
- Identifying the existing components in the organization.
- Understand the components characteristics.
- Recognize the values of those characteristics for knowledge management.

Technical and organizational initiatives, when aligned and integrated, can provide a comprehensive infrastructure to support knowledge management processes. But while the appropriate infrastructure can enhance an organization's ability to create and exploit knowledge, it does not ensure that the organization is making the best investment of its resources or that it is managing the right knowledge in the right way. One minor point of doing it this way, is that the result is as strong as the people who analyze the infrastructure. Small organizations might not have the resources to do a detailed analysis, e.g. they might not have the time, money or knowledge to do this right. The person or team that is going to analyze the infrastructure components and its characteristics must also find a balance to what detail the characteristic are analyzed, too global can mean that you miss opportunities for your knowledge strategy but too much detail will cost time and might cause you to loose your overall view.
Keeping this in mind, organizations with a small infrastructure might find it useful to look further then its own organizational infrastructure.

[Tiwana, 2000] suggest to leverage the internet. For almost all organizations this is an important and valuable technology. Specially for a young organization the internet can mean a cheap extension of their network which enables users to connect anyplace at any time. This distributed connection technology can also be used for resources such as databases and information of sites.
These characteristic are of high value to small organizations, especially those with users working on distributed locations.

Analyzing the current infrastructure and infrastructure possibilities provides understanding of how the infrastructure components support knowledge management and how it can be altered or extended to close knowledge gaps.

Small organization. Limited infrastructure
Distributed organization, what is the impact of it on the infrastructure. Multiple infrastructures

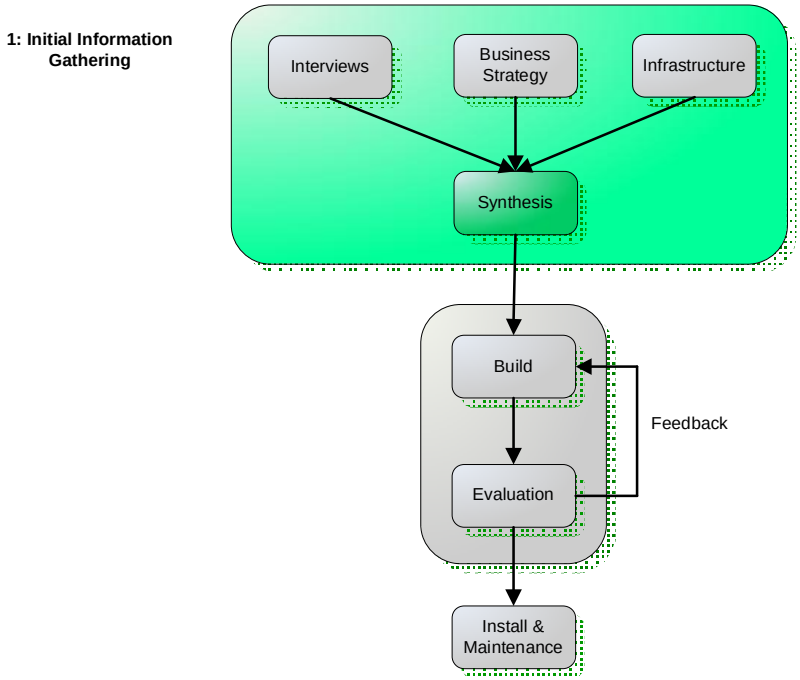

Figure 10: Synthesis

3.2.4 Synthesis

The synthesis step, Figure 11, combines all the information gained at the previous steps of the Initial Information Gathering phase. Based on the business information gained from the Initial Information phase, there can be checked if the knowledge needs that the users indicate to have are important to the business strategy of the organization. If the knowledge needs are found to be important to the organization, there can be checked if the organizational infrastructure can support the knowledge need, or if the infrastructure must be altered to support it.

If infrastructure components must be created or altered, a preliminary design is made.

This preliminary design is created on the information gained for the Initial Information Gathering phase.

To be sure the system will be useful and will be used by the intended users, the preliminary design is made based on the results of the interviews with the users. This will be a description of the functions the users indicated the system must contain combined with some sketches on how it might be implemented, nothing more.

The preliminary design is a rough sketch about how the resulting system must function. But besides the user's wishes, which assures that the system will be used, the system must be made by available techniques and within money and time constraints.

Especially small organizations may not have the resources to implement specific design decisions. This can result in buying or building a system, or even decide to implement an alternate design. And having employees distributed at different locations can also have an impact on the design.

Besides resources, there must also be thought about design characteristics. The preliminary design handles the core functionality, it describes the system roughly and the parts of the design might need change because of security reasons or because there are no current techniques to implement it this way.
Also may some situations change, sometimes rapidly, sometimes on the longer term. The number of users that make use of the system may change, which is called scalability, and the practices of the users may also change which may result in other wishes resulting in other system's functionalities.

When design decisions like used techniques, scalability, security, navigation etc. are clear, the design can be worked out in further detail. But when creating the formal design, it is important to take into account the design is made for a prototype that will change with every iteration. Therefore not every part of the design must be worked out in detail. Use cases are useful because they describe the functions an user must perform and can be used with future user interaction. But class diagrams are likely to change and take a lot of effort to create. Because of this, there might be chosen to only partially create a class diagram.

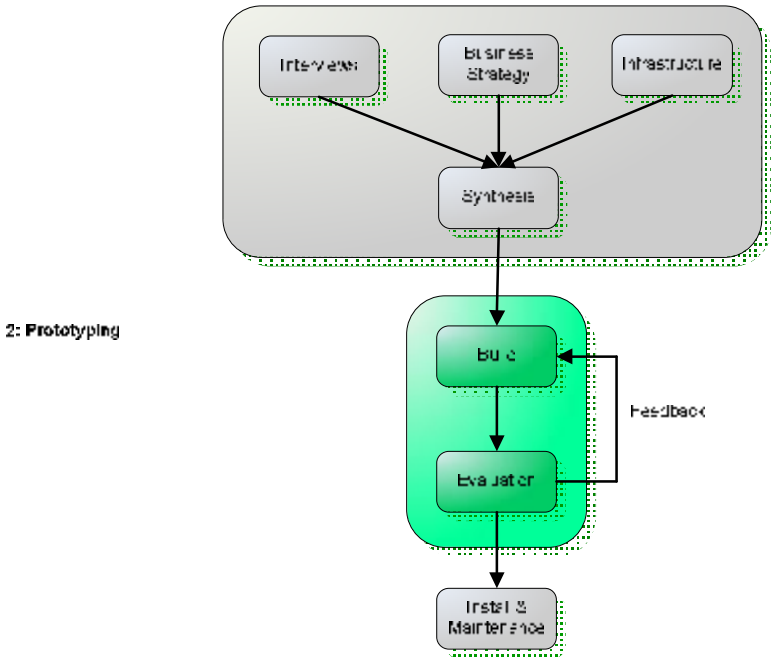

Figure 11: Prototyping

3.3 Prototyping

In the prototyping phase, depicted in Figure 12, a knowledge management system is built.
Based on the results of the synthesis step the first prototype is built. This prototype will be evaluated and based on the feedback from this evaluation the prototype will be altered. These steps, build and evaluation, iterate until a satisfactory knowledge management system is created.
A prototype provides both the developers and the users with ideas on how the system in its final form must function. By using such a prototype, even if it is incomplete, users can see the possibilities of the knowledge management system under construction, and this improved understanding of the final product can lead to, or trigger, highly desirable refinement of its features, interface, functionality and usability.

3.3.1 Build

Based on the design a simple prototype is built, which is just a mock-up or representation of the final system. This prototype is intended to give the users an impression. The first prototype can just contain some core functionalities and not much effort is put into the user interface and is made at an early stage. This because the earlier the testing and evaluation begins the cheaper it is to make alterations. The prototype should be broadly oriented, this means that it should address all the core functionalities, but these functionalities are not implemented in detail.
For instance, when search capability will be part of the system, there can be made use of a standard search algorithm, or the system can contain only a text input box with a search button next to it that does not do anything. Also the navigation may not be implemented; screen may not be linked to each other.
Prototypes are there to add and alter functionality, especially at the first iteration. By keeping the first ones simple, less effort is put in functionalities that at the end will not be used.
After a few iterations the functionalities of the prototype are less likely to change and it will change from a mock-up of the user interface to a highly functional, visually appealing, working prototype of the system.

Make the prototype broad enough to cover all functionalities of the system, when concerned about a certain functions there can be chosen to probe in depth a limited set of functions. But it is recommended to do this only after a few iterations, otherwise much effort might be put in a function of which, after evaluation, is decided to change or even removed.

Polished is not always best. If a visually appealing prototype is used to get feedback on the design, then making it look too polished might reduce the number and types of comments that you receive. The users may assume the design is complete and therefore focus on offering suggestions about the layout and refrain from offering creative suggestions on the functionality. Of course, when the final product is in sight, more effort can be put in the user interface. A well designed user interface allows users to accomplish their task quickly, effectively, and without frustration over the system's usability. It supports the users to easily find information that they need.

3.3.2 Evaluation

The evaluation phase is a contact point with the users. The prototype is evaluated by the users and feedback is given for further prototyping.

A prototype can validate user requirements. Although a functional specification captures the specific items the user pointed out during the interviews, it sometimes fails to convey how the user experiences the prototype. “Walking through” a prototype with an user enables more feedback. Early on in the project, observe users’ reactions on the early prototypes. As development progresses, and interaction with the prototype is possible, let the users use the prototype while observing and analyzing their behavior and reactions. If possible, let the users use the system in reality for a short period, and ask for feedback.

The feedback given by the users will be used building a more evolved prototype. And with every iteration the prototype will evolve more, until eventually the final knowledge system is created. Ideally is this when the users are satisfied.

Be careful when evaluating a prototype, there might be a pitfall. For instance, a prototype that includes placeholders for components not yet implemented may give the user an interpretation of a function the developer interprets in a different way.

The developer has developed a prototype. In this prototype he creates a large text field and explains to the user that that is the place where a document is displayed. They both agree that the document should be displayed in that context.
The developer works on the system and creates an editor where the text is displayed. This editor is integrated in other parts of the system.
When evaluating the prototype at a later stage, the user tells the developer that he had expected a link which then opens Word. This is a must because the text has some properties which require the use of Word.

Besides determining the user requirements enables prototyping the expectations of the future users appropriately. Before presenting a prototype, make sure the users understands what a prototype is, why it was created, and how the design is likely to change. If the prototype is in an early iteration, let the users know that the product may have a different user interface. After more iterations the prototype will have a more visual appealing appearance.

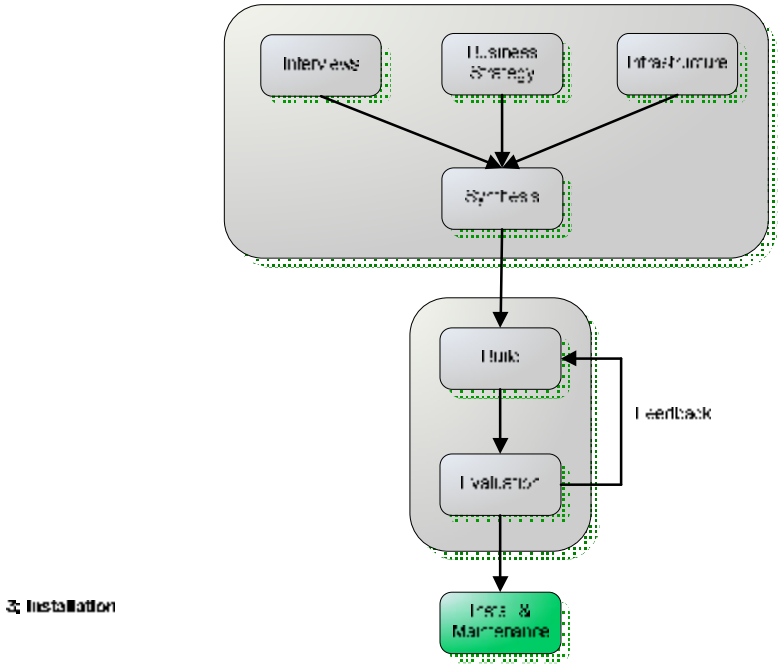

Figure 12: Installation

3.4 Installation

When the final knowledge system is build in the prototyping phase, the knowledge system will be put in use. But simply installing the system, let the users use the system and run away, can result in system that is poorly used and manages the knowledge badly. Before the system is put into use it must be introduced to all the users. A simple workshop and a manual help the users to familiarize themselves with the application, making the step to use the system in practice smaller.

When after a good introduction the application is in use it is important to evaluate the application over time. The organization and its knowledge change over time [paper Hicks], which may cause the need for altering the knowledge system.

Technology also changes over time, there might be developed some new technology which might certain functionality of the system be less useful and therefore it should be implemented in stead of the current functionality.

3.5 Summary

Chapter three introduces the User Oriented Knowledge Management Method to make it more likely to create a knowledge environment for the users. The main focus of this method will be on user involvement and infrastructure to create a knowledge environment that supports the business strategy. The User Oriented Knowledge Management Method consists of three phases as depicted in Figure 6, namely:

1 Initial Information Gathering phase which gains information and understanding with the emphasis on knowledge. This information and understanding is used to create a simple design.

2 Prototyping phase creates a pilot application based on the simple. This application is evolves with every iteration where the application is evaluated by the users and based on this evaluation altered.

3 Installation phase which introduces the resulting system to all users.

4 Practise

Chapter 4 puts the User Oriented Knowledge Management Method into practice by applying it to the Seven Stars organization. This chapter describes the results of this practice. The results are presented in order of the model's structure.

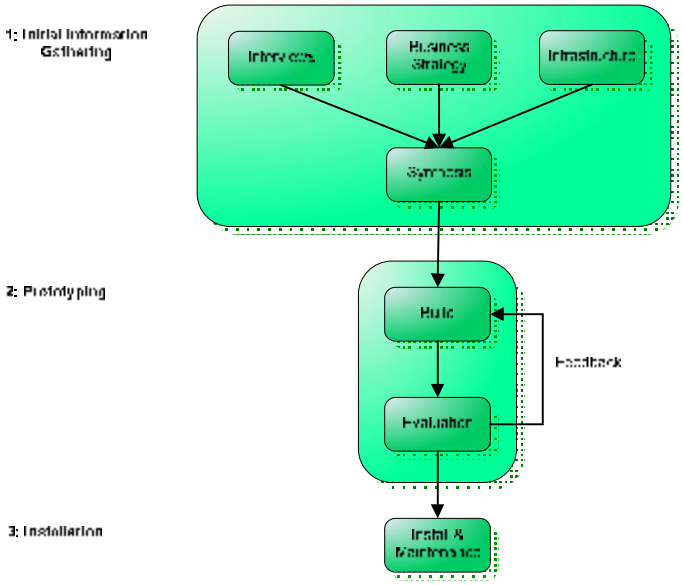

Figure 13: User Oriented Knowledge Management Method

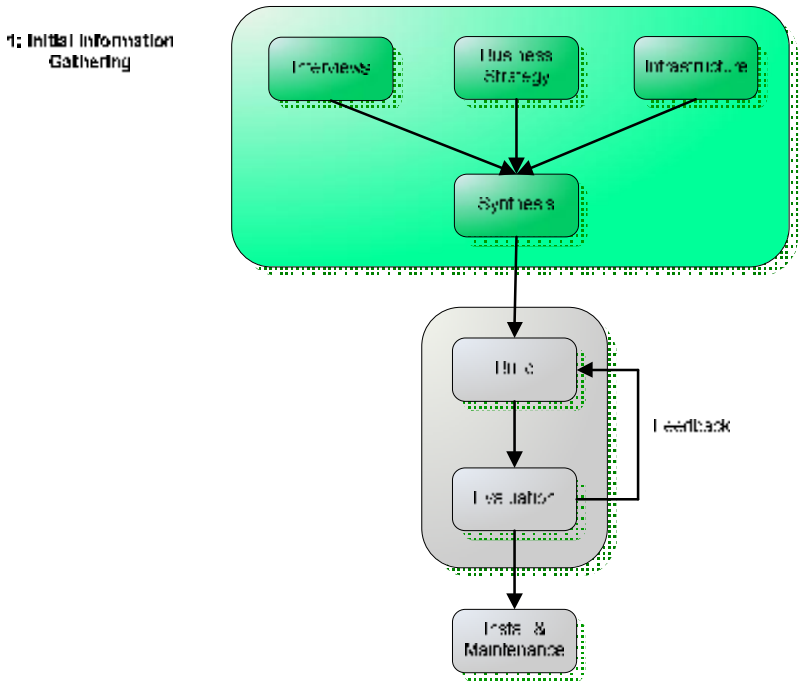

Figure 14: Initial Infromation Gathering Phase

4.1 Case Initial Information Gathering

This paragraph describes the results of the interviews, business strategy analysis and infrastructure analysis, and how from these results a simple design is made. The four steps of the Initial Information Gathering phase are explained per chapter.

4.1.1 Interviews

Although the main focus lies on the users, other stakeholders should not be overlooked. Chapter 3.1 mentioned that not everyone who is a stakeholder needs to be involved by the project, but their effects on the final product be considered.

4.1.1.1 Users

The main stakeholders of the system are:

- Dot Net professionals
  The professionals have, as the goal [Chapter 1.2.2] describes, the main focus, they will be the main users of the system. It is important to understand their knowledge need, culture, infrastructure components and their processes and activities, to successfully create the knowledge management system.

- Mixed group
  The mixed group consists of experts who are placed by Seven Stars at customers' locations, but are not contracted by Seven Stars. They are freelancers or employees from other organizations placed by Seven Stars to work at a customer's location. They have the same work, and therefore the same 'processes and activities' and 'infrastructure components' as the professionals but are only temporary linked to Seven Stars.

- Customers
  The customers are more indirectly involved with the system. This is the place where the professionals works and have their need of knowledge. The customers want the professionals to fulfill the task he/she is given. This of course as good as possible and in as less time as possible. But the customer might also have some other demands; the customer might be a bank or some other organization with sensitive information which they do not want to leak.

- Staff members
  The staff members are an important part of the organization, but they are a totally different group of practice than the professionals. They do link the professionals to the assignments at customers and make use of administrative information about the professionals.

The Dot Net professionals should be interviewed; they are the main users and can make or break the use of the resulting knowledge management system. One disadvantage of the case is, that not all members of the future Dot Net group were contracted when the project was in the Interview step of the Tacit Knowledge Model, Figure 4. To compensate for this disadvantage, the first interviews where also held with experts of the mixed group which already worked a long time for the organization. This way this group of practice is better represented in the first stages of the Tacit Knowledge Model.

Customers do not have a big influence on the project, although they may affect the project with specific demand and their infrastructure. Interviewing the customers is not useful because customers come and go. Seven Stars has many customers, taking all their wishes in consideration takes a lot of effort. With the involvement of the customers the focus might shift from the users to the customers. For these reasons customers are not interviewed.
The professionals are also familiar with the infrastructure components and they are aware of the kind of demands the customer might have. During the interview questions will be asked to clear these demands and to leverage the customer's infrastructure.

Although the staff members are a totally different group of practice and the only link they have with the future users is that they work within the same organization and they provide them with assignments, they can be useful for knowledge management. The staff members are in contrary to the Dot Net group more familiar with the organization and its infrastructure. This because the part that is already contracted did not work, or just a short time for the organization, and the staff members are working for a long time within the organization.
An other reason is that the staff members received notion of experts and professionals indicating that they had a need for knowledge.
The director is interviewed because he is aware of this knowledge need and is familiar with the organization and its infrastructure. He also created the Dot Net group and has a close connection with its members and a large portion with some of the experts.

The interviews where held one-on-one with the professionals and experts so they do not influence each other. The interviews where conducted in a semi-structured way, questions about the subjects; 'processes and activities', 'infrastructure components' and 'behaviour' which are mentioned in chapter 3.1.1 where used to guide the interview. Besides these subjects, questions [Appendix 3] about knowledge where asked to better understand the current state of knowledge use and transfer.

Based on the answers to these questions, other questions were asked to deeper discus the subject. This way more useful input might be gained from the interviewee. This way of interviewing can provide useful information on the subject that normally wouldn't come to light.

Knowledge
Questions were asked about the current state of knowledge to understand how the professionals deal with their knowledge needs and if there are knowledge gaps. Knowledge gaps indicate that the professionals have a need for knowledge but that this need takes a lot of effort to fulfill or can not be fulfilled at all.
Questions 7, 8a, 8b, 8c and 11 are used as a guideline to gain information of the professionals that helps understanding the current state of knowledge and its possible gaps.

Processes and practices
It is important to know what the professionals really do and when they do it.
These can be activities that are part of their work assignment, like implementing, but also less obvious activities like talking to someone during lunch break about work.
During these processes and activities the professionals create, use and share knowledge.
Questions 1, 3, 4, 6, 7 and 8b are there to give inside to the processes and activities of the professionals.

Infrastructure components
Important to know which infrastructure components are used to support knowledge activities. Sometimes infrastructure components are used by the professionals for different activities then where it was indented for. It can also happen that it isn't used at all.
This understanding can help determine the functionalities of the to be created system.
Questions 2, 5, 6 and 8c help to gain this understanding.

Behaviour
The behaviour of the professionals should be considered when designing a system. If the system does not fit the behaviour of the professionals then the system will probably not be used.
Understanding the behaviour of the professional can be critical to the system. For instance if the behaviour of the professionals is that they do not communicate with people on the phone when working at a customer location and the created system depends on this, it probably will not be used. That is why questions about what they believe is worth doing or having, how they should behave, and which routines they use to accomplice their work.
To gain this understanding questions 8c, 9-16 were asked.

Discuss possible solutions with the user. This creates involvement but also help considering other opportunities provided by the professionals.
Besides the interview questions it helps you to understand why certain solutions might work or not work at all.

4.1.1.2 From the interviews can be concluded

The professionals describe his practice as working assignments, which means that they work only for a certain period at a customer and then change environment. These periods vary between just a few months and one or two years. The professional's practices change also per the project, they mostly depend on the role the professional fulfills within the project. When a professional assumes the role of lead developer he has other practices than when he assumes the role of architect. Interpretation of a role also varies from customer to customer.
The infrastructure components, practices, methods and processes also vary based on the customer the professional is working and the role he there fulfills.

But there are infrastructure components that are almost always used, independent of customer or role. These infrastructure components are depicted in Figure 15.

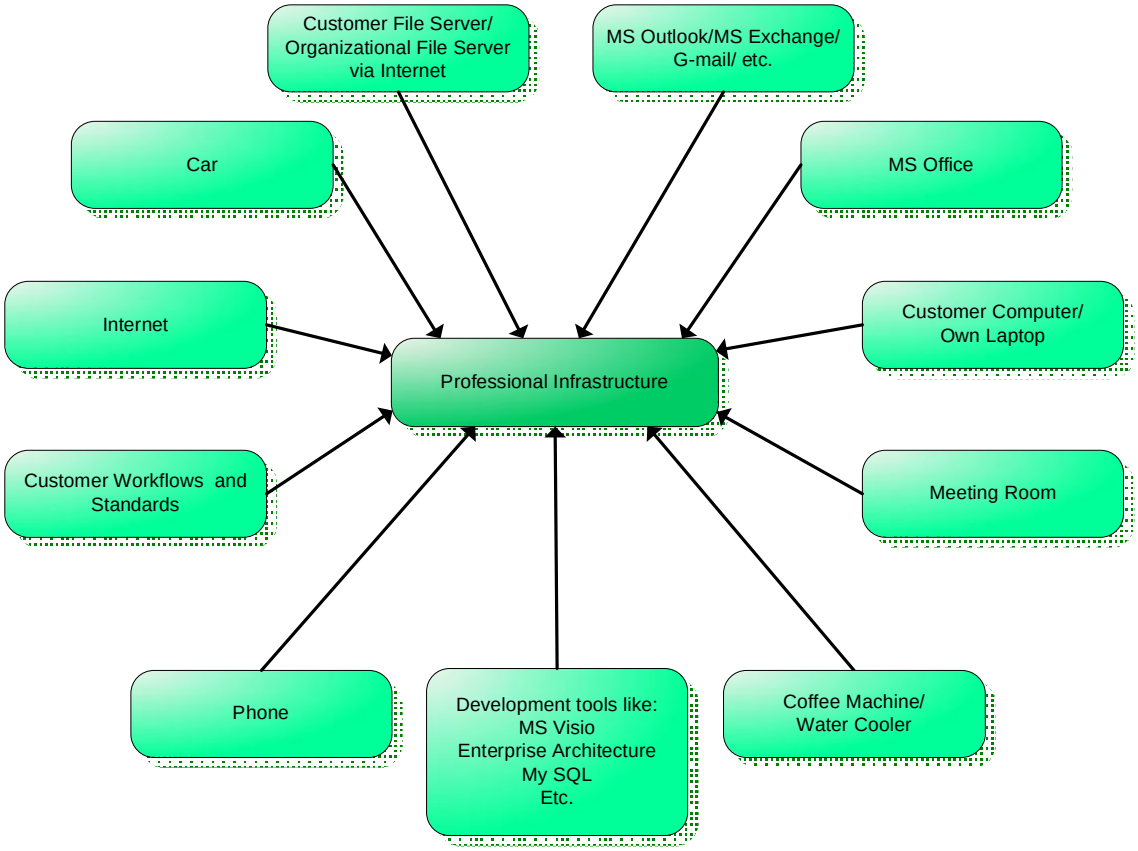

Figure 15: User infrastructure components

Processes and methods change per assignment, but these assignments are part of a project. These projects have always the structure as depicted in Figure 16.

Figure 16: User project structure

Resulting from the interviews the knowledge needs can be divided in two kinds of knowledge needs, namely:

- Organizational knowledge needs
- Technical knowledge needs

The organizational knowledge needs are needs that are specific to the project or the organization. These are needs like how the databases are structured or how what standard is used by the customer organization.
Technical knowledge needs are not specific to the organization or its project. This type of knowledge can be gained by people as well as inside as outside the customers organization. An example is knowledge about how to implement this new technology so that it can be used in certain situation and still is secure.

The professionals indicated that multiple times a day they help others gaining the knowledge they need. These are all kinds of knowledge, organizational, technical, explicit, tacit, easy and hard to gain knowledge.

The technical knowledge needs can be easy to gain knowledge needs, which can be solved by means of explicit or tacit knowledge, but also much harder to gain knowledge, which proves generally to be tacit, like knowledge on security issues with specific technologies or architecture knowledge as mentioned in the example of chapter 1.2. For this type of knowledge need the interviewee needs to put in a lot of effort to gain it. This situation happens to him ones every one or two weeks.

How the professionals solve a knowledge need depends on why the knowledge is needed and on the kind of knowledge. But the professionals follow the flow depicted in Figure 17.

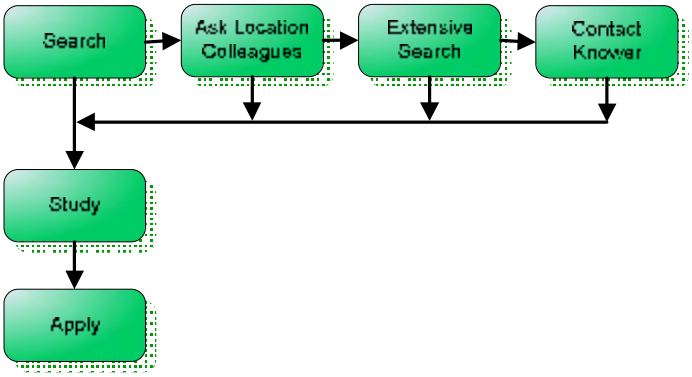

Figure 17: Gain knowledge flow

The professionals indicate that when they are in need for knowledge they generally first tries to solve it himself by searching on the internet, Figure 15. If he does not succeed, they ask their colleagues at the customer location. When they can not help with gaining the knowledge needed, they use their comment as input for searching more intensive for answers on the internet. Only when this also does not help gaining the needed knowledge the professionals mails or calls a person they know who possibly is able to help them with their need. This knowledge is then gained by talking to a person who possesses the needed knowledge and/ or studying the suggested information, and then put into practice.

Most needed knowledge is reasonably simple to gain, the only problem is when a professional is in need of technical knowledge, which colleagues at the customer location and resources like internet and documentation can not support in gaining this knowledge. This hard to gain knowledge is tacit knowledge.

Behaviour: open culture, professionals do not mind helping each other out. They understand that this can save a lot of time and effort, and helps getting work done.
Based on the interviews the following main norms, values and practices were noted.

Value, Norm, Practice	
01 Learn from each other	Value
02 Share knowledge	Value
03 Help to finish project	Value
04 Help to make a good product	Value
05 Help if interested	Value
06 You can contact someone you know to ask hem/her for help	Norm
07 You do not bother someone if you do not need to	Norm
08 You do not bother someone without tying to solve it first	Norm
09 You do not bother someone if he/she is busy	Norm
10 You try help someone	Norm
11 Help people when it does not have a negative impact on your own activities	Norm
12 More likely to help when giving help is not hindered.	Norm
13 More likely to ask someone that person knows well	Norm
14 You should not bother someone if he/she is busy	Norm
15 It is worth bothering someone if the project is at stake	Norm
16 You should try to find it out by yourself before asking for help	Norm
17 The must know the person and know he can help him before he is targeted to be asked.	Norm
18 Checking and answering email	Practice
19 Discussing work related topics at the coffee machine	Practice
20 Search the internet	Practice
21 Help colleague	Practice
22 Discussing work related topics at lunch break	Practice
23 Updating the résumé	Practice

4.1.2 Aligning Knowledge Management and Business Strategy

Seven Stars realizes the importance of strategy. Research about its strategy was recently done. A SWOT in combination with a confrontation matrix and an analysis of the current market determined its current course.

Seven Stars provides, as a service, professional Dot Net developers to customers. With the main focus on quality and innovation, and following P. Kotler's business approach category 'marketing'; satisfying needs and desires of target group more effectively and efficiently. The strategy that the organization follows is based on Customer Intimacy. Customer Intimacy has the main focus on the superior management of the customer experience and relationship. It commits to deliver a high level of service to every customer across all channels. Simply put, Customer Intimacy means knowing a customer's habits and

needs and delivering on, or even anticipating, their needs. This, to the extent that customer loyalty is increased, the customer's desire to switch to a competing vendor is vastly decreased, thus creating formidable competitive barriers.

The main goal of the customer intimacy strategy is extending this customer loyalty, [Heskett, 1994] provides with the service profit chain a relationship between employee and customer attitudes. The service profit chain establishes relationships between internal quality drives employee satisfaction, employee satisfaction drives loyalty, employee loyalty drives productivity, employee productivity drives value, value drives customer satisfaction and customer satisfaction drives loyalty.

The question then rises, how supports the organization the professional so that he/she will be productive and create the needed value. The answer to this is also given by [Preece, 2002], that is by creating internal quality. This internal quality must be viewed from the secondee perspective and is depicted in Table 1.

Table 1: Internal Quality Parameters

Seven Stars provides:
Primary working conditions – Salary etc.
Secondary working conditions – Car, laptop, collective insurance, pension etc.
Interest from our organization – Motivation, support, interest
Short distance to work.
Good job – professional match.

Besides the above, needs the professional to be able to be productive. For this he/she must have the resources to accomplice the customer's assignment. This means the professional must have the right tools, know-how, access to necessary data, etc.

Much of this is provided by the customer. Seven Stars additionalily provides the secondee with basic needs like a laptop to work on, a car to get to the location of the customer and training for basic skills. The customer provides the necessary data, tools and specific organizational know-how related to assignment.

Although the value created by the professional is important to Customer Intimacy, the service of providing this professional also creates value to the customer. It is important that the provided customer is presented in time, but also fits the organization and is able to successful fulfill the assignment. This means that staff members must know the customer, the field in which the customer has its need and the secondent market of that field.

4.1.2.2 Knowledge map

From a knowledge management perspective it is important to know your environment, chapter 2.3. The environment impacts the business strategy and knowledge management strategy, depicted in Figure 18. Changes in the environment, for instance new technical opportunities, can impact the knowledge management strategy. This new technology might be useful in the knowledge management system [Tiwana, 2000], it might bring a solution in the synthesis step.

There are also other influences of the environment that impact the business and knowledge management strategies. Many competitors within a small market can for instance be a reason to change the business strategy. There are big IT service organizations that operate across the whole country, these organizations might occasionally compete with the organization over a customer. But the real competition comes from organizations that, like Seven Stars, are focusing on the region. The organizational focus lies on Customer Intimacy, which strives to quality of service. To accomplice this it tries to be on top of new technologies that might be useful to the customer and provides this service directly to the customer.

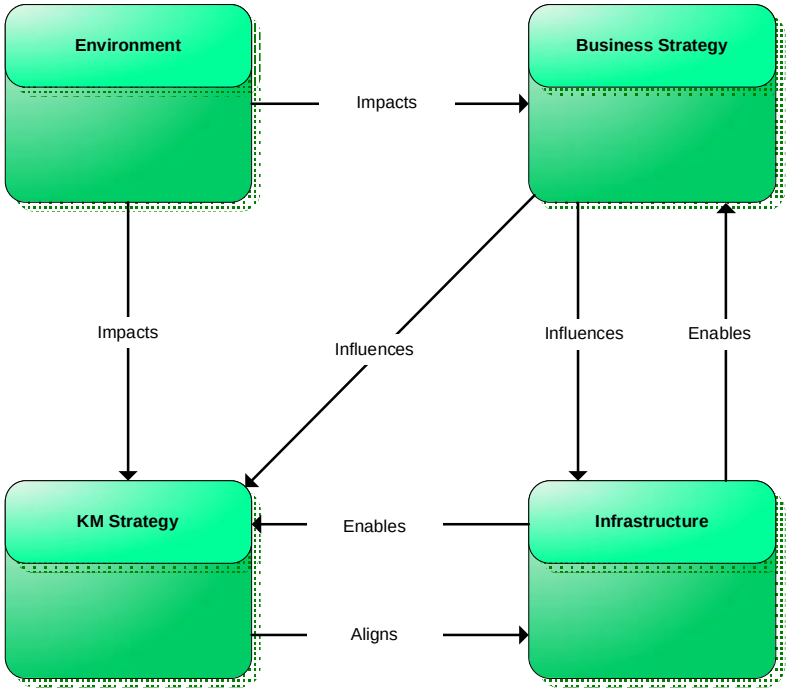

Figure 18: Knowledge Management Methods Components

The competition in the region has their focus on quantity. They want to place as much programmers at customers. These programmers have core and occasionally advanced knowledge. Concluding from Figure 19, not only the organizations business strategy differentiates from regional competitor but also the organizational knowledge. The focus on innovative knowledge is in alignment with the Customer Intimacy strategy. This is as expected, the organization is reasonably young and market research was done when the organization was created.

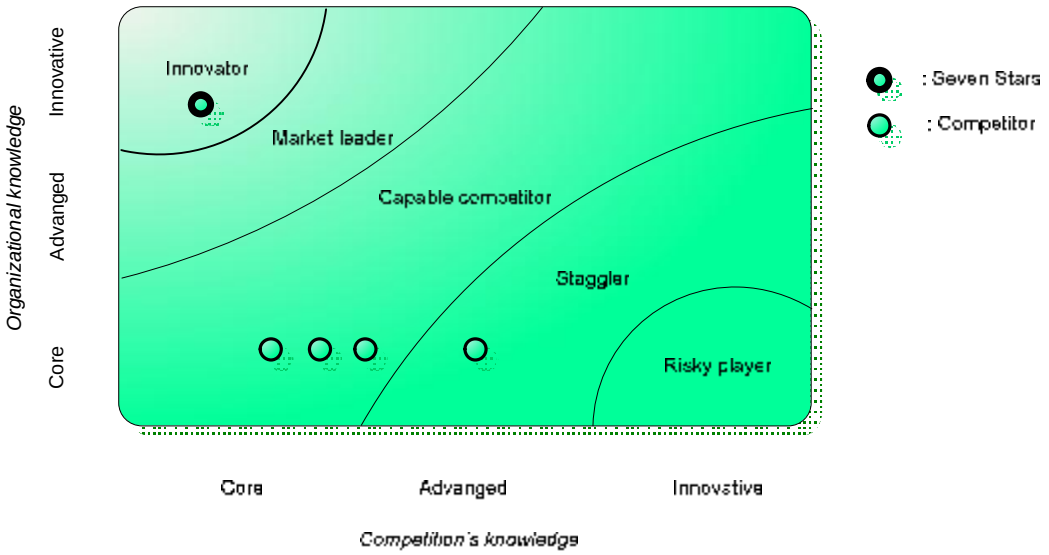

Figure 19: Environmental Knowledge Position

4.1.3 Infrastructure case

The problem with leveraging the infrastructure of the organization is that part of the employees, namely the professionals, works at other companies. The professionals, in contrary to the staff members who always make use of infrastructural components of the organization, have their own infrastructures at the customers' location. This infrastructure is no steady infrastructure. From the interviews can be derived that the professionals have a small base of infrastructure components, the organization provides them with a laptop on which they install their own applications. But their overall infrastructure is highly dependent on the customer. In fact, the professional makes mainly use of the customer's infrastructure. When a professional is finished with an assignment and he switches to a different customer, the professional also switches infrastructure.
Known from interviewing professionals that currently work for Seven Stars, is that until now all professionals are provided by the customer with access to the internet, a phone and a computer. They can also talk to colleagues of that organization. But they make use, or are given the ability to use, only a part of the customer's infrastructure, depending on the assignment and the role they fulfill. An architect needs for instance other infrastructure components than a tester, but might also be depending on something else like organizational policy.

Not having a real steady infrastructure and having most of the infrastructure at the customer location makes it hard to manage the knowledge of the professionals. This because there is no clear understanding which infrastructure components are used and for what. Filling possible knowledge gaps, adding an infrastructure component to the infrastructure to solve or help solving a knowledge need, is hard because the organization can not demand the customer to add components to their infrastructure.

The staff members are in contrary to the professionals working in a static environment. This means that they always work at the office of the organization. The infrastructure at the office can be inventoried and analyzed. When analyzing the infrastructure, it was taken into account that some components of organizational infrastructure can fulfill multiple roles within the knowledge management framework.

Figure 20 depicts the infrastructure components of the Seven Stars staff. The following explains the multiple roles these components fulfill within knowledge management:

- Phone: used for formal conversation making, such as making appointments, intakes

but also informal conversation making to create or maintain a connection with a customer, secondee or a candidate. The main use is information and knowledge exchange.

- MS Outlook: this tool is used for its mailing capabilities, informal conversation,

appointment making and sending and receiving documents such as résumés. A résumé is temporary stored in the mail box till it is decided that they might be to some value to the organization.
MS Outlook is also used for managing the agenda's.
Tasks are also managed in MS Outlook, an example of a task is; at this date we start an advertisement campaign.
The organization is at the moment busy with setting up a groups agenda for all the staff members.

- Maximizer is a CRM tool which is used for managing and storing all customer and

secondee data, such as information about the company, information about meeting with the companies contact person, résumé of a freelancers etc. When a new résumé is uploaded into the system the older version is still accessible.
Maximizer is a collaborative platform for all the staff members where information about the customers, secondees and candidates are stored.

- MS Office is a set of tools used for a number of purposes, the main practice it is used

for is documentation. One of the tools is MS Word, which is used for creating, viewing and altering the résumés.

- Meeting Room: this room is used for formal conversations. Staff members conduct mutual meetings, they have meetings with customers, secondees, candidates and employees. Information from this meeting is sometimes documented and placed in Maximizer or the file system.

- File Server: Not all the documents are stored in Maximizer or MS Outlook. Some files do not fit in the category where these tools are used; they then are stored at the file server.

- Web Server: a server where the organizational website runs on. This is a server which is hosted by an other company.

- Coffee machine: Staff members communicate also when they are getting coffee at the coffee-machine or are for instance on lunch break. For instance, Seven Stars recently got a new staff member. She sits at a desk with a staff member who did this kind of work for a longer period. The new staff member picks things up when watching the more experienced staff member and is sometimes told information about a customer during a lunch break.

- Internet: this is used finding people that search for jobs, for instance on sites like Monsterboard. It is also used for getting other work-related information.

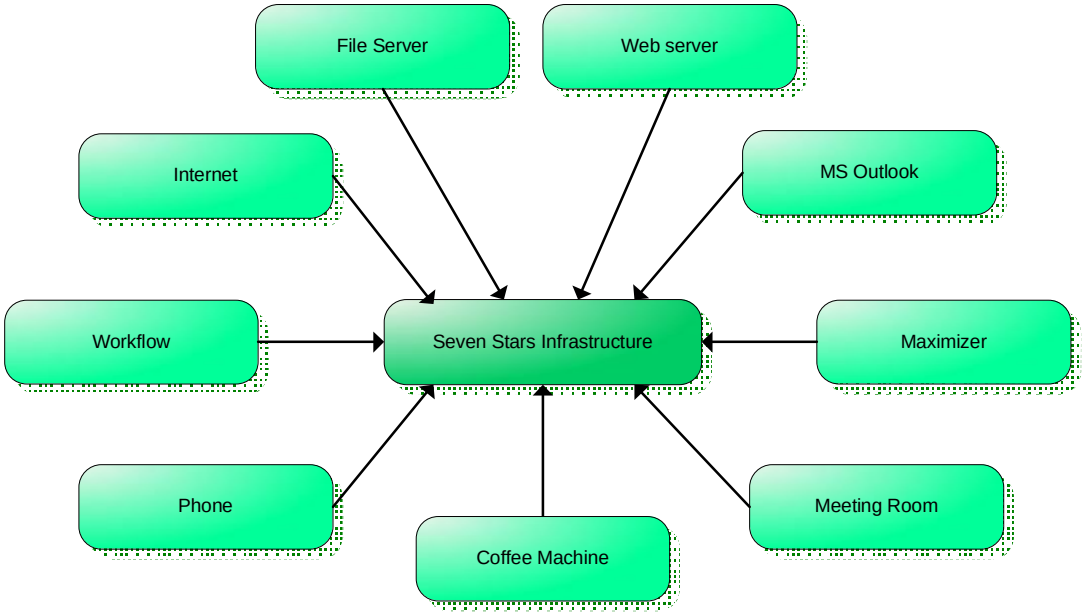

Figure 20: Seven Stars Infrastructure Components

To get a full understanding of the infrastructure components, it is useful to create a workflow that describes how and when the components are used. Understanding the infrastructure components and their functions in the workflow, might help you with brainstorming on how the infrastructure components can help in supporting knowledge management.
Understanding the workflow and the functionality of the components helps with searching for possible new useful components to be integrated in the infrastructure.
[Appendix 1] depicts the workflow of the staff members of Seven Stars.

4.1.4 Synthesis

The synthesis step combines all the gained information from the interviews, business strategy and the infrastructure step to better understand the knowledge needs.

The professionals explain in the interviews that once every one or two weeks they are in need of tacit technical knowledge that is hard to gain. Their normal ways, of asking a colleague or calling a person, does not support them gaining the knowledge they need.

The business strategy step indicates that it is important that the professionals accomplish their tasks. A knowledge need that is hard to gain can endanger the successful accomplishment of the professionals' task, it will take longer or can not be accomplished at all. This indicates there is a knowledge gap.

The interview step showed that one professional might be able to help another gain the needed knowledge. The Dot Net Group consists of professionals all which have a big amount of knowledge about Dot Net. But besides this amount of knowledge that they all have in common, they also poses knowledge that another professional does not have. For instance, they all have knowledge on basic Dot Net but one professional might have specific knowledge on databases and another on architecture. This situation creates the possibility for socialization.

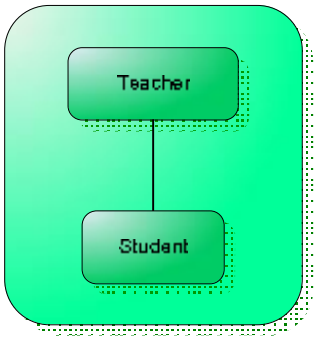

Figure 21: Socialization

One professional is in this situation to teach the other professional the needed knowledge, Figure 21. This for instance, by explaining him the needed knowledge and advising him what to study. The professional (student) need the knowledge to successfully fulfill a task. This ensures that the professional is interested and motivated to create the knowledge by studying and using it in practice. The teacher can share experiences and suggest reading but the student eventually has to put it into practice. [Nonaka, 1994] notes that tacit knowledge is acquired through experience. Referring to the example of 1.2.1, the professional might eventually, after studying and using it a couple of times in practice, not only see the data to be stored, but also the rich amounts of variables that will determine the best suited database connection.

The problem how to support socialization in an organization like Seven Stars is split into the following smaller pieces to make it easier to accomplish:

1 how to effective link student to teacher
2 how to make it likely to be used when people do not know each other
3 how to effective transfer knowledge with possible means

1 How to effective link student to teacher
The infrastructure step as well as the interview step show that there is no infrastructure component facilitating the professionals with gaining the technical tacit knowledge they need. The professionals have limited infrastructure; phone, computer, mail and the internet. The failing of these infrastructure components to completely facilitate the knowledge needs, means there is a knowledge gap. It might be possible to make this gap smaller or even disappear. This because the needed knowledge is already largely within the organization, namely at the professionals working at different locations poses this knowledge. But because the professionals are distributed among customers they are unaware of each others knowledge and knowledge needs, and they are not able to transfer knowledge as depicted in Figure 22.

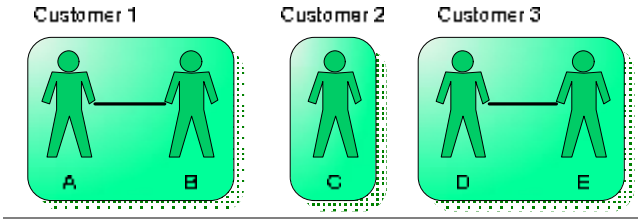

Figure 22: Distributed Situation

A solution to this problem is linking the professionals, and to make sure they are aware of other professionals' knowledge and knowledge needs. One way is a centralized system, as depicted in Figure 23, that links all the professionals to each other and possesses information on there knowledge and knowledge needs, thereby making socialization possible.

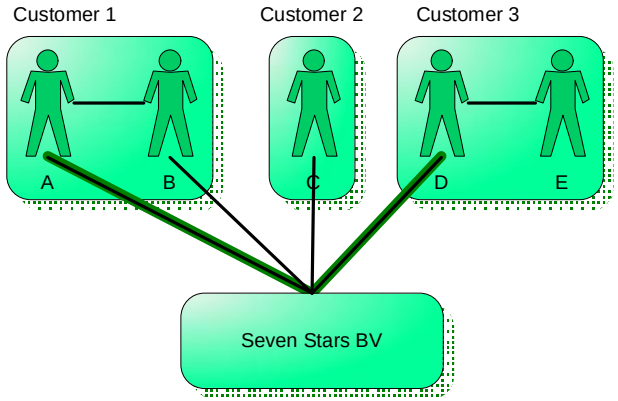

Figure 23: Centralized System

When linking the professionals not only the infrastructure must be taken into account. Linking the professionals must be done effectively; this means that the professionals must use it. To assure this, not only the infrastructure but also the culture must be taken into account. [Long, 1997] describes culture as values, norms and practices, depicted in Figure 7, this influences the behaviour of the professionals. This could determine if a professional will use the system, and so the sharing of knowledge.

To create an effective link, between the student professional and the teacher professional, the culture of organization and the professionals has to be taken into account. The norms, values and practices, indicated by the professionals at the information gathering stage are therefore considered.

The professionals do not mind helping each other out. But this can be taken too far. It is therefore important to try not to overwhelm a professional.
A possible solution is that the requests are categorized so that the professionals who have the knowledge can look for helping others in their specific field of expertise. The problem with this method is that it is depending on the action taken by the teacher. When in need the students do not like to wait until someone decides to look into their need. They probably already invested time in trying to solve it by them selves.
Another method is 'knowing who to contact'; categorizing and mapping who has what kind of knowledge. This way the student undertakes the action, he/she does not need to wait endlessly, the student professional applies a search based on the knowledge he needs. The teacher does not get bothered by many requests for knowledge he/she is only specifically contacted for knowledge needs of his/her field of expertise.

Looking to the context of knowledge in the example of chapter 1.2:
Professional A is looking for help gaining knowledge about databases. Professional A knows by means of a mapping that professional D knows a lot about databases, so when professional A is in need of knowledge about databases he contacts professional D.
The problem that originates from this method is that knowledge can differ over time. Professional B may have learned and worked with databases a lot the last year. This means that the categorization must be updated over time.

Updating the mapping will take effort and time. The professionals share the norm that 'one should help a colleague but the values 'helping others should not have a bad result on your work' and 'it should not take a lot of time and effort' also apply for actions that support and maintain the knowledge system. These actions have less direct results, and are therefore even less likely to be done than by fore instance helping someone over the phone.
A professional is not likely to additionally update a set of categories regularly.
The infrastructure analysis indicated that the organization let the professionals regular update their résumés. These résumés contain information that can be used to characterize the professionals' knowledge.
This way the professionals do not need to additionally update their knowledge characterization, and there is therefore compliant with the norms, values and practices.

This way a system that links the professionals makes use of the organizational infrastructure and is also more likely to be used because it takes the professionals culture into account.

The interviews and the infrastructure analyses revealed that the professionals have access to a limited amount of infrastructure component that they can use at the customers location. The car, phone, mail and the use of internet falls under the few infrastructure components that are often allowed by the customer. Practices also show that these components are used by the professionals. Therefore it is preferable to use one of these components to create the system. The component that is used for the system must support the functionality as described above. A web application can be created to contain the functionality described as above. The internet can then be used by the professional to access the knowledge management system which will run on the organizations web-server.

2 How to make it likely to be used?
The problem with socialization is that it is unlikely to happen if the professionals do not know each other well and if culture does not support it. The professionals' culture is very open and will support it but a problem might occur that the professionals might not ask each other for help or are less likely to support someone to gain knowledge because they do not know each other very well. That the Dot Net group is just formed and the professionals are working at distributed locations makes it even harder to familiarize them with each other.

Sol:
This means that besides providing the professionals with opportunities for interaction and learning, thus supporting their job and their professional growth. The system must also be able connecting the distributed professionals of the Dot Net group into a social network of the organization, thereby preventing unnecessary needs for knowledge.

The organizational infrastructure can be used to support familiarization. The website or knowledge management system can have a message board where the professionals can write occasionally something of interest. New members are introduced on a message board and a digital photo book can helps putting a face on a person's name. They might find additional information about the person. For instance what kind of projects he/she worked on or something simple like they live in the same city. All of this can help it to be more likely to ask a professional for help or help someone to gaining knowledge.

Besides the above alterations to the system which support the professionals social network even at distributed locations, the organization itself can also help. This can be done by organizing occasional formal and less formal meetings, especially when the group is just formed. And one simple introduction does not mean you know a person very well, regular meetings must be organized so that the created contact with the colleague professionals is maintained.

One professional mentioned that it help to integrate some additional features to make the system more likely to be used. Features that interest the professionals like news and a tool to manage when to take a day off.

3 How to effective transfer knowledge with possible means
The knowledge management system must, besides effective link the professional who needs knowledge to the professional who can help with gaining this knowledge and support familiarization, also support transferring knowledge through socialization.
Because this knowledge is tacit the best way is giving it
face to face. But because the professionals work at distributed location other communication methods like phone, mail, video dialog, msn must be considered.

Sol:
Video conversation and Skype can give problems because the customer has to adjust the environment that is used by the professional, they have to install microphones, webcams and make sure the internet connection is suited for this. The customer will also have performance and security issues.

A more likely solution is to create some kind of digital whiteboard where the professionals can sketch situations and with an additional text messaging application for additional explaining. But the problem with this is that it will take much effort for both professionals. The have to be logged into the system at the same time and not busy with their own work.

When comparing these components to the infrastructure components of the professionals, it shows that some of these components already are part of the professionals infrastructure. Namely the mobile phone, mail and internet can be used to support the knowledge transfer.

A more simple solution is to create a web-based application which the professional can approach by internet. The professional can use this web-based application to search for the professional who probably can help him with his need for knowledge.
He can then decide, based on the nature of the knowledge need and the timeframe in which he thinks he needs it, etc. how to contact this professional. When he thinks it is not that important he can decide to mail the professional. The professional can then respond when it suits him and help him with his knowledge need. Or he can decide to call the professional.

The Infrastructure step shows that some of the infrastructure components that can help close the knowledge gap are already in place, which is the phone, mail and internet facility.
One way to gain the needed knowledge might be that the professional with the knowledge need calls or mails everybody. But the problem with this is that the every professional gets a lot of questions, which eventually can overwhelm the professional which receives the calls or mails.

Value, Norm, Practice	
01 Learn from each other	Value
02 Share knowledge	Value
03 Help to finish project	Value
04 Help to make a good product	Value
05 Help if interested	Value
06 You can contact someone you know to ask hem/her for help	Norm
07 You do not bother someone if you do not need to	Norm
08 You do not bother someone without tying to solve it first	Norm
09 You do not bother someone if he/she is busy	Norm
10 You try help someone	Norm
11 Help people when it does not have a negative impact on your own activities	Norm
12 More likely to help when giving help is not hindered.	Norm
13 More likely to ask someone that person knows well	Norm
14 You should not bother someone if he/she is busy	Norm
15 It is worth bothering someone if the project is at stake	Norm
16 You should try to find it out by yourself before asking for help	Norm
17 The must know the person and know he can help him before he is targeted to be asked.	Norm
18 Checking and answering email	Practice
19 Discussing work related topics at the coffee machine	Practice
20 Search the internet	Practice
21 Help colleague	Practice
22 Discussing work related topics at lunch break	Practice
23 Updating the résumé	Practice
24 Discussing work related topics on internet by means of blogs, newsgroups etc.	Practice
25 Read topics of interest on the internet	Practice
26 Writing in a form of worked hours and days off	Practice

Combining the interview, business and infrastructure findings with the above findings from the synthesis step results in the following:

The knowledge management system will be a web application which will run on the organizations web-server and can be accessed by the professionals by internet.
The professionals who need support with gaining knowledge can search for a colleague who can help gaining the needed knowledge. The search mechanism makes use of information derived from the résumés (norm 11, 12). Result is a collection of colleagues who can help. These results are presented as links that link to the personal page of that person (norm 17). This personal page contains different kinds of contact information. This way the professional can decide, based on the nature of the knowledge need and the timeframe in which he thinks he needs it, etc. how to contact this professional. This supports norm 07, 09 and 15. He can call this person on the phone, or when he thinks it is not that important he can decide to mail the professional or put something on his blog. This way professional can then respond when it suits him and help him with his knowledge need. This supports norm 10, 12 and 14.

To make sure the professionals make use of the portal a number of features are added to the portal.

1. Updating the résumé is also possible with the portal (norm 12). There is no additional action needed for inputting and updating needed information into the system. And when they use the portal to update their résumé, they familiarize themselves with the portal and are more likely to use the other functions of the portal. For instance for searching for a professional which probably can help him with the needed knowledge.
2. To make it also more likely to use, extra features are added to the system like a Seven Stars news board where the latest news of the organization is displayed. A photo book where all the pictures and personal info of the professionals are displayed (norms 6, 10 and 13).
3. Photo book helps putting a face on a person's name (norms 6, 10 and 13).
4. Personal page, can additional to helping to put a face on a person's name (norms 6, 10 and 13) also provide additional information about the person.
5. A blog helps sharing knowledge, for most of the professionals it is already a practice.
6. Manage free days functionality is added to make the system more likely to be used. Like updating the résumé it is a function that supports an action that already is practiced by the professionals (practice 26).
7. To make it also more likely to use, extra features are added to the system like a Seven Stars news board where the latest news of the organization is displayed and IT-news bulletin with the latest new of the professionals field of interest (practice 25).
8. A choice for a portal application is made, because of its reachableness. The professionals who work at customers locations are able to use the web-application when they have internet connection. Which is the case with all the customers.

This results in a knowledge management system that can support transfer of tacit knowledge from professional to professional and which also takes the culture with its values, norms and practices into account. Explanation and study provide the opportunity for the professional to better understand the knowledge. After using it in practice, ones or more, it is likely that the professional made the knowledge his own.

The objects used to create the knowledge management system are summarized in the following table:

	Infrastructure	Environment	Norm/ Value	Practices
WebServer	x			
Portal		x		
Phone	x		x	x
Mail	x		x	x
Lucene SearchEngine api		x		x
Résumé	x		x	x
Photobook		x	x	
Personal page		x	x	
Blog		x	x	
IT-news bulletin		x	x	x
Organization news bulletin		x	x	
Manage day off		x		

This results in the following portlets:

Functionality	Comment
Portal manager	A set of portlets that enables an administrator to manage authorization, functionality and portlets.
Log-in portlet	A log-in portlet to make sure only authorized users use the portal.
IT news bulletin	This is made on the welkom page of the knowledge management system. It is implemented by means of a rss-feed.
Organizational news bulletin	A portlet that presents the organizational news on the welkom page of the portal. An additional portlet is created that provides the functionality to manage the organizational news. This portlet can only be seen and used by a user with administrator rights.
Photo book	The photo book portlet displays photo's off the professionals with a name and a link to the personal pages.
Personal page	The content of the personal page can be managed by the professional. Here he can upload a new photo, manage his/ her contact info and manage his/ her résumé. Other professionals can read this to get an impression of the professional.
Search and result protlet	A search portlet that enables a professional to find an other professional that can help him/ her to gain needed knowledge. The query is matched with all the résumés. The results are displayed as links to the personal pages of the resulting professionals.
Blog	A personal blog portlet
Day off	A agenda like portlet where professionals can manage their day's off
Welcome page	This is the main page. This page will be shown when a user successfully logs in. From here the user can choose to go to other pages.

4.1.5 summary

Chapter 4.1 puts the Information gathering phase of the User Oriented Knowledge Management Method into practice by applying it to the Seven Stars organization. The interviews were successful, users described their used processes, tools, infrastructure components and used knowledge, knowledge needs and the process how they solve their needs. Additional to this the infrastructure and business goal were analyzed. By combining information from these three steps can conclude that it is important that the professionals accomplish their tasks but that the tacit knowledge needed by the users for accomplishing their tasks is sometimes hard to gain by the one who needs it although most of the time one member of the organization can help gaining this needed knowledge. This indicates a knowledge gap. To overcome this gap the information from the interviews, infrastructure and business goal also helps providing a useful and likely to be used solution. Based on this information a portal, that helps transferring the needed knowledge by coupling the user who needs the knowledge with the one who is likely to help gaining this knowledge, is designed.

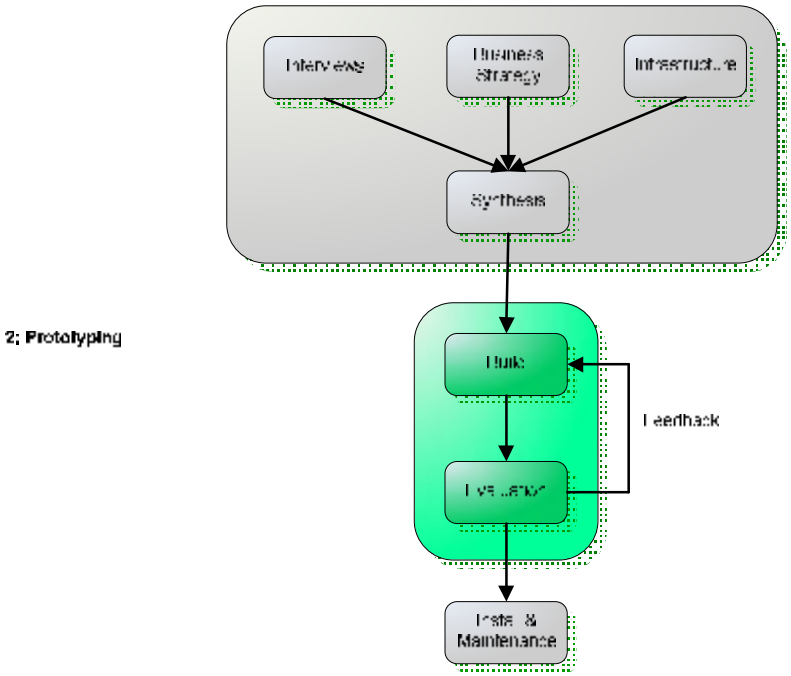

Figure 24: Prototyping Phase

4.2 Prototyping

The result of the synthesis is to create a web-application with functionality described in the synthesis chapter. Based on these results a prototype is build. The prototyping stage is practiced in tree iterations, each with their build and evaluation steps.

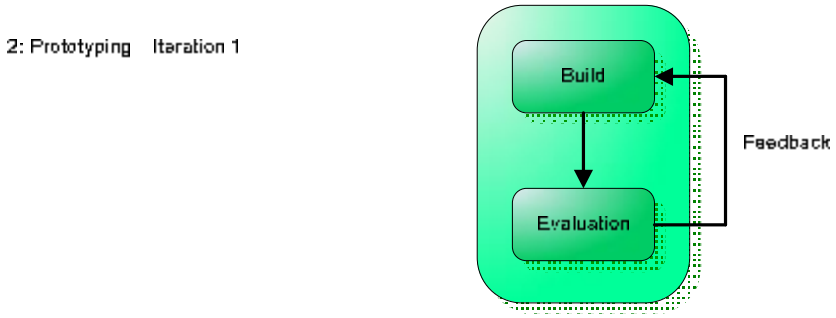

Figure 25: Prototyping Iteration 1

4.2.1 Iteration 1

A prototype is build based on the results of the synthesis stage. This prototype is then evaluated by the users. In the first build some fundamental implementation decisions are made.

Build 1

There is chosen to implement the web-application as a portal is chosen because such a centralized application can have access to various other applications, which creates possibility's like integrating a mail application or a vacancy management tool. Applications can easily be added without understanding the whole application. Various users with different roles can access the different applications with a single access point. It offers the users the possibility to personalize the applications by arranging the views.

After some research there is chosen to use a Jetspeed 2 portal because it one of the few free professional portals that make use of J2EE technology.
Jetspeed 2 has group and role based management, this means that it is possible to easy extend the portal for use additional groups in the future. When for instance in the future, besides the Dot Net group, a Java group is created they can easily be added to the system. They can have their own environment and make use of portals applications depending on their specific profile.

The portal was set up and portlets, small applications within a portal, were created to provide the wanted functionality. The following table describes the functions that are built.

Functionality	Comment
Log-in portlet	A log-in portlet is created.
IT news bulletin	Only an emply portlet is made in which the IT news bulletin will come.
Organizational news bulletin	Only an emply portlet is made in which the Organizational news bulletin will come.
Portal manager	Nothing is done with this function at this stage.
Photo book	A simple photo book portlet was created to present the portraits of the professionals.
Personal page	A simple personal page is created which contains a photo, contact information and a tekst field where the résumé will come in the future.
Search and results	The layout of the search screen as well as the result screen is altered. The search algorithm is made in accordance with de decision.
Welcome	An additional portlet with a welcome text is created.
Navigation	
Blog	A blog portlet
Day off	A simple agenda portlet is created

Jetspeed is built on top of Turbine, an open source application framework from the Jakarta Apache Project. Some of Jetspeed's concepts, such as screens and user information, are borrowed from Turbine. Jetspeed can sit on a number of servlet runners and databases. Tomcat 5.0 servlet runner will be used. Tomcat also acts as a Web server, so an additional HTTP server will not be needed. Jetspeed is bundled with a Hypersonic SQL database. Tables are already created and populated with user data in Hypersonic SQL. Hypersonic SQL runs in process to Jetspeed (and Tomcat), so no additional configuration is necessary. I changed this default database to MySQL because of easy management.

Jetspeed permits the construction of enterprise portals by means of portlets. Portlets are web components that can be used as plug-in and managed by a Jetspeed container. The pages are created assembling portlets, which are pieces of pages and their role is giving information from sources. The use of this technology allows users to construct their own portal, simply choosing where , how and in which page put the portlets with the different contents. In order to consent the portability between commercial portlet containers, the java community process has been asked to create a standard for portlets (jsr 168*). Portlets created for the Knowledge Management System will follow this standard.

Framework and components used in Jetspeed

Let's start to see in a logical-functional way how pages are assembled. The assembling of portlets in a page is made by Turbine. Turbine is a Jakarta framework for the creation of web application according to the paradigm MVC[Johnson, 1987].
Turbine gives services and functionalities, particularly by means of the actions , services in background and template. For template Turbine uses Velocity or the Jsp. Velocity is a Jakarta template engine, with his template (.vm Velocity macro) it is possibile to have access to java objects in his context. Velocity represents the view of Turbine. These templates are used in the prototype to configure java objects like portal components and portlets.

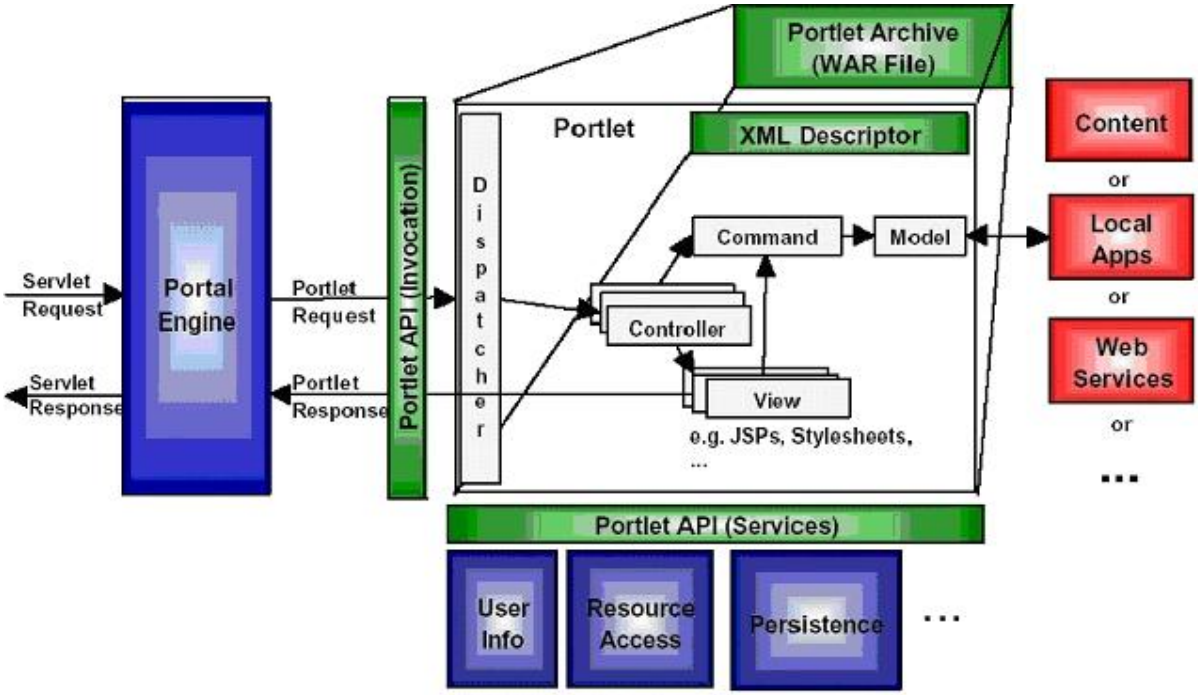

Figure 26: Jetspeed Portlet Interaction

The knowledge management system is build on top of the Jetspeed Portal Engine. It makes use of it's features such as security, user management system. For the user management system Jetspeed already had some portlets implemented. For specific knowledge management features portlets were created and combined with the Jetspeed Portal Engine.

The portlets were compiled as a war-file into the Jetspeed Portal Engine. Such a war file consists of Java classes, JSP's and Stylesheets for the functionality and a XML Descriptor for specific features such as portal placement en communication.

The total architecture of the Knowledge Management System looks as follows, Figure 23.
At the base is Tomcat 5.0 as Webserver with integrated JEE Web Container. On top of this runs Jetspeed 2.0. The Pluto and Lucene APIs' where put into Jetspeed for extra functionality.
Pluto for extra portlet communication and Lucene for it's' search capability.
To manage user Jetspeed has it's own user management system called JCMS. This JCMS is implemented as a portlet. Jetspeed had also it's own logging portlet but because of the need of additional functionality a own logging portlet was implemented.

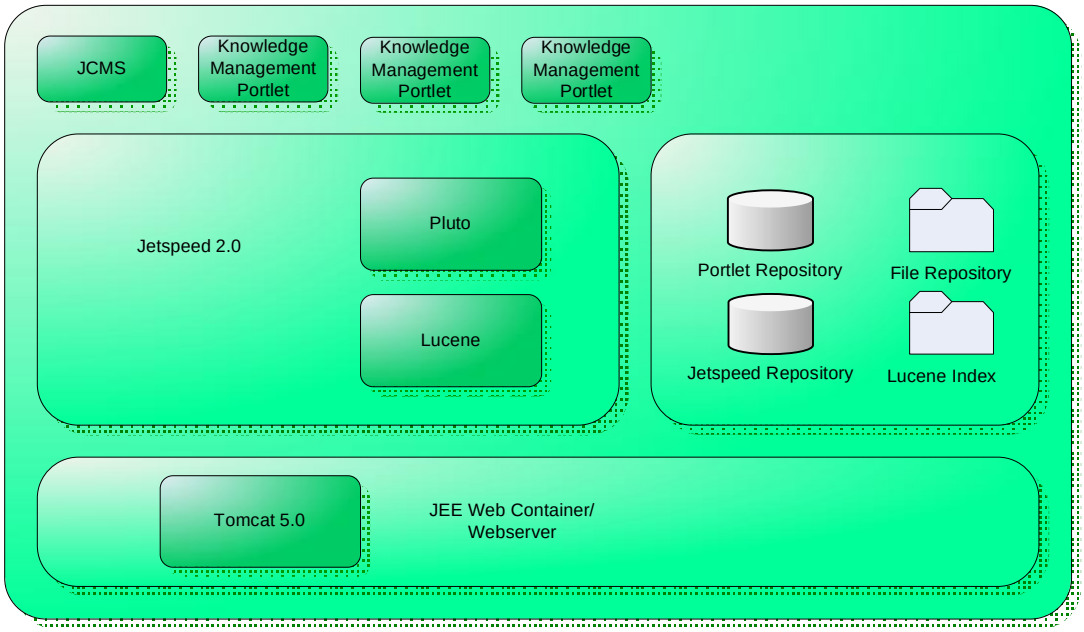

Figure 27: Knowledge Management System Architecture

The Knowledge Mangement System consists also out of portlets that are specially created for this system, these are in Figure 27 called Knowledge Management Portlets.
These provide the application functionality the professionals will use, such as log-in, creating your own profile and adding a résumé to it, searching trough résumé's to find who can provide the needed knowledge.

These functionalities provided by the portlets make use of data. The application data and the user data are placed in a Portlet Repository. This is a MySQL database which has relations to Jetspeeds' own Repository because of its close interaction.
The résumé's are place in a File Repository, a dedicated directory where the résumé's are placed after upload and alteration.
The File Repository is also used by the search engine. When an alteration or upload of a résumé occurs this directory is scanned for indexation.
These indexations are then placed in a Lucene Index Repository, which is used for searching for knowledge terms.

Evaluation 1
The evaluation of the prototype started with a small explanation.
The goal of the evaluation, that they give there opinion about the functions of the prototype, the usability were explained. Also was explained to them that they had to expect that the prototype is just a robust system which did not look all fancy and some of the functionalities where not implemented jet.

When the goal of the evaluation was explained, the prototype was presented to the users.
The functionalities where shown by presenting the screens of the prototype and explaining with each screen which operations can be preformed and what the goal of this operation is.
While walking through the prototype its functionality was discussed.

After the presentation, the users were asked to give their overall opinion about the system.
Enthusiastic

The feedback of the users, from the presentation and the discussion afterwards, was:

1 Stick to the goal of the system
The futures users recognized that it is important for the users to make the system more likely to be used. Some indicated that they liked the idea of having a photo book integrated in to the knowledge management system, but warned for putting to much extra functionality into the system. Having to much functionality in the system that does not contribute to the goal of the system can distract the user of the indented goal of the system; gaining the needed knowledge. One future user indicated that the managing free days functionality does not need to be in the system, besides there are already organization tools on the marked that help the organization manage functionalities for their employees including managing their day off.

Decision 1:
A list was made of all the functions in the system. The functionalities were, with help of the user, categorized and prioritized. A decision is made not to further develop the day off functionality.

2 *Reorganize prototype structure & layout.*
During the presentation of the prototype some users pointed out that they were expecting some functionality at different places.
They pointed out that the resume is presented in a space that is to small, because of this it is hard to have an overview of the document and it results in a lot of scrolling.

Decision 2:
The changes proposed by the users where all easy to implement. Based on the opinions of the users some structure of the knowledge management system was changed.

3 The search method
The current search method is not totally implemented in this stage. The professionals résumé is represented by a simple text file. This text file contains the same structure as the résumé used within the organization. The file contains personal information followed by a problem definition and a sum of used tools and methods per attended project.
The search algorithm just counts the number of times a term occurs in the text file. The users indicated that they probably would use a tool name or technique term to query their search.

Decision 3:
The search algorithm will be further developed; the weight of the résumé will based on grades of the different projects mentioned in the résumé. These grades are based on the amount of times a tool name or technical term is mentioned in this project.

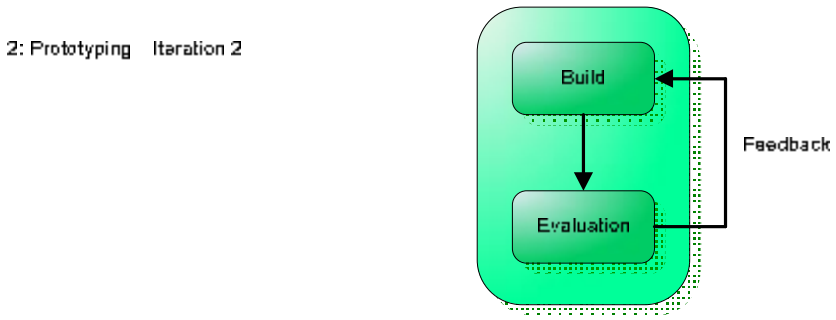

Figure 28: Prototyping Iteration 2

4.2.2 Iteration 2

The second prototype iteration is used to extend the already build functionality and implement the decisions based on the feedback from the previous evaluation stage. Additional to this the navigational flow of the portal improved. After these implementations the resulting build is evaluated by the users.

Build

The below table describes the alterations build during this iteration. The explanation that follows describes the alterations, based on the decisions made during the evaluation stage from iteration 1, in more detail.

Functionality	Comment
Log-in portlet	A log-in portlet is created.
IT news bulletin	This is made on the welkom page of the knowledge management system. It is implemented by means of a rss-feed.
Organizational news bulletin	A portlet that presents the organizational news is created on the welkom page of the portal. An additional portlet is created that provides the functionality to manage the organizational news. This portlet can only be seen and used by a user with administrator rights.
Portal manager	A portal manager is created where an authorized person create user id's, group users per role or group and manage content.
Photo book	The photo book portlet was given more form and links to the personal pages.
Personal page portlet	The content of the personal page is altered. Fields added are repositioned and show data from the database. A FCK editor is integrated to present and give the ability to alter the résumé.
Search portlet	The layout of the search screen as well as the result screen is altered. The search algorithm is made in accordance with de decision.
Blog	Removed from the portal
Day off	Removed from the portal

Decision 1:
Based on the decision made in the previous iteration, the development of the day off management portlet and the blog portlet is taken to a hold. These portlets are removed from the portal.

Decision 2:
A large number of small alterations were made to the flow and structure of the portal. Most of the alterations were repositioning or resizing screen objects from which the following are more important examples.
- The results of the search engine will link to the personal pages of the selected person.
- An additional button is created on the menu which links to the personal page. This means that the personal page is accessible via the photobook page and via the main menu.
- The resume will take in a larger portion of the personal page.

Decision 3:
The layout of the resume will be standardized; it will consist of two parts. The top part of the résumé will present the personal information like contact information, a function description etc.
The second part of the resume describes the history of projects a professional has worked on. This part is used by the search engine. Per project the company name, a short description of the project, the goal of the project, used techniques, used tools and used methods are described.

This standardization of the résumé makes it possible to create a more mature search algorithm.
The position a résumé gets in the result list is based on its weight. The weight of the résumé is based on grades of the different projects mentioned in the résumé. These grades are based on the amount of times the search term is mentioned in this project.
This means that the algorithm differentiates between projects.

Evaluation
The following decisions were made based on the users recommendations when they evaluated the second prototype:

1 Hierarchy in questions asking
During the evaluation of the system a professional indicated that the more experienced a professional is, the more likely he is asked to help with the need for knowledge.
The same can happen with the knowledge management system. A professional with a large and divers résumé is more likely advised, by the system, to help gaining the needed knowledge than a professional with less experience. This can result in a situation that one professional or a small group of professionals are always advised to help, and they are overwhelmed or even bothered.
Earlier findings note that professionals like to help but till a certain amount.
The problem here is how to spread the load of helping others gaining knowledge.

Decision:
During a discussion with a professional the question was raised: how do professionals solve their problems when within a project. The professional pointed out that he often ask people on the same level or just one level up in the hierarchy. Only when this does not help they ask for instance an architect.
This hierarchy model can also be used within the knowledge management system.
Although the professionals sometimes assume other roles at a customer organization, the professional has within the organization a main role to fulfill. The search algorithm can be altered so that professionals, higher up the hierarchy than the knowledge seeker, have some form of counterweight. This way a professional with the same role is more likely to be advised to help with gaining the knowledge.

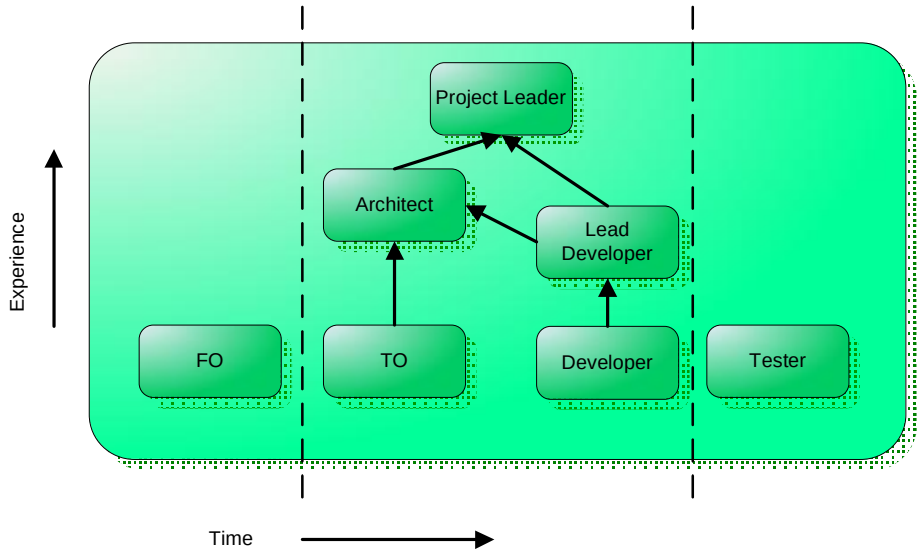

Figure 29: Professional Hierarchy

2 The use with organizational software.
Beside the professionals the system was also evaluated by the director of the organization.
His comment about the editor, that is used to present the résumé, was that he had other expectations. The editor used is one of leading WYSIWYG editors named FCK Editor. This editor is a lightweight version of MS Word. It has all of the basic functionalities but the director wanted to have MS Word mainly for its layout functionalities.

Decision:
There is looked at the possibility to integrate MS Word into the system. This must be a solution with MS Word on the server side although the customers probably would have MS Word. This because they would not permit that one of their programs is used to send data onto the internet and alterations need to be made to MS Word.

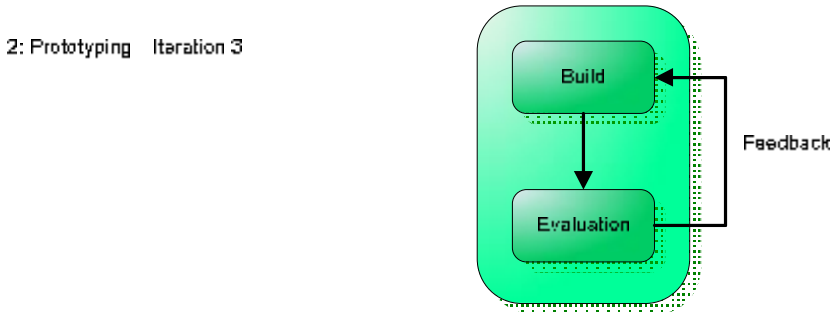

Figure 30: Prototyping Iteration 3

4.2.3 Iteration 3

The third prototype iteration is used to extend the already build functionality and implement the decisions based on the feedback from the previous evaluation stage.

Build

Before the implementation is started, the possibilities to use MS Word as an editor are analyzed.
The problem is that a professional must be able to edit his or her résumé, client side, although the résumé file and MS Word, that must be used to edit the résumé, are on the server side.

The result of the analysis was that there is no standard solution to this problem, the possible but still uncertain solution is highly technical. This solution is to make use of Web-based Distributed Authoring and Versioning (WebDAV), which is a set of extensions to the Hypertext Transfer Protocol (HTTP) that allows users to collaboratively edit and manage files on remote World Wide Web servers [WebDAV, 2007]. WebDAV looks like an ideal solution because it makes use of HTTP, which is less likely to be blocked by the customer's firewalls. But the problem remains that an application must be created that makes use of the protocol and therefore enables the professional to manage their resume with server side MS Word on a secure way.

This possible solution is highly technical and will take a lot of time and effort to be realized. If it is possible to realize it is still not certain if it will solve the problem in real world. It might still not work for some unforeseen reason.

Decision 1:
Because the knowledge management system does not apply to all the wishes it is not deployed in the organization. A decision must be made about the problem that the wish, of the director, to use MS Word as an editor can not be integrated in the knowledge management system. This decision must be made by the organization. A decision is made to stop this building on this iteration.

4.3 Installation

Because the practice of the User Oriented Knowledge Method in chapter 4.2.3. has been taken to a hold, the Installation phase is not reached.

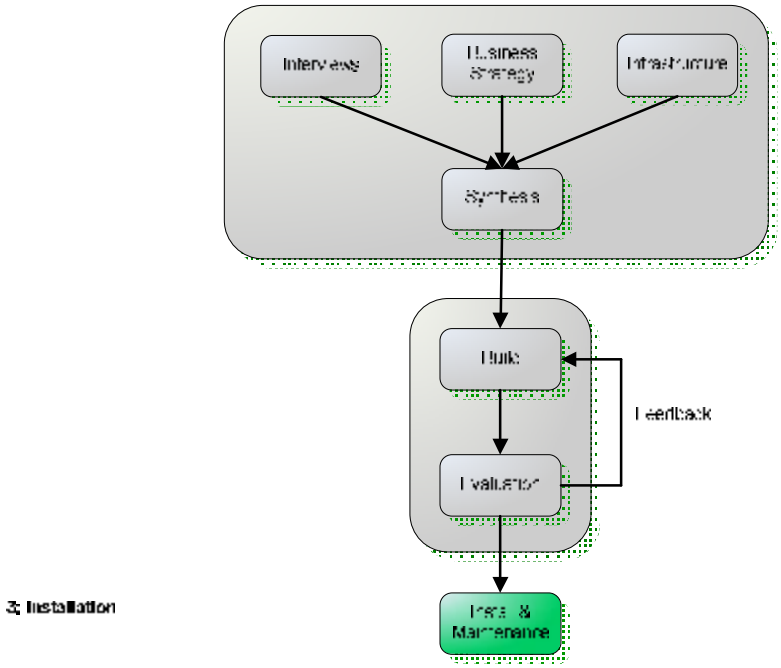

Figure 31: Installation

5 Conclusion and recommendations

Although a problem occurred in the practical execution of the knowledge management method and therefore the practical execution sadly came to an unexpected hold, this chapter looks back to the goal set in chapter 1.3. This chapter evaluates the presented knowledge management model.

The goal presented in chapter 1.3:
The goal of this thesis is to designs a model for knowledge management for a small organization with a distributed environment like Seven Stars, with the focus on the Dot Net professionals.

Something can be said about the knowledge management method although a problem occurred. The problem that causes the practical execution of the knowledge management method to a hold is a technical problem, there is no indication that the features provided by the knowledge management method or the knowledge management method itself is lacking.
A decision on how to proceed must be made by the organization. Following the conclusion a number of propositions are explained to provide some support in making this decision.

In chapter 2 this was clarified by additional to the knowledge management method setting three focus points.
1 focus on the user.
2 not only focus on a technical solution but also other solutions.
3 being able to be used by small organizations.

1 focus on the user
The focus was on the professionals who are intended to use the resulting system. This focus was present during to whole lifecycle of the knowledge management method. During the Information gathering phase, where the users were interviewed and the infrastructure analysis had a focus on the infrastructure components used by the user. The users were very open and they provided a lot of useful findings and information. Some of the user went even further by introducing possible solutions.
During the Prototype phase, the uses were enthusiastic. They liked to see the prototype which was build based on their input. They were involved and did not mind to review the prototype.
But especially in the early evaluations the users had comments about the layout. It was even sometimes necessary to mention a second time to them that the evaluation was mainly about the functionality.

2 not only focus on a technical solution but also other solutions.
In the Tacit Knowledge Model not only focuses on technology. It recognizes that the users play a big role in transferring knowledge and that not all knowledge can be stored on paper or in a computer. Tacit knowledge can sometimes only be gained by studying and practicing. A technological solution may support it, but it still is the job of the user to gain that knowledge.

3 being able to be used by small organizations.
The Tacit knowledge model can be used by the organization Seven Stars. It does help to have knowledge about the know

There can not yet be said that the model provided the wanted result, because the prototype is not put into use. When the knowledge portal is put into use and the professionals actively use it to gain tacit knowledge, only then can be said that the tacit knowledge management method worked.

Before there can be said that the Tacit Knowledge Model is successful or not, it should be put more into practice. Findings from these practices may offer some help better the model or provide guidance on how to put it into practice.

5.1 Recommendations

By putting the Tacit Knowledge Model into practice I found out that:
1 When starting the Prototype stage, it is advised to start with a paper version of the prototype. Present this prototype with a very detailed explanation to the users. This way, the prototype is evaluated before time and resources are infested in setting up a working environment, configuring servers etc.
2 It is important that in the evaluation step the prototype is explained in detail. Make sure that the user and the person explaining the prototype are on the same level. This way, surprises and misunderstandings at a later stage of the development are made to a minimum.
3 It is important to way the remarks made during the interviews and evaluations. Not every remark can be used to better the system. It is important to filter the remarks so that the ones that are useful to knowledge management are used. In these manners it helps consider how a remark supports the to be achieved goal.

5.2 Proposition

There can be made a decision to Because the limitations of Jetspeed, other ways to implement the functionality; the professional can edit the resume on the client side, must be considered.

Possible solutions are:

1 Sharepoint:
Sharepoint is created by Microsoft that serves as a framework for setting up of an internet site for information exchange and online cooperation within a group or organisation. It can be used for exchanging information and documents or ideas, but also for setting up forums, surveys or planning activities. The aim of Sharepoint is that information is shared in the correct manner with the correct person. SharePoint know two alternatives: Windows Sharepoint services where the emphasis lies especially on the so-called collaboration services and Microsoft Sharepoint Portal server where, as the denomination indicates, the emphasis lies on portal use.

Sharepoint makes use of the .Net framework. This makes the integration with Office is almost optimal, implementing a coupling with Word so that it is possible for the professionals to manage their résumé.

The advantage of this solution is that it can be implemented on server side, so the environment at the customer location does not need to be altered.
Downside to this solution is that it is costly.

2 IBM Websphere:
The WebSphere Portal Document Manager integrates with Microsoft products and allows for centralised file management. It allows users to create folders and open documents from within the portal and displays the document in HTML; it also allows editing of the document without the need for the user to have Word installed. Butler Group considers this ability to integrate with the Microsoft Office product suite a major benefit to organisations as it now enables sharing directly from Microsoft Windows and Microsoft Office.

All the above solutions can be considered to solve the problem of editing a MS Word file on client side. But before considering one of these solutions I must mention that adding such functionality to the knowledge management portal means that this can give serious security issues.

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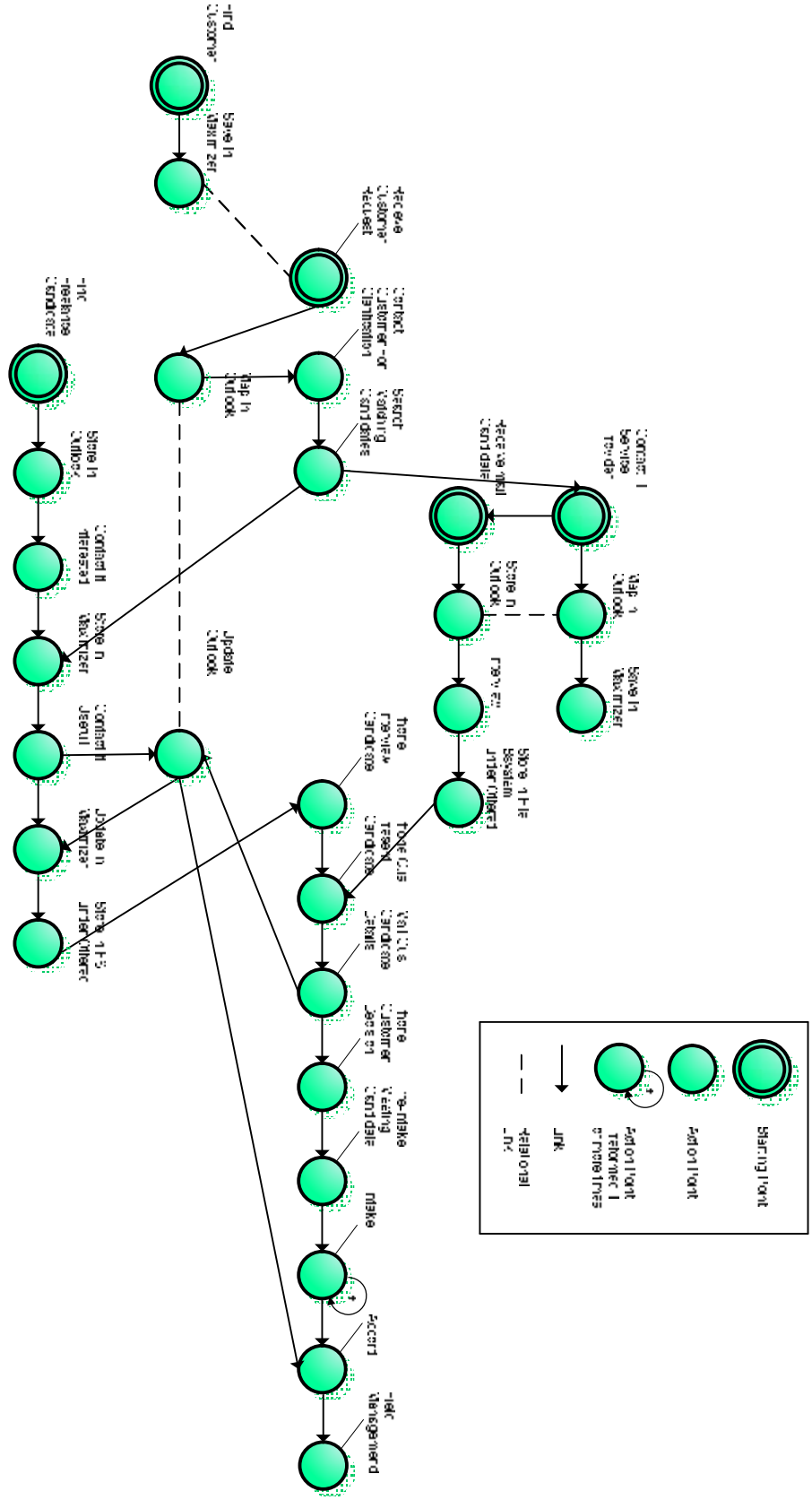
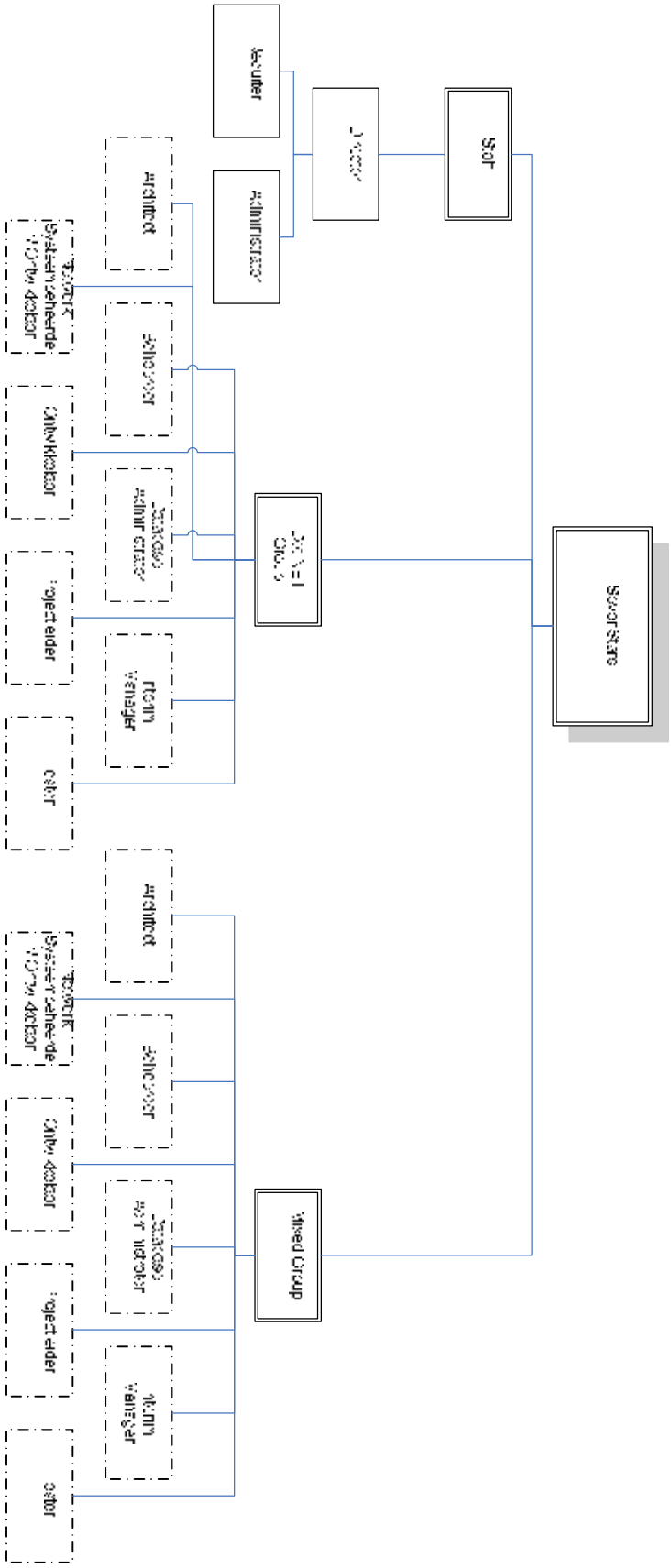
Appendix



Appendix 1: Workflow Staff Members



Appendix 2: Seven Stars Organizational Structure

- How would you describe your practice (activities)?
- Which infrastructure components do you use?
- Can your practice been seen as part of a process, if so how?
- Which processes and methods do you make use of?
- Which tools do you make use of?
- How do the tools relate to the activities?
- Which of your activities do you consider knowledge intensive?
- How often are you in a need for knowledge?
    - At what stage?
    - How do you solve your knowledge need?
    -
- Can there be a reason, to ask or not to ask a certain person when you are in need of knowledge?
- How often do you provide others with knowledge they are in need of?
- What kind of knowledge do you provide? Can you give an example?
- Can there be a reason not to provide knowledge to a person in need?
- Do you see ways to better the knowledge transfer?
- Do you foresee possible problems?
- How would you describe the culture of your 'community of practice'?
- How would you describe the organizational culture?

Appendix 3: Interview Questions

Server Toevoegen aan infrastructuur componenten, dit voor het draaien van het systeem
2 soorten infrastructuren, bedrijf en klant

Interview 1

The professional describes his practice as working assignments which means that he works only for a certain period at a customer and then changes environment. These periods vary between just a few months and one or two years.
The professional's activities change also per the project, they mostly depend on the role he fulfills within the project. When a professional assumes the role of lead developer he has other activities then when he assumes the role of architect. And the interpretation of a role also varies from customer to customer.
The tools, methods and processes also vary based on the customer he is working and the role he there fulfills. Most of the time he assumes the role of developer, and he has activities like implementing and changing the technical design. But these vary when he assumes another role. Regardless of the role he checks his mail and discusses work related topics at the coffee machine, during the lunch walk, during work with a colleague sitting nearby and occasionally by phone.

The professional indicates that most of the time the use of his laptop is permitted, and depending on the customer he works behind his own laptop or behind a working environment specially set up for him. The use of internet, mail and mobile phone is permitted and also is visiting a website to find needed knowledge.
Internet is used to find information, email is used for work related-communication.
He uses his phone for communication that can not wait or that uses much interaction between both parties, like a discussion.

To accomplish his assignments, mostly in the role of developer or lead developer, he makes use of Microsoft Visual Studio, Google, Microsoft site, Gmail and Microsoft Exchange,
where Microsoft Visual Studio is used for developing applications in Dot Net.
He uses Google is for looking things up, the Microsoft site and other similar sites are used to find information that can help him gain knowledge. He uses the Microsoft site and discussion sites to keep up to date and gain information and Gmail and Microsoft Exchange are used for simple communication.

The interviewee works most of his assignments as a developer in the implementation stage. When he starts on a new assignment, there is always time to familiarize himself with the environment so that he can understand the project, the organization and know the people he is working with. This means that he talks with someone of the organization, the technical designer, lead developer and other developers, and walks through the designs and some already existing code. In this phase he indicates that he has the most need for knowledge, but this is mostly project or organization specific knowledge which is solved by talking to project members.
After and during the familiarization phase he works mostly on implementing the application and attending meetings about the project. During this phase he still has an occasional need for project or organizational knowledge, and starts having more technical knowledge needs.
These technical knowledge needs can be easy to gain knowledge needs, which can be solved by means of explicit or tacit knowledge, but also are much harder to gain knowledge, which is mostly tacit, like knowledge on security issues with specific technologies or architecture knowledge as mentioned in the example of chapter 1.2. For this type of knowledge the interviewee needs to put in a lot of effort to gain it. This situation happens to him ones every one or two weeks.

How he solves a knowledge need depends on why the knowledge is needed and on the kind of knowledge.

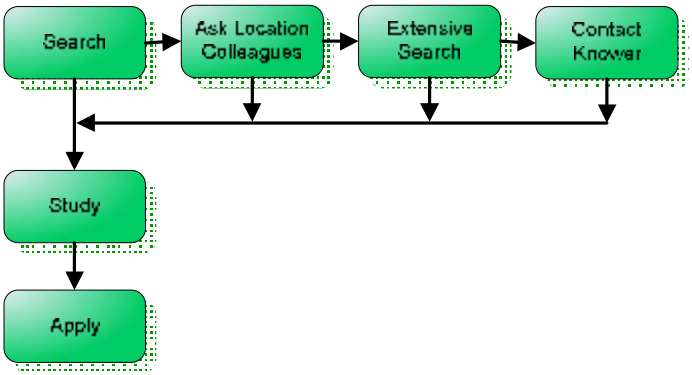


Figure 13

The interviewee indicates that when in need for knowledge he generally first tries to solve it himself by searching on the internet, Figure 15. If he does not succeed, he asks his colleagues at the customer location. When they can not help him gaining the knowledge he needs he uses their input for searching more intensively on the internet for answers. Only when this also does not help him gaining the needed knowledge he mails or calls a person he knows who possibly is able to help him with his need. This knowledge is then gained by talking to a person who possesses the needed knowledge and/ or studying suggested information, and then put into practice.

A reason not to ask or postpone asking a person who might be able to help the interviewee with the needed knowledge, is that he does not want to bother that person. It can be that the interviewee knows that that person is busy or he thinks he might have asked that person too often for needed knowledge.
The other way around may also happen. It can happen that a person asks for knowledge, and the interviewee knows that this person asks a lot for help but never helps others with their needs. Therefore he might decide not to help him at this stage.

He indicates that it happens that people working on the same project do not see each other. This is because of the timeline and the line of work; a person working on the functional design can be finished with his work when a developer starts with his part of the project.

The interviewee finds it important that a person does his best to accomplice an assignment and is also provided with the means to do so. And code exchange is because code can be copied and altered to your use.
Professionals have norms like helping each other out and they do not want to bother people too much. And they are not likely to share code, this because they are affright to be judged.

Interview 2
This professional also describes his practice as working for a certain period at a customer location and then change environment to another customer. He indicates that most assignments start as an assignment for just three months, but are mostly extended to periods of six months till two years.

The activities he performs are depending on the assignment, and also depend on the role although this is of less importance because he often has the same role. Activities like checking mail and discussing work-related topics at the coffee machine, during lunch walk or during work with a colleague seated nearby him, he mostly see as independent of the assumed role.

The professional indicates that most of the time the use of his laptop is permitted, but customers mostly want him to work at a working environment specially set-up for him. The use of internet, mail and mobile phone is permitted.
He makes use of the internet for searching on information, MS Outlook for mailing and managing his agenda, MS Word to document, and his phone to quickly call someone he needs to talk to. For his main activity, developing, he uses the tools MS Visual Studio and Enterprise Architecture. Besides developing, the professional also attends project meetings and sometimes consults with a person one-on-one.

Most of his knowledge needs occur during developing and occur once a day. This is knowledge he gains from his nearby colleagues or finds on the internet after consulting with his colleagues. It happens one or two times every week that he is really stuck and then he calls someone of who he thinks can help him gaining the needed knowledge, this can be a friend or an old colleague which he still has contact with.
He resolves his knowledge need by searching on the internet and asks colleagues at his working location for information that can help him gain the needed knowledge. If this does not help, he searches more thoroughly or calls a person of who he thinks might help him with his knowledge need. This will be a person he knows well and of which he thinks probably can help him.
The professional indicates that sometimes, additional to calling, e-mails are sent to provide extra information. Links, e-books or specific summaries that are useful for gaining knowledge are sent to the one with the knowledge need.
The professional uses, beside supporting the initial conversation, mail not often for knowledge purposes. He argues that when everybody sends mail, he gets a lot of mail in his mailbox of which only a small portion he can help. And when addressing mail to multiple people, lots of people think that one of the other people probably will answer the mail and therefore do not answer.

Approximately four times a day someone comes with a knowledge need to the professional. It happens multiple times a day that someone comes to the interviewee for a need of knowledge. Sometimes someone calls with a need of knowledge, he does not mind helping them although he does like to help but till a certain level. This because he works at a customer he does not like to be called too much.

He thinks that people should first send a mail, and when that does not give the wanted result, only then call a person.

The professional indicates that project and organizational knowledge is often gained when starting an assignment. A person, who is already familiar with the project works a small period together with the interviewee.

Processes and methods change per assignment, but these assignments are part of a project. Sometimes it happens that on a project you work with people who you know from past projects and some processes and methods stay the same, but this does not occur regularly.

Interview 3

The professional often works on an assignment with a duration of half a year until one year. Activities and processes depend on the project and the role the interviewee takes within this project. Most of the times he has the role of lead developer or architect. Activities that are most common are:

- Designing
- Developing
- Planning
- Consulting
- Attending meetings

For designing the tool Enterprise Architecture is used and Microsoft Visio for developing. But a large part of his work comprises consulting, planning and preparing meetings. For these activities he uses MS Word and MS Outlook.
Although he works occasionally on his laptop, most of his work is done on a working environment that was created for him.

The professional has two knowledge needs on an average day. But these knowledge needs are often project or organization specific. Technical knowledge needs he has approximately once every two or three days. Once every one or two weeks such a knowledge need is not easily gained. He asks surrounding colleagues and searches extensively on the internet but this does not help him gaining the needed knowledge. Then he often calls someone he knows well and of who he thinks might be able to help him. Most of the time this person is able to help him gaining the needed knowledge, but occasionally he can't. Then the professional has to put in much time and effort to gain the needed knowledge.

The professional has the opinion that helping someone with a knowledge need is important. This because it will help the one with the knowledge need to go further with their work.
He indicates that most of the time he helps people gaining the needed knowledge he does this in a face to face conversation. Besides the conversation he often gives the person, who needs the knowledge, advice to study a website or book.

Besides face to face conversation he also get emails and phone calls with the request to help gaining needed knowledge. Phone calls he often helps directly, this depending on how busy he is. He does not mind that people call, he even finds it useful, but he also indicates that he does not like to be called too much. This because he does not want to be all the time on the phone helping people who work for another customer while he is hired to do a job on this location. The professional answers emails when he has time and if they have been sent specifically to him. He only answers an email that has been send to multiple people when he knows the person very well.

Depending on the kind of knowledge he needs he searches on specific sites for his knowledge need. This can be the Microsoft site if he needs to know something about Dot Net or Oracle Metalink when he needs to know something about an Oracle database.
If this does not provide him with the knowledge he needs, he searches the internet with Google. Followed by searching more thoroughly specific site like the Microsoft site. When all of this fails he puts a request for knowledge on a mailing list, or contacts a person of who he thinks can help him by mail or by phone.

Most of the times he puts the request for knowledge first on the mail before calling the person. He does not want to bother the person who can help him with his knowledge need, therefore he most of the time he mails that person, but there are times when he calls the person because he needs the knowledge quickly.

When sending the mail, it will take time to receive an answer. It might also happen that more two-way communication is needed. With mail this will take a lot of time, which the knowledge seeker might not have.

It happens approximately four times a day that he is asked, by someone who is in need of knowledge, to help with gaining knowledge.
He always has time to support someone who is in need of knowledge.
He makes much use of mail; when he is in need of knowledge he often sends a mail but also the other way around, when he receives mail he often tries to help that person.
But when receiving mail he pre-selects the mails by subject, if he knows something about the subject he opens and reads the mail, otherwise he deletes them.