Improving knowledge management at a CRO
a case study at NIZO food research

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Improving knowledge management at a CRO

A case study at NIZO food research

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identity number 0819408

in partial fulfilment of the requirements for the degree of

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Preface

This paper is the result of my master thesis project, performed in partial fulfilment of the requirements for the degree of Master of Innovation Sciences at the Eindhoven University of Technology. In this preface, I would like to thank those who supported me throughout the process of completing my master thesis project.

My first thanks is for Mila Davids, who was my first supervisor from the Eindhoven University of Technology. Her guidance and insights, as well as the useful feedback helped me through the process of performing my master thesis project. I learned a lot during the writing of my thesis and appreciate the support you gave me during this last part of my master. I also like to thank my second supervisor Thijs Peeters, who is also working at the University. I appreciate your thoughts and feedback and the specific guidance on the quantitative parts of the research.

I also like to thank Wynand Alkema who was my supervisor at NIZO food research, the organization that formed the research subject of my thesis. Thank you for the insightful meetings we had during the five months of research and the practical guidance in the project. I would also like to thank all NIZO employees that contributed to a greater or lesser extent to the data generation of the research as well as the good times that I had as their colleague. Being a part of the organisation has been a great learning experience for me.

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Anne Geleyns

Eindhoven, September 2014
Management Summary

Introduction
To be a successful player in an industry, companies have to be innovative to keep up with the changing needs of the customers and be ahead of the competition. The role of knowledge has become more important and even one of the critical driving forces for business success (Wong, 2005). In the last decades the economy has been shifting to a knowledge-based perspective instead of a resource-based one. This makes it not surprising that the management of the knowledge processes of companies has gained the interest of many researchers.

Previous research on the subject of knowledge management has mostly been focussed on comparing the use and implementation of knowledge management initiatives between larger companies in different industries, making predominantly use of survey methods. Some examples are the articles of Chong & Chong (2009), Chou (2005), and Ju et al. (2006). While the focus of these studies has been on the knowledge management in companies of different industries and countries, they were all performed on industrial knowledge intensive companies. Companies with a different structure, like Contract Research Organisations (CROs), are only marginally discussed in the previous literature.

The goal of this study is to look at the knowledge management of one smaller sized CRO in detail, in order to discover how the knowledge is managed and to see whether the knowledge processes or activities are different than in larger industrial organisations. A second objective is to test two knowledge activities that are relatively new to the organisation and see whether they can help in improving the knowledge management of the organisation.

Theory
The research is guided by the knowledge management theory of Mathieu Weggeman (1997) and uses the knowledge value chain consisting of six knowledge processes to evaluate the knowledge management of the researched organisation. This theory is chosen because of its clear structure and the applicability of the knowledge management scan, which has also been performed in 2003 at the organisation on which the research is performed.

The knowledge value chain approaches the management of knowledge through dividing it in six knowledge processes. The first two processes are the determination of new knowledge that the organisation wants to have or acquire and the identification of the knowledge that it already has. These are the base for the third process of knowledge creation, which is focussed on filling the gap between what the organisation wants to have and what it has. The fourth process is the transfer of knowledge, which is often between employees in the organisation, with as goal to get the right knowledge at the right place. The fifth is in turn the application of the knowledge in solving problems or the improvement of products or processes. The sixth and last knowledge process is the evaluation of knowledge, which is important as you want to keep the valuable learning for the organisation (Weggeman, 1997).

A discussion of the theories on the knowledge management in relation to some organisational features forms the second part of the theory. Important here are the theories on CROs and smaller organisations as these form a basis for the research of this paper.

The third part of the theory discusses the different knowledge management strategies that an organisation can have. The two strategies that play a part throughout the research are the personalization strategy and the codification strategy. The personalization strategy is mostly concerned
with the handling of tacit knowledge through face-to-face contact, while the codification strategy is more about storing and retrieving explicit knowledge (Gammelgaard & Ritter, 2005).

Methodology
The main unit of analysis in this research is NIZO food research, a smaller sized CRO. Knowledge initiatives have been especially researched at larger industrial organizations. They also have been focussed mostly on comparing the organisations, which has resulted in predominantly survey-based research. A case study can give an in-depth analysis of a knowledge management initiative and can contribute to the generation of a theory on the knowledge management in smaller CROs.

The study includes both qualitative as quantitative methods to investigate the knowledge management at the organisation. The qualitative methods consist of: interviews with employees that have different functions within the organisation, observations at meetings and general work processes, group discussions with the chosen focus group, and a document analysis. All these combined give a strong analysis of the strengths and weaknesses of the knowledge processes of the knowledge value chain at NIZO food research. In addition a survey is conducted, based on the knowledge management scan of Weggeman (1997), which gives quantitative results on the knowledge management performance at the organisation. This scan has also been conducted in 2003 as well as at other service businesses, which gives the opportunity to compare the survey results of this research, with the results from 2003 and with similar organisations.

Results
The evaluation of knowledge processes at NIZO food research is quite good as NIZO food research performs a lot of the activities that lead to the effective management of knowledge. The knowledge processes that are especially positive are the first two processes in the knowledge value chain, being the determination of the needed knowledge and the identification of the existing knowledge. NIZO food research seems to have a good view on how much they already know and what they can do. This is in confirmation with their core business as they have to estimate in the early stages of a project whether they have the knowledge for the project or are able to generate the knowledge. The third process of creating knowledge stays a bit behind in the evaluation. This has also to do with the eagerness at which the project managers take on new projects.

The fourth process of transferring knowledge can become better, as it scores not so good in comparison to the evaluation of 2003 at NIZO food research. Some of the reasons for this are the complex data sharing systems that are currently used, which consist of four different platforms. It also has to do with the work system at NIZO food research as the employees have to write their hours on projects and feel that they don’t have much time to discuss not project related topics with other colleagues. The fifth knowledge process of applying the knowledge goes rather well, as the employees are in general willing to learn. With the last knowledge process of evaluating the knowledge, there is still room for improvement as this didn’t score well. A reason for this is also that the time restrains often result in the skipping of evaluations of projects.

The organisational features contribute to the effectiveness of certain knowledge activities and with it the knowledge processes. The results show that the organisational structure is rather flat, meaning that there are not much management layers and everyone can be approached quite easily. Another important point is the size of the organisation which makes it possible for everyone to get to know each other. This also shows in the knowledge activities as the employees say that they can find the person with the right knowledge in the organisation.
The organisational structure also contributes to the strategy of the organisation, which is more on personalization but also includes codification. The personalization comes back in the dependence on the expertise of the employees. A negative point with this strategy is the loss of knowledge when an employee leaves the organisation. The codification strategy comes back in the project report writing as well as in the lab journals and such. This codification of knowledge should make it easier to proceed with projects when someone leaves the organisation. However, the current document system forms a barrier.

The results of the evaluation of the knowledge processes of the knowledge value chain at NIZO food research, have led to the decision to implement two knowledge activities of which one is mostly focussed on the transfer of knowledge while the other is more focussed on the evaluation process. A social network site was introduced to the focus group as a platform to post questions and interesting findings. The first results of this knowledge activity are that it doesn’t work well in the normal work environment as the employees prefer to ask questions directly. However, the use for conferences is much more promising as both the attendants at the conference liked to post the main message of every presentation and the non-attendees at NIZO food research liked the live reports. The second knowledge activity that was implemented were the action reviews. These were conducted at three projects as a midterm evaluation of the project. The responses to these reviews were positive and the learning’s could be used in the remainder of the projects as well as shared with others outside of the project.

Conclusions
The research has shown that the knowledge management at NIZO food research is rather good in comparison to other service businesses, but there is some room for improvement as they scored better for some knowledge management processes in 2003. The size of the organisation has an effect on the knowledge management performance as it is easier to know which knowledge resides in the organisation and who knows what in comparison to large organisations. There is not much difference to be seen from the fact that it is a research organisation, only that this might explain why they score relatively higher for the first processes of determining and identifying the knowledge. However, it would be logical if the creation was also a bit higher, but this doesn’t really show.

For the knowledge management strategy, it is best to apply a combination of both the personalization and the codification strategy as the analysis show that it happens too much that knowledge leaves the organisation when an employee leaves. However, NIZO food research is dependent on the expertise of its employees and this simply cannot all be codified which is why the personalization strategy is very important too. This has to be taken into account for the improvement of the knowledge management, for which the knowledge activities of the organisation have to be assessed regularly.

Limitations
This research has some limitations of which the most important one is the generalizability, which is rather limited due to the case study design. The results are dependent on the context and can be specific for this organisation. Therefore, further research in needed on knowledge management at SMEs and CROs to support the findings.
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1. Introduction

The foundation of organisational competitiveness is shifting in the current economy. A couple of years back the foundation were the tangible resources of the organisation, such as capital, personal, machinery, and so on (Migdadi, 2009). Nowadays ‘knowledge’ is becoming more and more important: organisations are hiring knowledge workers, focussing more on ‘minds’ than ‘hands’ (Wong, 2005). This has led to an increase of studies and literature on knowledge and knowledge management, including discussions on the concept ‘knowledge’ and the implementation as well as the evaluation of knowledge management in organisations.

Knowledge management can be seen as the need to manage knowledge and the processes associated with it in an organisation like an asset, as an economic resource (Ghani, 2009). It is becoming a critical factor for competitive advantage (Ju et al., 2006). Knowledge management is often associated with the intellectual capital of a company or organisation which affects the innovation and financial achievement. However, knowledge management includes more than the intellectual capital as it is not just concerned with knowledge as an asset but with the whole knowledge value chain, including knowledge processes such as the creation, sharing and the application of knowledge.

It seems to be a good idea to actively manage the organisation knowledge processes, but it is not so easily done. There are some difficulties, starting with the fact the knowledge and knowledge management are complex and multi-faceted concepts. Weggeman (1997) gives as a definition: “Knowledge is the ability to perform a task by combining data and information with experience and attitudes.” This definition shows the distinction between explicit (‘information’) and tacit knowledge (‘experience and attitude’). The knowledge of an organisation can be distinguished by the stock or flow approach. In the stock approach knowledge is seen as objectively transferable, while the flow approach states the opposite as an actor will always ad subjective value to transferred knowledge, whether intentional or not (Weggeman, 1997). The flow of knowledge in an organisation needs to be managed which is why knowledge management can help organisations learn and compete.

Knowledge management can be used to improve the knowledge processes of an organisation. The knowledge processes come forth from the knowledge flow approach as knowledge has to be created, transferred, applied and evaluated to be or remain of value for an organisation. These knowledge processes form together the knowledge value chain which should be managed by the organisation. According to Weggeman (1997) knowledge management is the design and management of the operational processes of the knowledge value chain, in order to realise the collective ambition, goals and strategy of the organization.

For organisations a problem with the implementation of knowledge management is the difficulty to evaluate the effectiveness. There is a lack of appropriate metrics to measure the performance of knowledge management (Chen & Chen, 2005). To solve this problem, research has been done by many scholars to find more appropriate ways to evaluate knowledge management. Some of the methods used are the balanced scorecard (Cebeci & Sezerel, 2008; Chen & Chen, 2005), the knowledge management performance index and other comparable indexes (Chang Lee et al., 2005; Chong & Chong, 2009), the knowledge management scan (Weggeman, 1997), and criteria for measuring knowledge management performance outcomes (Choy et al., 2006; Migdadi, 2009). The research of Chen and Chen (2006) shows that quantitative evaluation methods are preferred but a social and behavioural sciences approach has also gained interest. A difference can also be seen between the internal evaluation of the knowledge management and the benchmarking with other companies in the same industry. The different methods are taken into account in the research of this paper.
To successfully implement or improve a knowledge management initiative, it is important to look at the features of organisations. Previous research on the subject of knowledge management has been performed mostly on regular industrial companies. Organisations with different features, such as the service businesses, Contract Research Organisations (CROs) and smaller organisations are not or only marginally discussed in the previous research (Leitner & Warden, 2004; Nunes et al., 2006). An organisational feature that has been discussed is the Knowledge Intensive Organisation (KIO), which is an organisation that has predominantly knowledge workers to perform its primary processes (Weggeman, 1997). KIOs are discussed in previous research as these are organisations for which knowledge management is more beneficial.

The features of the organisation are of importance in choosing a knowledge management strategy. A knowledge management strategy can be characterized based on two dimensions, the knowledge management focus and the knowledge management source (Choi et al. 2008). The focus is concerned with either the explicit or the tacit knowledge of an organisation, while the source can be either internal or external. According to Choi et al. (2008) a personalization strategy should be used for dealing with tacit knowledge while a codification strategy is more useful for handling explicit knowledge. The choice for a knowledge management strategy will come back in this research.

This research is a case study of NIZO food research, a CRO of smaller size. A case study can give a more in-depth view into the knowledge management and the role that the organisational features play in the knowledge management strategy for the organisation. According to Nunes et al. (2006) differences in the knowledge management at a smaller organisation in comparison to large companies can be expected. This is also the case for a CRO in comparison to industrial companies (Leitner & Warden, 2004). Apart from analysing the case study in depth, a second objective is to improve the knowledge management of the organization by improving one or more knowledge processes of the knowledge value chain by implementing knowledge activities. Knowledge activities are in this research tools that can be used in the organisation to support one or more knowledge management processes, which has an effect on the knowledge value chain.

The main question of this research is:

**How can knowledge management at NIZO food research be improved?**

To support the main questions, three sub questions are formulated:

1. How is the performance of the knowledge management in the organisation in comparison to other organisations in the service business industry and in comparison to their evaluation of 2003?
2. Are there knowledge management processes and activities less or more important for the organisation because of the organisational features (organisational structure, size, etc.)?
3. Is one of the two knowledge management strategies more suitable for the efficient knowledge management at the organisation?

The research is performed at NIZO food research, which is a CRO of smaller size. The organisation is knowledge intensive because of their high reliance on the knowledge workers. According to the SME definition of the European commission (2003), NIZO food research is medium sized as the number of employees is less than 250 and the annual turnover does not exceed the 50 million euro limit. For this research, NIZO food research is seen as a smaller organisation as only a differentiation is made between large and smaller organisations. NIZO food research is categorized as a CRO as their main...
activities, which are research activities, are initiated and financed by industrial companies (Von Zimmermann et al., 2012).

The scientific relevance of the research lies in the contribution to the knowledge and theories on knowledge management. Different aspects that are researched and discussed in this paper are the measurement of the knowledge management performance at an organisation with specific features that haven't been explored much yet. The research also investigates the possibilities with the different knowledge management strategies for an organisation with these specific features.

The research project fits the innovation sciences domain as it includes the aspects of social interaction and the use of technological tools in an organisation to achieve better knowledge management, which should lead to a competitive advantage as the innovation of the organisation should improve. In addition, it will provide insight in the degree of importance of certain knowledge activities in CROs in comparison to industrial companies.

The practical relevance of the research is the advice that is given to NIZO food research about their knowledge management processes and activities, and the possibilities to improve their knowledge management. It also can provide other smaller organisations, CROs and/or service businesses with useful insights on the possible differences in handling a knowledge management initiative.

For the report, the following structure is used. Chapter 2 contains the theoretical background on knowledge, knowledge management, the knowledge value chain and the associated knowledge management processes. The chapter also discusses the different organisational features that play a role in the research and a discussion on the use of the right knowledge management strategy. Chapter 3 contains the methodology of the research, including the research design, the data collection methods and the data analysis methods. Chapter 4 is a detailed overview of the case and the organisational changes with regard to the organisational features that it has gone through throughout the years. Chapter 5 gives a representation of the results of the research. Chapter 6 concludes the research by answering the research questions, while the 7th and last chapter contains the discussion and reflection of the research, the limitations, and the recommendations for further research.
2. Theoretical background
This chapter of the research paper consists of a literature review on knowledge management and the related concepts that are important for this research. The chapter starts with a discussion on the different views on knowledge and with it on knowledge management, the knowledge value chain, the knowledge processes and the knowledge activities. The second section is a discussion of some of the organisational forms that are important for the research and the implications with regard to knowledge management. The organisational features that are covered are the KIO, CRO, SMEs and project-based organisations as these are the specific characteristics of the organisation that is researched. The third section consists of a discussion on the different knowledge management strategies that are most commonly used.

2.1 Knowledge

The definition of knowledge is usually given in one of the two following manners. The first is by presenting the relationship of knowledge to information and even data, in which knowledge is authenticated information. In other words knowledge is information that is possessed in your mind and can be related to pacts, procedures, ideas, concept interpretations, observations, and judgements (Alavi & Leidner, 2001). When not seen in comparison to information, the different authors usually just stress the personal or human element. An example of this is given by Sunassee and Sewry (2002), who state that knowledge can be regarded as the human expertise that is stored in a person’s mind, gained through experience and the interaction with others in their environment. As Hendriks and Vriens (1999) state, knowledge resides in people’s heads. Nonaka et al. (2000) add a dynamic aspect to the definition as they state that knowledge is a dynamic human process of justifying personal belief toward the truth.

Apart from the definition, there are also different ways of classifying knowledge. An often used distinction is made between explicit and tacit knowledge. Explicit knowledge is articulated, generalized knowledge, while tacit knowledge is rooted in actions, experience, and involvement in a specific context (Alavi & Leidner, 2001). This classification is used by several author such as Lee & Yang (2000) and Ju et al. (2006). It is also in some cases divided in individual or collective knowledge, where individual knowledge is person specific and collective knowledge comes from knowledge integration, combining the efforts of several individuals with different but complementary skills (Alavi & Leidner, 2001; Ju et al., 2006).

In this research, the definition of Weggeman (1997) forms the basis, where knowledge is the ability to perform a task by combining data and information with experience and attitudes. This definition is in agreement with the definition of Alavi & Leidner (2001) as it includes more than information and includes the tacit element. The other definitions also come back in Weggeman’s definition as the human element is reflected in the experience and attitudes to be able to perform a task.

2.1a Knowledge management

Going from recognizing the importance of knowledge to successful knowledge management in an organisation is not easy. A problem lies in the complexity of knowledge management. In this paper, the knowledge value chain consisting of six knowledge processes that can be enabled by knowledge activities, is used to clarify the concepts. Each of these concepts has in turn its own variances, which are discussed first.

Knowledge management is defined in many different ways by authors over the years. A rather clear definition to start with is given by Von Krogh et al. (2000), who state that knowledge management
refers to identifying and leveraging the collective knowledge in an organisation to help the organisation compete. Sunassee and Sewry (2002) use a similar definition, but they included the importance of the creation of an organisational culture that permits further knowledge creation. However, they also believe that knowledge cannot really be managed, but that instead an organisation can be knowledge focussed, in which the environment in which knowledge is created is being managed (Sunassee & Sewry, 2002). This is the opposing view of knowledge management as the identification, growth and effective application of an organisation’s critical knowledge (Duffy, 1999).

These two views are in accordance with the two knowledge management approaches that Weggeman (1997) identified. The definition of Duffy (1999) is in line with the stock approach, indicating that knowledge is objectively transferrable. The definition of Sunassee & Sewry (2002) follows the flow approach of Weggeman (1997), which states that knowledge management is about facilitating the learning processes of an organisation.

The aim of knowledge management in organisation is also subject to discussion. According to Alavi and Leidner (2001) knowledge management can have three different aims for an organisation. The first is to make the knowledge visible and show the role of knowledge in an organisation. This is mainly done by making knowledge maps, yellow pages, and using hypertext tools. This is not much different from information management as it is focused on the explicit knowledge only. The second possible aim is to develop a knowledge intensive culture by encouraging and aggregating behaviours such as knowledge sharing and proactively seeking and offering knowledge. A third aim can be the building of a knowledge infrastructure, being not only a technical system, but a web of connections among people and encourage them to collaborate and interact (Alavi & Leidner, 2001).

The latter is in this research. For this research, the flow approach to knowledge management is used, which also implies a focus on the second and the third aim. To support the flow approach, the knowledge value chain with the knowledge processes is used. To clarify a discussion in the literature, some authors argue that knowledge cannot be managed but only be enabled (Von Krogh et al., 2000). Therefore, for this research paper a distinction has been made between knowledge processes and knowledge management activities. The first refers to the knowledge processes that naturally exist in an organisation and are part of the knowledge value chain, and the latter ones to those management practices which support the efficient and effective management of knowledge for organisational benefit (Andreeva and Kianto, 2012). The knowledge processes are out of direct management control but can be enabled by implementing the right knowledge management activities.

2.1b The knowledge value chain

Knowledge management can be guided by seeing knowledge as a chain of steps that follow up on each other, also called the knowledge value chain. Most authors agree on the view that knowledge processes can be placed in a circular model to form a spiral of knowledge accumulation. However, there are discrepancies in the delineation of these processes in the literature, such as the number and labelling of the processes that form the value chain (Alavi & Leidner, 2001).

In most of the articles, the knowledge value chain or spiral is seen to consist of knowledge processes (such as knowledge creation, sharing, acquisition, transfer and application) and infrastructures or capabilities or management activities that support and enhance the knowledge processes (Andreeva & Kianto, 2012; Foss et al., 2009; Shu-mei & Sheng-hua, 2006). The differences are found in the definitions and amount of knowledge processes that are highlighted by the authors of the research articles. Carlucci and Schiuma (2004) use for example seven different processes of generation, codification, application, storing, mapping, sharing and transfer of knowledge. Other authors like
Chen & Chen (2005) only distinguish four processes in the chain, which are the creation, conversion, circulation, and completion of knowledge.

The model used for this research is developed by Weggeman (1997) and shows the whole knowledge value chain in a clear manner, see figure 1. The value chain shows the importance of the strategy and the goals of an organisation in deciding which knowledge needs to be developed or acquired, but also how the different knowledge management processes can in turn lead to an adaptation of the organisation strategy.

The knowledge value chain of Weggeman (1997) makes a distinction between six processes that are important in the management of knowledge, besides having a clear strategy. The first two are the determination of new knowledge that the organisation wants to have or acquire and the identification of the knowledge that it already has. These are the base for the knowledge creation, which is in turn focussed on filling the gap between what the organisation wants to have and what it has. The fourth process is the transfer of knowledge, which is often between employees in the organisation, with as goal to get the right knowledge at the right place. The fifth is in turn the application of the knowledge in solving problems or the improvement of products or processes. The sixth and last is the evaluation of knowledge, which is important as you want to keep the valuable learning for the organisation (Weggeman, 1997).

The knowledge value chain and it’s six knowledge processes guide the research. While the processes seem clearly distinguished, there is in reality must overlap between them. This has to be taken into account in the evaluation and improvement of the knowledge processes and with it the knowledge management of organisations.

2.1c Knowledge management activities

Knowledge processes are in general difficult to make explicit and therefore difficult to manage. Knowledge activities are in turn much clearer and can contribute to the improvement of the knowledge processes. While the literature gives many different knowledge activities that can be implemented, they will not always lead to an improvement of the knowledge processes and with it the knowledge management of an organisation. Lee & Choi (2003) state the dependence on the organisational structure and culture for the successful use of the knowledge activities.

Knowledge activities are often tools that have an influence on various processes of the knowledge value chain. The article of Young (2010) provides a list of the commonly used knowledge activities along with the knowledge processes that they have an effect on. Of these 20 activities only 5 are focussed on just one knowledge process of the value chain, showing the complexity. Three extra...
activities from DVN-CIBIT (2009) are included in the research, as these also seem applicable to the organisation. The knowledge activities are divided in non-IT and IT tools as technology plays a big role in the work environment, see table 1.

Table 1: knowledge activities/tools from Young (2010) *added activities form DNV-CIBIT (2009).

<table>
<thead>
<tr>
<th>Non IT Tools</th>
<th>IT Tools</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brainstorming</td>
<td>Document Libraries leading to a Document Management System</td>
</tr>
<tr>
<td>Learning and Idea Capture</td>
<td>Knowledge Bases (Wikis, etc.)</td>
</tr>
<tr>
<td>Peer Assist</td>
<td>Blogs</td>
</tr>
<tr>
<td>Learning/after action Reviews</td>
<td>Social Network Services</td>
</tr>
<tr>
<td>Storytelling</td>
<td>Voice and Voice-over-Internet Protocol (VOIP)</td>
</tr>
<tr>
<td>Collaborative Physical Workspace</td>
<td>Advanced Search Tools</td>
</tr>
<tr>
<td>APO Knowledge Management Assessment Tool</td>
<td>Building Knowledge Clusters</td>
</tr>
<tr>
<td>Knowledge Café</td>
<td>Expert Locator</td>
</tr>
<tr>
<td>Community of Practice</td>
<td>Collaborative Virtual Workspaces</td>
</tr>
<tr>
<td>Taxonomy</td>
<td>E-learning*</td>
</tr>
<tr>
<td>Mind mapping*</td>
<td>Yellow pages*</td>
</tr>
</tbody>
</table>

The list of knowledge activities can be extended much further, but these are the most often used and more practical applications that appear in the literature. The knowledge activities will be discussed further in the knowledge management strategy part of this chapter.

2.2 Organisational features and knowledge management

The features of an organisation are an important factor in both the need for knowledge management as well as the methods of implementation. For this research, it is important to have a closer look at knowledge management for knowledge intensive organisations and the organisational structure, contract research organisations, and smaller organisations as these are the characteristics of the case used in this study.

2.2a Knowledge Intensive Organisations

Weggeman (1997) defines a KIO as an organisation that has predominantly knowledge workers to perform it primary processes. In a KIO, the knowledge workers are constantly identifying, creating, transferring, applying and evaluating knowledge to achieve the organisational goals and satisfy internal and external clients as well as themselves.

According to many knowledge management authors, the knowledge management process should be seen as crucial by knowledge intensive organisations (Nunes et al., 2006). The knowledge workers have a dominant position in the functioning of the organisation, which also shows the weakness of an knowledge-intensive organisation. The loss of key personnel can result in the loss of their competitive edge.

The organisational structure of KIOs can usually be divided in either a professional bureaucracy or an adhocracy. The work tasks in a professional bureaucracy are coordinated by sharing information and the integration with the knowledge of the professionals. The professionals are primarily interested in their methodological approaches, while the organisation is less relevant. The adhocracy is characterised by the flexibility and task-oriented collaboration. The professionals are often divided in functional sub-departments for practical reasons, but work together in multidisciplinary teams to perform innovation projects (Weggeman, 1997). The adhocracy can in turn be divided in an
administrative or executive adhocracy. In the administrative adhocracy the project teams don’t work for customers, but for the organisation itself. In an executive adhocracy the project teams innovate and solve problems for the customers (Weggeman, 1997).

The different organisational structures are discussed as the approach for implementing a knowledge management initiative is different in each of the organisational structures. According to Vârzaru and Vârzaru (2013), the organisational structure influences the effective knowledge management of an organisation. An adhocracy has, because of its characteristics of autonomy, cooperation and self-control, a strong base to develop an organisational culture and social climate that benefits the knowledge processes of the knowledge value chain.

2.2b Contract Research Organisations

According to Leitner & Warden (2004), there are some important differences between research organisations and industrial firms. The first difference can be seen in the output of the organisations as for research organisations, the R&D activities are an end product in itself, while R&D is for industrial organisations only the input to new products and processes. This is related to the second difference where research organisations often contribute to the early stages of an innovation process and with it the knowledge value chain.

Research organisations can be characterized by their different kinds of ownership structures, legal status, missions, organisational structures, and outputs. They are often strongly influenced by science and technology policy and publicly funded (Leitner & Warden, 2004). When a research organisation is performing research on a contractual basis it is called a CRO (Von Zimmermann et al., 2012).

The CRO of this research is a private organisation that performs research on contract basis for private or public clients, where specific problem solutions are generated. As the most important resources of contract research organisations are intangible and the output is mostly knowledge, it seems rather logical that knowledge management has great potential (Leitner & Warden, 2004).

2.2c Small and Medium sized Enterprises

While knowledge management has been successfully applied in many large companies, it is largely discarded for organisations of smaller size. The classification of an organisation as a small or large organisation is based on the SME definition of the European commission (2003). When the number of employees is less than 250 and the annual turnover does not exceed the 50 million euro limit, the organisation is seen as relatively small.

From the research of Nunes et al. (2006) comes forth that knowledge intensive SMEs acknowledge the advantages that adequately managing the knowledge processes of the knowledge value chain, the managers are not prepared to invest in long term knowledge management goals. A reason is the relatively high effort needed combined with the difficulty of establishing the added value. According to Nunes et al. (2006), SMEs tent to be more vulnerable to problems of high staff turnover and knowledge retention. This stipulates the need for knowledge to be managed, disseminated and retained inside the organisation.

The priorities with regard to the knowledge management for smaller organisations in comparison to large organisations should be different as the flows of knowledge and the accessibility are also different. For example, knowledge management activities within smaller companies tent to happen in an informal way and are only rarely supported by a purposely designed ICT system (Nunes et al., 2006).
The organisational features play a role in the discussion to follow a certain knowledge management strategy. The next section will discuss the different knowledge management strategies and the relation to the organisational features.

### 2.3 Knowledge management strategies

The various researches that have been performed on the possibilities to improve the one or more knowledge processes of knowledge management in an organisation show that there are different strategies that can be applied. A knowledge management strategy can help an organisation to choose knowledge activities that will suit the organisational features. The two strategies that are discussed are the personalization strategy and the codification strategy, which are often seen as the two ends on a scale (Gammelgaard & Ritter, 2005). Other authors that also distinguish different knowledge management strategies are Lee and Choi (2003) and Andreeva and Kianto (2012), who will also come back in the discussion.

Hansen et al. (1999) argued that organisations typically operate with through one of the two knowledge management strategies of codification and personalization. The codification strategy is based on storing knowledge in databases, while in the personalization strategy personal interaction is essential and information technology is only a tool for communication. The organisations choice for one of the two strategies depends on the way the organisation serves its clients, the economics of the business and the people it has hired. Hansen et al. (1999) also state that "emphasizing the wrong strategy or pursing both strategies at the same time can quickly undermine a business“. However, Gammelgaard and Ritter (2005) argue in their article that the strategies can complement each other.

Lee and Choi (2003) also make use of both the strategies for their socio-technical perspective, where the social and technical systems are interacting systems. The technical system is concerned with processes, tasks, and technology, while the social system is concerned with attributes of people, relationships, reward systems, and authority structures. Andreeva and Kianto (2012) show with their research again the differences between a technical and social system. They have researched the relation between human resource management and knowledge management performance, as well as the relation between information communication technology (ICT) practices on knowledge management performance. While both turned out to have a direct effect on the competitiveness of the firms and on the financial performances, the effect of ICT on financial performance was negative. However, when the indirect effects were included, it became positive as the human resource management practices functioned as mediator in the relation between ICT and financial performance (Andreeva & Kianto, 2012).

The choice of the knowledge management strategy can depend on the features of the organisation. An example is the size of an organisation as large organisations often choose a codification strategy as the geographical dispersion and localization in various sub-units hinders makes a personalization strategy difficult (Gammelgaard & Ritter, 2005). The expectation is that the personalization strategy works much better in a smaller organisation.

The knowledge activities that can contribute to the successful management of the knowledge processes have been divided in non-IT and IT tools, however this doesn’t mean that they belong to either the personalization or codification strategy. This can for example be seen with the Voice over Internet Protocol, which is a technological tool but is used to get people to interact more efficiently. For clarification, some of the knowledge activities are presented in a matrix in table 2 where they are divided to the codification and personalization strategy as well as to the non-IT or IT activities. The activities that are meant to help store and retrieve knowledge without personal contact are part of the
codification strategy, while activities that make explicit use of personal contact are part of the personalization strategy.

<table>
<thead>
<tr>
<th>Personalization strategy</th>
<th>Non IT activity</th>
<th>IT activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brainstorming</td>
<td>Social Network Services</td>
<td>Blogs</td>
</tr>
<tr>
<td>Learning and Idea Capture</td>
<td>Blogs</td>
<td>Voice and Voice-over-Internet Protocol (VOIP)</td>
</tr>
<tr>
<td>Peer Assist</td>
<td>Blogs</td>
<td>Collaborative Virtual Workspaces</td>
</tr>
<tr>
<td>Learning/after action Reviews</td>
<td>Mind mapping</td>
<td>Document Libraries leading to a</td>
</tr>
<tr>
<td>Storytelling</td>
<td>Mind mapping</td>
<td>Document Management System</td>
</tr>
<tr>
<td>Collaborative Physical Workspace</td>
<td></td>
<td>Knowledge Bases (Wikis, etc.)</td>
</tr>
<tr>
<td>Knowledge Café</td>
<td></td>
<td>Yellow pages</td>
</tr>
<tr>
<td>Community of Practice</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Codification strategy</th>
<th>Taxonomy</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Mind mapping</td>
<td>Document Libraries leading to a</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Document Management System</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Knowledge Bases (Wikis, etc.)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Yellow pages</td>
<td></td>
</tr>
</tbody>
</table>

The theories discussed in this chapter are used throughout the paper to support the research and the findings. The knowledge value chain contributes to the answering of the first sub question. The theories on the organisational structure contribute to the answering of the second research question. The third research question is concerned with the knowledge management strategy and the theories associated with it. The knowledge activities will come back throughout the research as these are the basis to make adaptations possible in the knowledge management.
3. Methodology
The methodology is concerned with the validation of the steps taken in the research to find an answer to the research question. The chapter is divided in several sections. The first is the general research design of the study. The second discusses the case on which the study is performed and why this case was chosen. The third part includes the data collection methods used in the research. The fourth part consists of the data analysis methods. The fifth and final section of the methodology discusses the validity and reliability of the research and the tactics that can improve the research.

3.1 General research design
The goal of the this study is to find out how a CRO of smaller size is dealing with their knowledge (management) and how these may differ in comparison to the knowledge processes at not-CR organisations as well as large organisations. Therefore, the general design of this research is a case study, in which the case had to be a CRO with less than 250 employees, where the researcher was allowed to gather data. This led to NIZO food research in Ede, who is interested in the research topic and sees the opportunities that the research can have for the organisation. The researcher has been given almost full access to the company archives and documents as well as the opportunity to make observations, perform interviews and conduct a survey, as well as to work with a focus group. This all took place over a period of five months.

The purpose behind the case study is to make an analytical generalisation. This means that the researcher strives to generalize a particular set of results to some broader theory (Yin, 2009). The case of NIZO food research meets the criteria to be able to test the broader theory on knowledge management as it is a smaller sized KIO which makes them suitable to analyse their knowledge processes and activities, while also being a CRO. Therefore, it can be seen as a representative case for the study.

The research has an embedded case study design as there is given attention to different subunits within the single case. The organisation as a whole is the main unit of analysis, while subunits are being used to get in-depth information. The subunits are represented by the individuals that are interviewed as well as the focus group and the project groups that are involved in the research. This has led to the use of a mixed method strategy, where a survey is included in the case study.

3.2 Description of the case
NIZO food research was founded in 1948 by the joint Dutch dairy industry. It served as an institution were the quality and safety of food was tested. Throughout the years it has seen various changes, of which the most important ones are the early shift to a self-innovating organisation shortly after being founded, the shift from joint-research to competitive research in the 1990s, and becoming a private company in 2003. A more detailed overview of the history of NIZO food research is included in the next chapter along with some longitudinal analyses of the growth of the organisation.

The main office and research facilities of NIZO food research are located in Ede, but NIZO food research also has representatives on several international locations such as France, the USA, Japan and Thailand. This will not lead to a problem for analysing the knowledge processes as all the core activities take place at the facilities in Ede. This is supported by the distribution of the employees as only three of them are operating abroad while the other 155 work in Ede.

Over 80 percent of the employees that are working at NIZO are in the possession of a higher education degree, being scientists, communication specialists, IT specialists, business development managers,
and other types of managers working in teams to solve problems or research issues for the client companies (De Boer, 2013). This makes it interesting to see how all the expertise of the employees is being used inside the organisation.

### 3.3 Data collection method

The data collection method of this research is rather complex as it involves many different techniques. There are some reasons for using a mixed method for the data collection. First of all, the research is a case study with an embedded structure, meaning that there are different units of analysis in the research. The main unit is the entire organisation and the knowledge processes that are being used by the organisation. The main data collection techniques involved document analysis, observation, a survey and some interviews. For the second unit of analysis, which is the focus group, the data collection took place through observation, interviews and group discussions. A focus group has been chosen as it is easier to find out the working processes within the organisation by observing one working group of around twenty employees more closely, in this case the fermentation group. Another advantage of a focus group arises in the implementation phase of the knowledge activities, as the focus group is used to test the chosen activities before an organisational wide implementation.

A weakness in the data sources can be the high reliability on data provided by the organisation that is being researched which possibly leads to biased information. However, the high amount of different data sources provides a strong point as this leads to data triangulation (Yin, 2009). Each of the data collection methods is discussed separately in the next paragraphs.

#### 3.3a Documents

Finding as much documentary information of the case as possible is an important start for the research. Documents as a source of evidence has some advantages, like the possibility to review repeatedly, its unobtrusiveness as it is not created as a result of the case study, and the broad coverage. However, some disadvantages can be the retrievability and access, as well as the biased selectivity and possible reporting biases (Yin, 2009).

In this research the documentation consists of administrative documents like annual reports, social reports, research proposals and research reports. It also includes some personal document like e-mail correspondence. Other documentation forms being used are written reports of events as well as news clippings and other articles that appear in the mass media or in community newspapers.

#### 3.3b (Participant) Observation

The data generation through observation takes place throughout the entire period of five months that the research is done. The advantage of observing the processes is that the organisation can proceed without real interference, while the researcher is able to gather information about a certain way of working in the organisation.

The participant observation in this research is of an open structure, meaning that the group that is being observed, knows that it is part of a research project (Reulink & Lindeman, 2005). This also means for this research that the role of the researcher is new to the organisation and not an existing one which has to be filled. The degree of participation is moderate, as the participant observes the processes in the focus group of around twenty people and also the activities of some project teams. These project teams consist partly of the same people that are in the focus group, but also contain other employees as the project teams are formed across the expertise areas. The researcher has quite a
high involvement as a participant observant as it is useful to interact and find out what the underlying opinions are to be able to analyse the problems and to be able to empathise with the employees.

3.3c Interviews
The interviews taken in the study can be divided in two categories. The first interviews had an open structure and have as goal to find out the general working structures and handling of the knowledge processes in the organisation. The second set of interviews was performed to get more in-depth information to support the findings from the other data collection methods. These interviews were semi-structured as there was a set of questions, but deviations were possible. The employees for both sets of interviews were taken from in and outside the focus group.

Interviews have the advantage of being targeted and focused directly on the case study topic, while also giving insight into perceived causal inferences and explanations. However, some of the disadvantages of interviews are the biases due to poorly articulated questions or response bias, and reflexivity of the interviewee giving the answers that the interviewer wants to hear (Yin, 2009).

3.3d Group discussions
The group discussions are held with the focus group with as purpose to find out what the opinions, associations, experiences, expectations and barriers are to a topic of knowledge management. A second reason for having group discussions is to get input for the concept development and test ideas for the research (Rijksoverheid, 2014). These are in this case the knowledge activities that can be implemented to improve one or more knowledge processes.

The group discussions took place with the focus group at the three weekly meeting of the fermentation work group. This means that it didn’t cost a lot of time for the participants as they would already go to these meetings.

3.3e Survey
The survey is used to complement the qualitative methods with some quantitative data. There is chosen to use the knowledge management scan as developed by Mathieu Weggeman (1997), as this provides the organisation with a clear indication of the performance on the knowledge processes that are part of the knowledge value chain of knowledge management. Important here is that the scan evaluates the knowledge processes of the knowledge value chain of the organisation, making it possible to see what the stronger and weaker points in the knowledge process are. Another advantage of the scan is that it has been performed inside NIZO before in 2003, as well as on many other organisations active in the business services of which the average results are published by Proven Partners. This makes it possible to compare the results of NIZO over time as well as their performance in comparison with other organisations.

The scan is distributed organisation wide as it is a structured questionnaire. The questions are included in appendix A. Weggeman (2000) uses as restriction that employees who have been in service for less than six months should be excluded as they have limited knowledge on the processes that take place to manage the knowledge of the organisation. This is taken into consideration in the data analysis.

The scan itself could not be adapted as this would interfere with the possibilities to compare the generated data with the earlier data from NIZO and Proven Partners. However, there were some questions added about the work tasks of the employees, as well as on the use and perceived usefulness of a set of knowledge activities.
A summary of the data collection techniques and the intensity, number of people or activities involved, is given in table 3.

<table>
<thead>
<tr>
<th>Data generation</th>
<th>Number of people/activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Documentation</td>
<td>The document analysis is performed on various documents, such as annual reports, social reports, project reports, and other data sources like news publications.</td>
</tr>
<tr>
<td>(Participant) Observation</td>
<td>Observing at 3 Telcons, the CHEF meeting, the quarterly meetings, the three weekly fermentation meeting, the weekly lunch meetings/seminars, the three action reviews, and the yammer activities</td>
</tr>
<tr>
<td>Interviews</td>
<td>8 open interviews were taken with employees that have varying tasks to get to know more about the working processes at NIZO.</td>
</tr>
<tr>
<td>- Open interviews</td>
<td>The in-depth interviews are part of the evaluation of the action reviews and the yammer activities, as well as to learn more about the case of NIZO.</td>
</tr>
<tr>
<td>- In-depth interviews</td>
<td></td>
</tr>
<tr>
<td>Group discussion</td>
<td>The group discussions take place at the three weekly fermentation group meetings (group of around 15 employees). The first was to find out the preferences of the group for different knowledge activities, the following discussions were held to inform and get feedback from the group about the action reviews and yammer activities.</td>
</tr>
<tr>
<td>Survey</td>
<td>All NIZO employees were asked to fill out a survey on the knowledge management processes at NIZO. This survey was based on the knowledge management scan of Mathieu Weggeman (1997) and supplemented with some questions about the use and expected value of a series of knowledge activities.</td>
</tr>
</tbody>
</table>

3.4 Data analysis

The data analysis for this study consists of qualitative data analysis that is complemented by the statistical analysis of the survey results. This combination provides a strong analytic tool for evaluating the knowledge management at NIZO food research.

For the qualitative data a case study data base is formed, including all the notes from the interviews, discussions, meetings and general observations, as well as the documents like annual reports, publications, etc. All the evidence is analysed by dividing them in fragments and labelling them according to the theoretical base that is being used in the research. This means that the fragments are divided in groups that are relevant for the specific knowledge processes, knowledge activities, and organisational features.

The results of the qualitative analysis is a detailed description of the researched processes of the case and the placement of the results in a broader context, which is the theory on knowledge management, the knowledge value chain and its processes. The results are complemented by quotes from the collected evidence. The quotes can come from interviews and group discussions, for which the initials of the interviewee are given, or (online) documents where the reference will include the source and year of publishing and can be found in the reference list. The possibilities of multiple explanations and interpretations of the generated data is taken into account by the researcher and there will always remain some lose ends in the interpretation. However, the results give an analytical description that fits and contributes to the conceptual framework.

The complementary quantitative analysis consists of some statistical tests on the survey data, performed to compare the means of the variables for the different knowledge management processes with the reference materials. Therefore the data had to be cleaned first and adapted to provide the right variables for comparison. This means that the indicator variables for each of the different knowledge
processes had to be checked for reverse scaling and combined to form one scale variable with the means of each of the knowledge processes.

There is also checked whether there are significant differences between groups of employees within the organisation, such as job duration, work division, work task and whether the employees are only working at NIZO food research or also somewhere else. This is done to check for response biases between groups of employees. The tests depend on the number of groups to compare and on the number of respondents per group. An independent T-test is used when \( N \geq 20 \) for the different groups and the data has a normal distribution. In this paper, one-sample T-tests are used to compare the means of variables of the survey to the means of a population, being either the service businesses in general or the data from NIZO food research in 2003. When \( N < 20 \) or the data were not normally distributed, the Mann-Whitney U test [for two groups] and the Kruskal-Wallis H test [more than two groups] were performed, as these are nonparametric tests (Field, 2009).

After this the results are compared with the reference materials. The reference materials consist of the earlier results of NIZO food research from 2003 and the benchmark numbers of organisations that are also active in the business services. For this analysis the one-sample t-test is performed on each of the knowledge processes to compare them to the values of Proven Partners on the organisations in the same sector, and to the values from NIZO food research in 2003. The one-sample t-test is used as for the reference values only the means where available instead of the raw data.

3.5 Validity and reliability

To ensure the quality of the research, the validity and reliability issues that can arise are discussed in this part. The validity issues are divided in construct validity, internal validity and external validity. Each of these plays a role in different parts of the research, such as the data collection phase, the data analysis or the overall research design.

The construct validity is concerned with the identification of the correct operational measures for the concepts that are being studied (Yin, 2009). To make the data collection as objective as possible, there is chosen to use multiple sources of evidence in the data collection phase, making it possible to establish a chain of evidence. For the composition phase, the draft of the case study report is reviewed by at least one of the key informants.

The internal validity is of less importance in this research as the case study has a descriptive and more exploratory character. However the part where some knowledge activities are tested inside the organisation does deserve some attention, due to the causal relation that is tried to make visible here. Some of the tactics to increase the internal validity here are the explanation building and trying to address rival explanations (Yin, 2009).

The external validity is concerned with defining the domain to which the study’s findings can be generalized (Yin, 2009). With the case study results, the researcher strives to generalise the results to some broader theory, which makes it analytic generalisation. The importance lies in the use of the theory to guaranty the external validity.

The reliability is concerned with the question whether the research is replicable, so when another investigator would follow the same procedures, it would arrive at the same findings and conclusions (Yin, 2009). This stipulates the need to document the procedures that are followed in the case study. A case study protocol can help with this as well as a case study database, containing the raw data that is being used, but without the inferences made by the researcher.
4. NIZO food research
To understand and support the results of this research, the history of the case has been analysed as well. This is important as the organisational structure and culture have been developed over time, due to organisational choices and have led to how the organisation operates now. This chapter is divided in the background of the organisation, the macro perspective, the organisational structure as it is now and an overview of the growth of the organisation in terms of employees and product results, which is part of the knowledge assets of the organisation.

4.1 Organisational background
The organisational background is of importance to the research of the knowledge management at NIZO food research because the organisational characteristics play an important role in the efficiency of the knowledge processes. Therefore, this subchapter is written to describe the organisational structure and changes since the foundation in 1948. The data are derived from the annual reports and other documents.

NIZO has been founded by the around two hundred small dairy organisation in the Netherlands as an independent research institute, with the help of the government, to support the dairy industry. The first research activities of NIZO were performed at the governmental agricultural experimental station by people that were in service of the government. In 1951, Ede was chosen as the location to build the facilities for NIZO. This was also the year that the researches resigned from the governmental service and came in service of NIZO. As the governmental support also stopped the institute became entirely independent, with a staff of 18 people. The financing was arranged through the dairy industry board and the annual contributions of the dairy organisations (AR ’51).

The next year’s NIZO grew steadily. The organisational structure became visible as the research activities were divided under three departments, namely a chemical, a bacteriologic and a technical department. NIZO had a different structure in comparison with other dairy institutes worldwide as it was financed by the industry and had a pilot plant that works on an industrial scale. This could also be seen by the innovations of the institute like the Kernhemse Cheese (AR ’58).

From the 1960 a shift could be seen in the industry as the demand for new methods of dairy production increased rapidly. This new demands led to a structural change at NIZO in ’61, where the workgroup program was started. As NIZO kept growing and the demand also remained high, the institute recognized the need to expand their facilities (AR ’63 & ’68). With the expansion came also the broadening of the research field of the institute with the formation of the physiological research department.

In 1969 and 1970 the importance of a central research institute was being questioned by the board and the management of NIZO, but the importance turned out to be still very high. However, there were some points that needed attention to remain valuable. The first is that NIZO should be able to generate basic knowledge and make sure that it is applicable for practical purposes in the industry. The second objective is that at same time the industrial laboratories must be able to proceed with the performed research, leading to the third objective that there was a high need for tight cooperation (AR ’69). Apart from the cooperation between NIZO and the industry, there was also the need to cooperate more efficiently with other institutes, such as CIVO and the University of Agriculture. These all led to a high growth of the organisation and as a result a new organisational structure where the four research divisions are redistributed into seven divisions with each its own division manager (AR ’70).
In 1971 an important shift could be seen as NIZO started with a new system where some of the projects and advised had to be paid for by the customers. This also meant the start of the time writing on the project for the employees (AR ’71). These changes also led to new policies with regard to exclusivity and intellectual property rights in the upcoming years. Other important changes in the first years of the 1970s are the size and amount of organisations operational in the dairy industry, showing a decrease in the amount of organisations but an increase in their size. This led to a stronger focus on the new nutrition section of the organisation (AR ’73 & ’74).

A period of stability held on until 1984 which was rather turbulent due to: (I) economic recession, (II) limitation on the milk production set by the council of the European community, (III) the dominant role of the dairy companies in the Netherlands that also formulated their own marketing and innovation policies, and (IV) the new scientific sub-disciplines to which NIZO had difficulties to adapt because of already formulated working tasks over the years. NIZO reacted with material cuts, stronger focus on paid for projects and advice work, and a temporary stop on the hiring of new employees (AR ’84).

At the end of the 1980s, NIZO started to believe that a wider and more market-oriented position could be more desirable as the industry had changed. This led to the shift of more emphasis on the dairy companies providing NIZO directly with research contracts, instead of NIZO performing collective research for the connected organisations. Important in this process is that the companies have to be involved with NIZO and aware of the possibilities and opportunities that can be provided (AR ’88). From 1993 the changes of the organisation structure become even more clear as the composition of the board is being changed and the advisory committee is replaced by a program committee (AR ’93).

In 1995, NIZO has grown into a CRO where confidential research is done while still building on their fundamental research. The applicability of the research has become very important, but the management team also sees that fundamental research is necessary to keep the organisation running in the long term. To keep focussed on their research activities, NIZO arranged with a close partner that the production activities were taken over (AR ’96).

In 1998 NIZO changes its name to NIZO food research, which is in accordance with their shift in focus throughout the years to a broader research field. In this year the amount of turnover generated by the confidential projects is already 70%, which shows the successful change to a CRO (AR ’98). To support the commercialisation NIZO food research decides in 1999 to appoint some sales managers (AR ’99).

In 2003, NIZO food research becomes a fully independent research organisation, in which the financial structure through the product board of dairy is entirely market-based (SAR ’03). The international role gets more focus and this leads to the appointment of representatives in the UK in 2004 and the US and France in 2005 (SAR ’04 & ’05). Business is going well until the economic crisis starts to be of influence in 2009. The management of NIZO food research responds with a hiring stop and a reorganisation, they also cut back on the investments in education of the employees (SAR ’09 & ’10). In 2011, the investment in education is almost back to normal and the organisation did well, also because of some large projects in pro-competitive research (SAR ’11).

4.1a Knowledge processes

The knowledge processes at NIZO food research have also changed much over the years. This is closely related to the structural changes of the organisation, but also with the industrial shifts and more general progresses of technology that have taken place. This can be seen in the shift from a national
dairy research institute that performed mostly collective research to a private contract research organisation in the food industry that performs confidential research.

The knowledge processes in the first years were concerned with performing research for the dairy industry of which the results were publicly available. The need for the research was noticed by the industry and NIZO grew rapidly and was asked to participate in many activities that were less related to its core task. In 1964 it was stipulated that in order to meet the demand of the industry, the secondary activities like participation in international meetings, serve on committees, and contributing to dairy magazines, had to be limited. Research for the industry was their main task and should receive sufficient attention (AR ’64).

1964 was also the year that the first discussions on the intellectual property generated in the collective research started to come up. This topic kept returning over the years as the industry became more competitive and the customers sought ways to generate competitive advantages. Therefore it was decided that it should be possible to perform assignment for companies where exclusive rights would be granted, however NIZO had to arrange that they wouldn’t give away rights that could block itself in the research. This meant that each application had to be assessed separately (AR ’64 & ’72).

The knowledge created and the knowledge processes in general also changed in another aspect as the focus of NIZO has shifted to direct contract based research where the application of the generated knowledge has gotten a much higher value. In its former structure NIZO food research was supposed to perform collective research for the industry. When looking at the knowledge value chain, a shift can be seen from the emphasis on the first processes of mostly creating and transferring knowledge for and to the industry, to a focus on all the processes as the application as well as the evaluation became more important due to the contract research structure.

4.2 The macro perspective

The previous section showed that NIZO food research started as a research institute for the Dutch dairy industry. Important were the research for quality and safety of products as well as improving the analytical methods. While this still remains important for the organisation, many other things have changed and the focus has especially been broadened.

The shift to a commercial and private knowledge institute has increased the need for a strong competitive focus and positioning in the food and dairy industries. NIZO food research has an advantage in comparison to their competitors as it has a pilot plant in which experiments on large scale can be performed. The shift in the industry, where organisations have become larger and often have their own research facilities has led to the focus on collaborative projects and an international focus within NIZO food research. This has led to the establishment of various internationally locates offices.

The commercialization of NIZO food research meant that it has less rights to claim funding, however there are still possibilities to receive some funding for projects that are performed in relationship with public partners or for general research that has no intended purpose yet.

NIZO food research has various kinds of projects, especially in size. The first variants are projects that are performed for a single client company that has a specific question or problem that they want to solve. The second are the research consortia in which NIZO food research is cooperating with more commercial partners at the same time to improve something, and the third are the projects to contribute to fundamental knowledge for which NIZO food research participates in an international network of research institutes and universities.
4.3 Organization structure

Figure 2 shows the organizational structure of NIZO food research with the most important departments and their relations in the company. In this section of the report, the different divisions will be explained as well as the expertise associated with them. As can be seen in the organogram, knowledge management doesn’t appear in the picture. This has to do with the fact that it is not seen as a separate management function in the organisation, but is part of the general management.

Under the management falls the management team which consists of the managing director (Ad Juriaanse), business manager food beverages and ingredients (Koos Oosterhaven), Business manager dairy (Nel Zoon), research director (Meike te Giffel) and the finance director (Marcel Sleutjes).

Underneath the management team are many separate divisions which make it possible for NIZO food research to keep all the processes running. These are the divisions such as communication and Public relations, Human resources, and contracts and patents; as well as program management, finance, and of course operations. Operations consists of the research divisions, Flavour and texture, health, and processing and safety and the processing centre, but also includes the general services.

Each research division is divided in groups including employees with similar areas of expertise. The division has a division manager and each group in the division has a workgroup leader. Figure 3 gives a graphical understanding of the hierarchy. Teams for a project will be formed with members from different research groups depending on the research that has to be performed, also each project team will have a project leader, which doesn’t have to be a work group leader.
4.3a Organizational methods

The working processes or organizational methods of NIZO food research have some important features due to the type of business, which is elaborated on in the following section. First of all NIZO food research is a CRO which means that their core business is performing research under a contract for other companies or organizations. Therefore the work is divided in projects for and with customers which will be executed by project teams. For a regular project, the team will consists of around five employees with different expertise and skills that are needed for the project, resulting in inter-divisions team formations.

However, the work tasks at the organisation consist of more than just executing the research. Clients will go through an acquisition or definition phase first where the project goals and all the requirements have to be agreed on to come to a contract. So from start to the end a project has two main phases, the acquisition or definition phase and the executing phase. In the acquisition phase it is very important for a CRO in general to give the client company clear expectations of the possibilities with the research, without already releasing too much information or knowledge as there is no contract written yet. These processes go quite good at NIZO food research, due to their previous experience and good reputation that the organisation has and the involvement of a business development manager whenever necessary.

The contract research of NIZO food research can be performed for a single company or organization with a problem or question, but it can also be for multiple client companies in one project or so-called consortium. An important recurring issue in the consortium projects are the rights to the intellectual property that might be generated along the way.

Apart from contract research, NIZO food research is also participating in some research projects with institutions and government funds, like for example the projects for the Top Institute Food and Nutrition (TIFN). TIFN tries to bring the industry, science and government together to provide the knowledge base needed for high-impact innovation in food and nutrition (TI Food and Nutrition, 2014).

For the last few years the amount of work under contract research was about two-third of the total work, the remainder of one-third was spent on projects from TIFN and other similar initiatives. This will be changing in the recent future as the prognosis is that these (government funded) projects will decrease resulting in a higher amount of contract research (quarterly meeting, April 2014).

4.4 knowledge assets NIZO food research

The knowledge assets or actual stock of knowledge of NIZO food research form an important aspect for the knowledge management. In the introduction was stated that knowledge is seen from a flow approach in this research. However, the current stock of knowledge and the changes in the last years are important to evaluate the knowledge management. This is why the following sections discuss some of the important assets, such as the employees, the project reports, the patents and the scientific publications. The employees are important for the organisation as they have the specific fields of expertise to perform the projects. The project reports form an important part of the knowledge output of NIZO food research as these are the main outcomes. The patents can also be seen as an outcome of knowledge, as they are protected ideas to which the organization has exclusive rights (Boudreau, 2002). The number and pattern of research publications that are generated and used by an organization, is also an indication of the stock of knowledge.
4.4a Employees

Since the foundation of NIZO in 1948, the number of employees has been growing quite steadily over the first forty years, see figure 4. After this time the number of employees started to decline due to a couple of reasons such as reorganisations and economic recession. These where described in more detail in the previous section. The decline is also a result of a shift to hiring self-employed workers for the duration of a project (int. MG).

![employee growth and decline](image)

Figure 4; The growth of NIZO over the years represented by the number of employees. Based on data from the (social) annual reports from 1949 till 2012.

A change over time can also be seen in the hours that the employees work. In the first 25 years it was normal that almost everyone had a fulltime contract, while now around 50% of the employees have a part-time contract (SAR ’12). This is why the Full Time Equivalent (FTE) number of employees is included in the figure for the last couple of years. The shift to more part-timers has an effect on the knowledge processes and activities in the knowledge value chain as it is harder to arrange meetings where everyone should be available. However, an advantage of more part-time employees can also be the increase in different expertise of the employees, which is positive for the knowledge processes of the organisation.

4.4b Research reports

Looking at the numbers of the (confidential) research reports gives a good view of the amount of projects that NIZO food research performs every year and the growth of the organization. Figure 5 shows the number of confidential research reports per year from 1992, as NIZO became a full contract research organisation at that time. This means that the research reports are a clear knowledge output of the organisation. The first period that NIZO operated as a CRO show a rapid growth in the research reports after which the amount has been declining in the last 10 years. However, while the amount of research reports has become less, this doesn’t have to imply that NIZO food research is generating less knowledge. The size of the projects is not included in this figure, also one of the project managers stated that the really small projects are often not reported in research report anymore, but just in a presentation (BS).
The patent activities of NIZO started quite early in mid-1960, this can be seen in the annual report of 1964 as the patent policy of the organisation was discussed by the board. The first patents were acquired for the Kernhemse cheese, the continuous cheese maker and the cleanser K500 (annual reports). The organisation gave (exclusive) licences to other organisations to produce and sell the products in the Netherlands and abroad.

When searching the Derwent Innovations Index for patents with NIZO food research as assignee, there were 39 patents found. However, the first three mentioned didn’t come forth in the search. The publication dates of these patents start at 1978 and show an average patenting activity of almost one patent per year. Important with this knowledge stock indicator is to point out that NIZO’s strategy makes clear that the intellectual property that comes from the contract research work, will in most cases be for the client company. The exception on this rule is that when an invention includes basic processes for which NIZO will exclude itself when patented by the client, the patent will be for NIZO or arrangements have to be made where NIZO possesses a license to the patent, thus not blocking their own work.

When looking at the publishing dates of the patents in figure 6, there are some points for attention. The patenting activity has been relatively low in the first forty years, this is due to the structure of the organisation as its main role was to be a national research institute. This meant that all the partners of the product board of dairy were able to use the generated knowledge. The issue of confidentiality and exclusive rights has become more and more important from around ’64 when the first exceptions were made to provide exclusivity. Around the 1990s an increase in activity can be seen, which is most likely the result of the shift to a competitive organisation. Another important observation can be made about the lack of new patents in the last years, which is possible the result of the recession.

Figure 5: Decreasing trend of the number of research reports. Numbers extracted from cardweb, the internal database of NIZO food research. Figure shows only the trend and not the actual numbers as this is seen as confidential information.
Publications

As said before, the publications of an organisation are also an indicator of the knowledge assets of an organization. However, a difference with the confidential reports is the focus on basic science instead of applied science. Due to the nature of NIZO's working process, it can be expected that there are quite a lot of scientific publications as it is a research organisation where fundamental research is also important for the long term profitability. The amount of publications per year are shown in figure 7.

An explanation for the increase in publications from the 90s might again be the shift of focus of the organisation, where they have become fully competitive and have broadened their research field to the food industry. The decrease in the last 5 years is in line with the other figures show in this chapter and can be explained by them too, as a decline in employees will also result in less knowledge output, whether they are research reports, patents or scientific publications. An explanation for the general decline is that the crisis also has had its effects on NIZO food research and maybe even more on their customers.

4.5 Concluding remarks

The sections in this chapter give an overview of the organisational structure and the working processes at NIZO food research. Some important remarks for the remainder of the research are the effect that the organisational structure has on the knowledge processes of the knowledge value chain, such as the size of the organisation, and the project-based working processes. These organisational features can have an effect on the knowledge activities that suit the organisation and have an influence on the knowledge processes of the organisation.
One of the important aspects that come forth in this chapter was the shift of NIZO food research to direct contract based research. When looking at the knowledge value chain, a shift can be seen from the emphasis on the first processes of mostly creating and transferring knowledge for and to the industry, to a focus on all the processes as the application as well as the evaluation became more important. The next chapter discusses each of the knowledge processes in detail.

With regard to the knowledge assets or output, there could be seen that all four of the indicators show a decreasing trend in the last five to ten years. The organisational background shows that this can be explained by the structural changes in 2003, when NIZO food research became an entirely independent contract research organisation. This has led to a different approach to projects and advices. Another possible explanation is the economic crisis that also has influences the customers of NIZO food research and therefore on NIZO food research itself, leading to a decline in project proposals.
5. Results
The results of this research are divided in a part on the knowledge management processes with a section for the knowledge activities. The second part of the chapter is focussed on the organisational features and the third on the knowledge management strategy of NIZO food research. In each of these parts both qualitative and quantitative research methods are analysed, leading to results that complement each other.

5.1 Knowledge processes
The results of the analysis on the knowledge value chain is given by stating the strong and weak point of each of the knowledge processes, even though these will sometimes overlap. The evidence for the qualitative results is generated through the interviews, group discussions, observations and documentation, while the data for the quantitative results come from the survey.

5.1a Qualitative analysis
The results of the qualitative analysis are based on the evidence from the interviews, group discussions, observations and documents. After each statement or assumption, the evidence base is stated as clearly as possible, indicating the data generation method and the specific interviewee or meeting.

1) Determining needed knowledge
The determination of the needed knowledge organisation wide is dependent on the strategy that the management of NIZO food research wants to pursue. The following citation shows the mission of NIZO which is quite broad. This also shows the problem with the determination which knowledge the organisation needs to fulfil the strategy.

“Companies can increase their profits with our results. We accelerate innovation to improve our clients’ products and processes, as we have top expertise, excellent infrastructure and we understand the businesses our clients operate in. We combine problem solving skills with a proactive approach when we see new opportunities in science and technology. By being relevant, both for the companies we work for and for the NIZO employees, we are able to take the necessary steps to reach the next level.” (About NIZO, 2014)

When looking at the underlying processes, it can be seen that NIZO works on a project basis with each its own targets. The determination of the needed knowledge for NIZO on this level is therefore dependent on the research proposals that they get from their customers, which are in many cases companies in the food industry. This is a difficult process as both NIZO and the companies are rather reluctant to share their knowledge when a contract is not formalized yet (observations telcons). The company will want to know what NIZO can do with their research and NIZO wants to have a clear view of the research direction that the company will want to pursue, which is also sensitive information.

“The company [customer] has a certain question and we [NIZO] will try to generate the answers” (HB)
After the first contact has been made, it is important for NIZO to find out which knowledge is needed to accomplish the research goals of the customers. Besides these projects, NIZO also has to determine whether there is need for more basic instead of just applied science. The problem with this is that basic science has no clear profit benefits in the short run, but it is of importance on a long term basis and can contribute to the technology-push strategy that NIZO also sometimes likes to pursue.

II) Identifying existing knowledge

The identification of the existing knowledge takes place through the acquisition phase of a new project as the research proposal is being generated. In this phase NIZO food research starts orienting on who should be a part of the project team making sure that the expertise of the project team is the best fit for the proposed research.

From the interviews came forth that the employees have a relative good view of who knows what in the organisation and can easily find the person with the right expertise if they have a problem to solve. Important on this aspect is the organisational structure with workgroup leaders and division managers who can always be asked who to approach with a question and the size of the organisation, which makes it in general easier to keep track of the expertise of the employees. The next quote shows an example:

“I often don't know who I need for solving a certain problem, but I just ask my direct colleague and he will know who can help me because he's been working at NIZO much longer.” (MF)

There is an employee database on the intranet of the organisation, but this is only used for the contact data of the employees, while there are also possibilities to insert the areas of expertise of the employees. If this data would be regularly updated, it could be useful to find who can help you in solving tasks and problems without having to ask around. This can be particularly useful for recently started employees as these have more trouble in knowing the expertise of their colleagues.

III) Creating new knowledge

In the knowledge value chain could be seen that the determination and the identification are part of the creation process of knowledge. However the creation of knowledge encompasses more as it is concerned with the generation of knowledge. At NIZO can be seen that new knowledge is constantly being created in the organisation as the main activities all resolve around performing research, either under contract or as a part of a funded research group. But due to the project based structure, the topics of research and therefore the knowledge that will be generated depends on the requests that come from the customers.

“Developing your scientific base is taking place in your own time [are not viewed as billable hours]” (HB)

“Developing and maintaining the scientific literature is difficult as there is not much time for. Management would like to see it as a part of the project and to make these hours billable, but this is not feasible in reality.” (WE)
The quotes as well as responses from the other interviews show that the employees feel that they don't have enough time to develop their scientific knowledge. This can become a bottleneck for the organisation as basic knowledge needs to be generated to stay innovative on a long term basis.

Another negative point that came forth from the management updates in the NIZO info is that NIZO food research likes to say yes to almost every request from companies. This is due to the organisational structure where NIZO food research is dependent on the amount of projects that they can perform. The knowledge creation process suffers from the eagerness to proceed with projects as the direction of the knowledge creation is not structurally evaluated. The management sees this problem and tries to make clear that for example new technologies/ expertise/ projects with new customers should be avoided (NIZO info, 2014).

**IV) Transfer of knowledge**

The transfer of knowledge at NIZO food research takes place at various levels, like from employee to employee, inside a project group, between project groups in for example workgroup meetings, or even over the entire organisation. The transfer of knowledge is influenced by the structure and culture of the organisation, as the employees must be able and willing to share their knowledge and to reap the benefits of it. Comparing the view of a project manager to the view of an analyst shows that the opinions are rather divided on this subject.

Project manager: “I like to make bridges by sharing knowledge between different working groups, even though I don’t get a real reward from it myself, I like to think that I have helped to make processes more efficient […] some people in the company don’t want to share their knowledge, due to different reasons. Some think that the knowledge won’t be used to its full potential by others or that they won’t have enough work left themselves.” (BS)

Analyst: “I feel like my knowledge is exploited when I am asked to contribute as an expert on a topic in the definition phase while not being the analyst in the project itself. Like I am replaceable after I have told how to approach a research task. This makes me less inclined to share my knowledge” (FK)

The knowledge sharing inside project groups goes through various channels, such as email, face-to-face contact, telephone, and project meetings. The intensity of this contact is dependent on several factors such as the size of the project and thus the project group and the problems that have to be overcome during the project. The transfer of knowledge outside the project groups takes place in the work group meetings that take place on a two- or three-weekly basis and in the seminars and lunch and learn sessions (observations).

The transfer between workgroups and special sections like the sales department is again different. These are managed through a monthly meeting of the sales group with the management team, including the division managers. This meeting takes a couple of hours and in it the (financial) progress of NIZO is discussed as well as the best practises. After this, it is the function of the division managers to inform their project leaders when something of interest for them has been discussed. This meeting and the communication of the results throughout the organisation is important for the knowledge management as a whole as these are the meetings where knowledge management aspects can be discussed.
The transfer of knowledge NIZO wide is a different story as there are a lot of possibilities to reach the employees, but the success depends on the accessibility by the receivers. For example, NIZO has protocols when it comes to what to do with finished project reports and how they should be made available to the organisation and in what form. This results in a project database where all finished project reports can be found, but which are only rarely consulted.

Spontaneous transfer of knowledge that is not directly related to a project is rather difficult due to the focus on the finishing of the contract research projects in the given time period. There is not really time to exchange thoughts about scientific literature with colleagues as these are non-billable hours. This is shown in the following quote:

> “Just talking about interesting scientific topics with colleagues is difficult as this is lost time in the perspective of the organisation” (HB)

A final problem with the transfer of knowledge is that much knowledge is lost when an employee leaves the organisation. The transfer of the working tasks and with it the knowledge of the leaving employee, is not sufficient. The quotes show the difficulties with the transfer of the codified knowledge of the leaving employee, which should be rather easy to resolve. However the lack of transfer of tacit knowledge became clear in the observations of the review meetings held with some project groups where the project leader had left and the replacing project leader had much difficulties in picking up the project. They will manage to proceed in most of the cases, but it takes much more time if you’re not informed properly with a sufficient knowledge exchange.

> “The exchange of knowledge from employees that leave NIZO is often not very good. An example is the data exchange from the personal I:Drive, when this is forgotten, the data gets lost leading to hours of double work when another employees encounters a similar question.” (NP)

> “If I will resign or won't be able to work for a while, am I afraid that some of the work that I've done will be lost because it cannot be found or used properly.” (MF)

**V) Applying the knowledge**

After the determination, identification, creation and transfer of the knowledge, it is applied over the whole project with the project report as a result for NIZO food research. The project report describes the whole project and the findings which are in most cases for the customer. However, NIZO food research will always make sure that it will poses the intellectual property rights to developed research methods that will be used for other products, while the property rights to the end product goes to the
customer. In case of a consortium project, the intellectual property is handled through shared ownership or licensing agreements (CHEF meeting).

In case of applying new knowledge in the form of new working processes or research methods, the employees are rather willing to learn. This is also due to the structure of the organisation where the employees are mostly high educated and rather used to keep on learning. The observations show that the employees are in general also very interested in the views and research methods of their colleagues.

**VI) Evaluating the knowledge**

The evaluation of knowledge takes place mostly through project presentations either in work group meetings or in the (lunch) seminars. The presentations in the work group meetings take place during or at the end stage of the project when the result can be shown. The advantage of this is that the research and with it the generated knowledge is critically reviewed by a group with varying but related fields of expertise, which leads to good feedback on the research and on possibilities to proceed (observing). However, most of the presentations given in the seminars are about finished project which is good for sharing the knowledge, but for the evaluation it is less relevant as feedback will no longer be applied as the contract with the customer is finished. In case of a follow-up project it regains its value.

In case of the evaluation of the knowledge of individual employees, it can be seen that there is no regular evaluation. This came forth in one of the action reviews where a participant stated that she had never have an evaluation before. This can be rather important as the fields of expertise of the employees may stay the same but the strategy of the organisation changes over time, leading to employees with a knowledge gap that can be resolved through additional training or giving courses. While NIZO does arrange learning sessions, it is not clear if the ones that need the training also make use of them. These type of knowledge activities are discussed further in chapter 5.2.

In conclusion, the qualitative analysis showed that there are strong and weak points that can be highlighted for each of the knowledge management processes by observing and interviewing the employees. The analysis also shows that the sharing of knowledge especially deserves more attention as this takes place through various activities, but there are also some clear problems. In the next section the processes are analysed quantitatively through a survey after which the combined results of the analyses of the knowledge processes are given.

**5.1b Quantitative analysis**

The data of the survey is used to find out how well the different knowledge processes are being used inside NIZO food research. A survey containing the knowledge management scan developed by Mathieu Weggeman (1997) is held under the employees at NIZO food research. The knowledge management survey has been online for two and a half weeks. The NIZO employees have been notified of the survey through an email on the first day that it was online and again after a week. The link to the survey was also posted on Yammer, the enterprise social network, and advertised through direct contact.

“There should be a final meeting to at the end of the project to evaluate on the processes taken place. However this is regularly ‘forgotten’ as the hours for the project are spent and the team members want to proceed with other projects” (WA)
This has led to 72 responses from the 160 employees, which means a response rate of 45%. For a knowledge management survey, this is quite good as a part of the employees (plant operators, canteen employees and facilitators) probably won’t feel the urge to fill it out as it is rather complex and focused on the knowledge processes inside the project teams. This also comes forth from the data as the group of supporting staff has the highest rate of unfinished surveys. However, all employees had the opportunity to contribute; this means for the analysis that it is important to compare the differences between groups of employees as can be seen further on in this report.

The data of the 72 respondents could be extracted from theistools.nl in an excel file. This excel file could in turn be opened in SPSS to perform the statistical analysis. The first step with the data preparation in SPSS was to clean it and to give all the variables proper names and labels. The cleaning of the data showed that approximately 42 respondents had filled in the entire survey while the others had given up somewhere during the process. Some of the given reasons where that the respondents couldn’t relate to the questions, that the questions were too complex, or that the respondent simply didn’t had enough time to finish it. This can bias the results as there is a higher rate of responses from employees that are more involved in the organisational processes. This doesn't seem to be a problem as there is still enough diversity in the respondents. However, to check for possible variations, the means of the groups are compared in the research. To proceed with the data, the zero values have been changed into missing values as the scale of the questions went from 1-5 or 1-3 for some of the final questions, which made zero an invalid answer.

A second step in the data preparation was to transform the variables that had a backward scale in order to make them comparable and to be able to combine variables to form one for each knowledge process. After that a reliability analysis could be performed for the groups of variables that belong to each of the knowledge processes. The Cronbach’s alpha results are shown in table 4. These results do have some implications as not all of the α-values reach the ,70 barrier. This is the case with the variables for creating knowledge and for evaluating knowledge. The knowledge value chain shows that the first two process are a part of the creation process, which is why the alpha value of the first three process is also calculated and showed a value of α = .84.

After looking at the reliability of the indicators, new variables (scales) have been made by combining the indicating variables into mean-variables. This has been done for each of the six different knowledge processes and the scores have been multiplied by 2, making it a 2 to 10 scale which is comparable to scaling and the reference numbers of Proven Partners.

<table>
<thead>
<tr>
<th>Knowledge process</th>
<th>Number of variables</th>
<th>Cronbach’s alpha</th>
</tr>
</thead>
<tbody>
<tr>
<td>I Determining needed knowledge</td>
<td>4 (Determining_1 till _4)</td>
<td>α = .721</td>
</tr>
<tr>
<td>II Identifying existing knowledge</td>
<td>5 (Identifying_1 till _5)</td>
<td>α = .738</td>
</tr>
<tr>
<td>III Creating new knowledge</td>
<td>9 (Creating_1 till _9)</td>
<td>α = .609*</td>
</tr>
<tr>
<td>IV Sharing of knowledge</td>
<td>18 (Sharing_1 till _18)</td>
<td>α = .801</td>
</tr>
<tr>
<td>V Applying the knowledge</td>
<td>5 (Applying_1 till _5)</td>
<td>α = .792</td>
</tr>
<tr>
<td>VI Evaluating the knowledge</td>
<td>5 (Evaluating_1 till _5)</td>
<td>α = .489*</td>
</tr>
</tbody>
</table>

The reliability of the creating variable could be improved by excluding four of the nine variables, which resulted in a Cronbach’s alpha of .728. However, as the results of proven partners with which the comparisions will be made did include all variable, there was decided to include them here too. The same accounts for the evaluating variables, which could only be slightly improved by excluding one of the variables. The weak reliability of these two mean variables has been taken into account for the concluding section. The separate variables are also used throughout the analysis as they give an
indication of the strong and weak points for each of the processes. These detailed results are included in appendix B.

**Analysis of the knowledge processes**

There are several analyses that can help in testing the knowledge management of NIZO food research and checking for differences in the evaluation of the different groups of employees inside the organisation. A separation will be made in the time that the employees have been working for NIZO food research, the divisions that they are working for, the type of work that they perform, and whether they work for NIZO only or have another job besides their NIZO function.

The analysis that are executed, after the cleaning of the data, are the comparisons between the different groups of employees at NIZO by using various analyses methods such as the Independent-Samples T-Test, the Mann-Whitney U test and the Kruskal-Wallis H test (Field, 2013). These tests show whether there are groups that have a significantly different view on the knowledge management process and if they should be included in the next analyses. After this the mean values of the knowledge processes can be compared with the reference number from Proven Partners and with the earlier results from the scan at NIZO in 2003, by performing one-sample T-tests.

**Differences between groups within NIZO**

The next analyses are performed to find out whether there are significant differences between the different groups at NIZO. This gives an indication of where the best possibilities lie for improvement. The first division is made between the years of employment between the employees. Two different tests were used to find out whether the job duration or employment time had an influence on the evaluation of the knowledge processes.

The first was to perform a Kruskal-Wallis H test with as test variables the averages variables of the different knowledge processes and as grouping variable the job duration. A Kruskal-Wallis H test was used as the groups had N < 20, which indicated the need for a non-parametric test. The results of this test indicated no significant differences in the values of the groups. To check even further on possible variances between job duration a new variable has been made dividing the employees in two groups, employees in service for less than 10 years (52,1%) and employees in service for 10 years or longer. In this case an independent sample T-test could be performed, as the two groups had N ≥ 20. This test also didn’t show any significant difference which indicates that the job duration is not significantly related to the valuation of the knowledge processes.

A similar analysis has been performed to see whether there are differences between employees working only at NIZO and employees that have also another job besides working for NIZO. The analysis method used here is the Mann-Whitney U test as again the N for the groups is for some of the variables less than 20. The results show only a significant difference (p = .012) between the ‘NIZO only’ employees and the ‘working also somewhere else’ employees for the for the average determine variable. The mean for NIZO only employees is here 5,74 while the NIZO employees that are also working somewhere else have a mean of 6,55, see also table 5. A possible explanation for the difference can be that the NIZO employees that are working also in another organisation tend to compare their experiences when they fill out the questionnaire, however this difference only shows for this particular knowledge process, making it difficult to find an explanation.
The next analysis that has been performed is again a Kruskal-Wallis H test, but this time to see whether there are significant differences between the responses of the employees of different departments. The results of this test show that there is no significant difference between the groups, indicating that all the employees experience the knowledge processes in a similar manner.

To complete the group analyses, the same test has been performed but now with the respondents divided in accordance with their function in the organisation. This Kruskal-Wallis H test gave one significant difference, which was for the application of knowledge variable (p = .049). Further analysis through testing all groups in separate Mann-Whitney U tests showed that the supporting staff gives significantly different values for the application of knowledge variables, with means of 5,1 compared to 6,8 for not support staff (p = .022).

About the comparison between different groups inside NIZO food research can be said that the responses of the employees are rather consistent in their evaluations as there are only a few significant differences in the means of the groups, as can be seen in table 5. This indicates that there is no need to deliberately differentiate between employees of different groups in the other aspects of the research.

A note for the discussion of the results is that there might be a bias in the results of the survey as it is reasonable that the employees who are not concerned with the innovation and knowledge processes of the organisation, haven’t filled out the questionnaire. However, as the comparisons between the different groups of employees that have filled out the questionnaire, doesn't show much differences, there can be argued that the employees have in general a similar view of the knowledge processes even though some will in general be more knowledgeable on the topic.

**Comparison with reference material**

With the mean variables of each of the knowledge processes and the confirmation that the groups at NIZO food research evaluate the knowledge processes in most cases similar, the result of the organisation could be compared with the reference numbers of organisations that are also operative in

<table>
<thead>
<tr>
<th>Table 5: Summary of the group analyses with only two significant differences for the evaluation of the knowledge processes.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Job duration</strong></td>
</tr>
<tr>
<td>------------------</td>
</tr>
<tr>
<td>I Determining needed knowledge</td>
</tr>
<tr>
<td>II Identifying existing knowledge</td>
</tr>
<tr>
<td>III Creating new knowledge</td>
</tr>
<tr>
<td>IV Sharing of knowledge</td>
</tr>
<tr>
<td>V Applying the knowledge</td>
</tr>
<tr>
<td>VI Evaluating the knowledge</td>
</tr>
</tbody>
</table>

39
the business services and with the results of the same scan performed at NIZO food research in 2003. The results are shown in Table 6 and graphically in Figure 8.

Table 6: Table with the one-sample t-test results (N for NIZO 2014 ranging from 37 to 53 and for NIZO 2003 from 51 to 60) *significant

<table>
<thead>
<tr>
<th>Knowledge process</th>
<th>NIZO 2014</th>
<th>Reference number of Proven Partners (other organisations in the business services)</th>
<th>NIZO 2003</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Average</td>
<td>Significance of NIZO 2014 compared to averages business services</td>
<td>Average</td>
</tr>
<tr>
<td></td>
<td>N≥37 (range 2-10)</td>
<td>N and SD</td>
<td>N/A</td>
</tr>
<tr>
<td>I Determining needed knowledge</td>
<td>6.08 1.49</td>
<td>5.6</td>
<td>.024*</td>
</tr>
<tr>
<td>II Identifying existing knowledge</td>
<td>6.97 1.33</td>
<td>6.2</td>
<td>.000*</td>
</tr>
<tr>
<td>III Creating new knowledge</td>
<td>5.69 1.05</td>
<td>5.2</td>
<td>.004*</td>
</tr>
<tr>
<td>IV Sharing knowledge</td>
<td>6.14 1.03</td>
<td>5.8</td>
<td>6.045*</td>
</tr>
<tr>
<td>V Applying knowledge</td>
<td>6.63 1.40</td>
<td>5.7</td>
<td>.000*</td>
</tr>
<tr>
<td>VI Evaluating knowledge</td>
<td>5.35 1.06</td>
<td>5.3</td>
<td>.769</td>
</tr>
</tbody>
</table>

When comparing the means of NIZO food research to the reference numbers from the other organisations in the business services, it can be seen that the organisation performs reasonably good with all the means of the knowledge processes significantly higher except for the evaluation of knowledge process, which is not significantly different. However, when looking at the results of 2014 compared to the results of 2003, it can be seen that the employees of NIZO food research have evaluated three of the knowledge processes significantly lower now. This is the case for the creation of new knowledge, the sharing of knowledge and the evaluation of knowledge processes, indicating an opportunity to improve.

A final point that can be made about the means of the knowledge processes is that a score of six is neutral. As two of the

![Figure 8: The mean values of the knowledge processes compared](image-url)
process score lower than neutral, while the other four are only slightly above this value, it is reasonable to say that there is still a lot of room for improvement as the scale goes from 2-10.

To sum up the results of the survey, it can be seen that NIZO food research scores quite good in comparison with the numbers of other organisations in the business services, but they don’t score well in comparison to their own result of 2003. The knowledge processes should be improved to become better throughout the years, instead of declining.

5.1c Knowledge activities

The knowledge processes of the organisation can be improved by making use of the right knowledge activities. Therefore, the current use of the knowledge activities of the organisation as well as the expected value that the employees expect to get from using certain knowledge activities is analysed. This contributes to the possibilities to improve the knowledge activities and with it the knowledge processes of the knowledge value chain.

The analysis of the knowledge activities is mostly qualitative, but there is some quantitative data as a result of the inclusion of some extra questions in the survey. The questions are about the possible useful knowledge activities for NIZO food research, as well as some related activities that are not necessarily used in the working environment, such as Facebook. These where included to see whether the employees have experience with such tools. The quantitative data is being used to support the qualitative analysis as it gives a more general view on the use and expected value that certain knowledge activities may have at NIZO food research.

In the theoretical background could be seen that there are many different knowledge activities that can be useful for organisations to implement, depending on their organisational structure, culture and other aspects. The first analysis was to select the activities that could have added value for NIZO food research and therefore should be used further on in the research. To evaluate the knowledge activities, they were included in the survey where the respondents could give a score for the use of the activity at NIZO food research and the possible expected value that can come of implementing the activity.

Non-IT activities

The data from the observations as well as from the group discussions and interviews indicate that the non-IT activities to improve the knowledge processes are valued quite high. This comes especially forth in almost all of the interviews, as the interviewees state that they have a lot of face-to-face contact in which they exchange thoughts, discuss projects or just ask for help with a problem. These exchanges often take place during coffee breaks or by just walking to each other’s office. The face-to-face contact can also be seen in the brainstorm activities that are undertaken mostly in the definition phase of a project with a possible project group, as well as the pitching or brainstorming at meetings in response to a project presentation. This shows clearly in the lunch seminars and in the working group meetings. Therefore, it can be said that the informal contact is rather good and the size of the organisation plays an important role in it.

However, from the interviews also came forth that more structured knowledge management activities like peer assist on projects and action reviews are not really used. Peer assist is not being used as it is rather expensive to get another group of employees to read and give feedback on the project as these are non-scheduled hours for the project. The employees also think that this can be done more efficiently by just asking for help from others outside the project group when they run into a problem (Group discussions). according to DJ, the action reviews should already be a part of the projects as a project is supposed to be reviewed by the project members after it has been finished. However, this is
often neglected as there are no more hours left for the project and the project leaders believe that the weak and strong points of the project are general knowledge to the project members (Int. HB). What also can be said about the internal meetings is that they are seen as less relevant, which results in bad preparations. This following citations support these inferences:

“There is supposed to be a kick-off and an final meeting for every project. The kick-off meeting is used as an introduction to everyone’s working tasks and the final meeting should be used to reflect, but this is often forgotten. For me [a project manager] it has been a couple of years back that I had a final meeting with a project group to reflect.” (WE)

“Internal meetings can be much better, the involved employees are not well prepared leading to lost time to get everyone informed, also meetings start often late because of latecomers and the time set for the meeting is often exceeded because of these points.” (NH)

Some other non-IT knowledge activities that need to be highlighted are the communities of practice and the storytelling activities. From the observation of the working processes and structure of NIZO comes forth that the working groups can each be seen as a community of practice. This is due to the organisational structure where the employees are divided into research groups with a shared expertise field. This means that they naturally are a community of practice. The exchange of knowledge in these working groups goes through work group meetings and lunch seminars which is where a lot of storytelling is done on the projects that have been finished or are still in progress (observations, group discussions). These activities were not included in the survey as there seemed to be no need for improvement.

The results of the survey are shown in table 7 and graphically in figure 9 and give an indication of the current use of the activities and the value that can be expected according to the respondents. The use of the tools and the expected value are plotted in the same diagram, but it must be said that the scales are not the same. However, it does give a nice representation of the use and expected value of the different activities. About the use of the activities can be said that face-to-

<table>
<thead>
<tr>
<th>activity</th>
<th>use (1-5)</th>
<th>Expected value (1-3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>brainstorming</td>
<td>3</td>
<td>2,73</td>
</tr>
<tr>
<td>face-to-face contact</td>
<td>4,29</td>
<td>2,97</td>
</tr>
<tr>
<td>action reviews</td>
<td>2,58</td>
<td>2,62</td>
</tr>
<tr>
<td>peer assist</td>
<td>2,16</td>
<td>2,68</td>
</tr>
</tbody>
</table>

![Figure 9: Non-IT knowledge activities](image-url)
face contact is the most used way of interacting of the non-IT tools while the other three don’t score very high. When looking at the expected value of the activities, it can be seen that all of them are expected to be valuable for NIZO food research which shows that some improvement can be made in this area. This is taken into consideration in a further step of the research, which will be discussed some paragraphs later.

**IT activities**
The IT based knowledge activities are analysed in a similar way again by observing, asking and discussing the different possibilities with employees from NIZO food research. Form this came forth that the most used IT-tools for contacting others with questions and such are the email and just calling by telephone. Voice over internet protocols like Skype are not used intern but they are sometimes used for contact with customers (WE). A more frequently used communications method with satisfactory results are the telcons without imaging, which makes it possible to discuss topics with more people at the same time (WA).

However, while these communication methods work ok for direct questions, it is a different story for more general information like messages from the communications department. As most employees check their email frequently, this seems a good channel to send certain notifications to all employees. However due to the overload of email, the attention to each mail drops. The question is how this can be improved and if there is another communication channel more suitable for general notifications. The next quote gives a nice representation of the problem:

> “The complaints of the employees are that there is too much information send over the email, which has as a result that these mails are badly read.” (MF)

> “It’s always the question of ‘How do you exchange information?’ Mails are direct but easily forgotten and the intranet page is not visited regularly.” (NP)

When it comes to document systems, NIZO food research uses *cardweb* for storing their finished project reports. This is a web-based database that is accessible by all NIZO employees and which has a good functioning search engine. For ongoing projects a *Customer Relationship Management* (CRM) tools is used, where project managers can view their own ongoing projects as well as all the other projects. This tool provides a centrally structured platform where the progress of the projects can be followed and which can be used to create flows between employees of different departments. The most common documents in the system are the project proposals, offers and project reports. While some of the project managers are quite positive, others in the organisation don’t like the system because of the limited access for the project teams in general as it is only meant to be used by the project managers so that not everyone can make changes without permission (WE & MF). A third document system is the *H: drive*, where shared folders can be made that allow the (team) members to exchange and adapt work in progress. Some trouble here is that a new folder can only be made by someone from IDT which means that an extra step is required and the project managers often just use their I:drives and email to share documents to avoid this step, which is less efficient (WE & BS). A fourth place where documents can be found is the *intranet* of NIZO food research which has more general documents that can be relevant NIZO wide, like employment conditions and the NIZO newsletter and such. All these systems show that it is often difficult to find the right documents as it is scattered over various places. This shows an important point on which the knowledge management can be improved.
However, while this would have been interesting to research and change in the time-span of this research. It became clear at the first interview that such a change in the document systems in combination with a strong search tool is already scheduled and the IDT department is working on it at the moment (NP). Therefore, the document system and advanced search tool were no longer included as possibilities for the implementation phase of this research.

NIZO’s activities with knowledge bases, wikis or other collaborative virtual workspaces are very low at the moment. As could be seen with the document systems, the project members make use of a lot of different tools to share their documents and communicate. This could easily be combined by using for example a knowledge base. The advantage of a knowledge base as an knowledge tool, is that it has many different functions, like the sharing of documents, asking questions in the forum, posting important links, scheduling meetings, assigning tasks. This works well as all the members of a group have access and can read, store, retrieve, answer and adapt all the shared knowledge. From the group discussion and the interviews came forth that the employees are quite enthusiastic about using a knowledge base for each project group as long as it is easy to use and het clear advantages over the systems that are used now. See the next quote:

“I believe that it can have advantages to have a web-based software program that makes sharing of knowledge easier, but the program has to work good. It has to be intuitive, and from the perspective of the IDT department, well secured. (WE)"

Knowledge activities like blogs and social network services have some similarities to the knowledge base, but also vary on a couple of points. The most important difference is the broader accessibility for the employees, which is not restricted to only personally invited members. Blogs can be seen as only the forum part of the knowledge base, where questions or research problems can be posted and answers generated by anyone who reads the blog. A social network service has a broader functionality as it also gives possibilities to share documents, schedule meetings and form groups inside the organisations network. From the group discussion came forth that the opinions on the expected value of these tools are divided among the employees, which is also the result of inexperience with social networks.

Other possible IT tools to use in organisations are focused on the in-house expertises. An expert locator or yellow pages system can contribute to finding the right employees when embarking on problem. However, this only works when the employee information is regularly updated and the search tool is working properly. NIZO food research has an employee database which is suitable for
this, but the only information displayed now is a picture, email address, room number and telephone number of each employee. As the organisation is not so big, it can be seen that it is not so difficult to find someone to help you out when solving a problem. Therefore, the implementation of a yellow pages system, may be an unnecessary activity. This can also be seen in the next quote:

“most people know the expertise of colleagues by experience and otherwise the work group managers can help in finding the right person.” (WE)

The results of the survey questions on the IT knowledge activities are shown in table 8 and graphically in figure 10. The same applies here as with the graph of the non-IT knowledge activities, that the scales of the two variables are not the same, but it does give a nice representation of the use and expected value of the different activities.

The high scoring activities for both use and expected value for the organisation are emailing, call contact and search engines. The first two came also forth from the other data collection methods. The use of search engines was not specifically asked for in the interviews, but shows to be quite high.

From the interviews came forth that the use of the intranet is not so high, however the figure shows that the use is still quite good, which shows that it might be good to improve this knowledge tool. The activities with a medium score for the usage where LinkedIn and wiki’s, while the remainder of the activities scored very low for their usage. The expected value that each of the activities can have, according to the respondents, shows a more interesting result. The clearest one is Skype, which is regarded to have a rather high value but

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**Table 8: Use against expected value of IT KM tools.**

<table>
<thead>
<tr>
<th>Activity</th>
<th>Use (1-5)</th>
<th>Expected value (1-3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>call contact</td>
<td>4.29</td>
<td>2.62</td>
</tr>
<tr>
<td>email</td>
<td>4.79</td>
<td>2.78</td>
</tr>
<tr>
<td>Skype</td>
<td>1.92</td>
<td>2.38</td>
</tr>
<tr>
<td>search engines</td>
<td>4.68</td>
<td>2.81</td>
</tr>
<tr>
<td>the intranet</td>
<td>3.61</td>
<td>2.46</td>
</tr>
<tr>
<td>Facebook</td>
<td>1.63</td>
<td>1.38</td>
</tr>
<tr>
<td>twitter</td>
<td>1.42</td>
<td>1.56</td>
</tr>
<tr>
<td>yammer</td>
<td>1.11</td>
<td>1.51</td>
</tr>
<tr>
<td>LinkedIn</td>
<td>3.11</td>
<td>2.24</td>
</tr>
<tr>
<td>wiki’s</td>
<td>3.05</td>
<td>2.43</td>
</tr>
<tr>
<td>blogs</td>
<td>1.27</td>
<td>1.62</td>
</tr>
</tbody>
</table>

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*Figure 10: IT knowledge activities*
is almost never used. Other interesting ones are the wiki’s and social network sites in general.

In appendix C, a table with the non-IT activities and a table with the IT activities is included. These give a summary of the relevance and use of the knowledge activities at NIZO food research. They also give a description of how the activities are used or can be used.

5.1d Combining the results

The results of the qualitative and quantitative analyses of the knowledge processes are combined in this section to give a full evaluation. With this evaluation can be worked on the implementation or replacement of some knowledge activities to improve the knowledge management.

Form the survey came forth that the determination of the needed knowledge had an average score of 6.08. A rather negative point that came out of the survey was that the determination of the needed knowledge to achieve the organisations strategy is not a systematic routine based process. The qualitative results supported this as the mission of NIZO food research is rather broad and each project requires a different approach which makes it difficult to have a standard process for them. In the qualitative analysis could be seen that NIZO doesn’t just work with a market-pull strategy as it also uses the ideas generated inside the organisation as leads for new projects. This does mean that they have to find a partner company that is interested in the project proposal to be able to perform it. This technology push strategy also shows in the positive response to the question whether NIZO food research also looks for strategic opportunities based on the nature and level of the knowledge that is inside the organisation.

The results for the identification of knowledge at NIZO are relatively high. For this process can be said that while NIZO doesn’t have a good working index/database where the knowledge of the organisation can be found, the employees still have a good view of the knowledge distribution. This is due to the relative small size of NIZO, which makes it easier to know your colleagues, and the structure of the different departments where each division manager knows quite well who has which expertise in his/her department.

The creation of knowledge scored not very well in the survey and there were three clear negative variables that influenced this score. The first is that the make or buy decisions are not always made on rationale grounds; this also came forth from the qualitative analysis as the project leaders are in general very eager to pursue projects even when they need a lot of ‘new’ knowledge. The second is that sometimes a knowledge gap appears in a department that needs investment in education to be resolved. The third negative point is that the question which knowledge the organisation should have in about 5 to 10 years is not discussed structurally. The qualitative analysis showed that the direction of the knowledge creation is dependent on the projects that NIZO performs, which shows that the organisational structure makes it difficult to think about the knowledge that NIZO will need in 5 to 10 years.

For the transfer of knowledge a rather negative point is the in time distribution of knowledge. The survey shows that a large part of the respondents believe that valuable mistakes are made because knowledge is not transferred in time and therefore not available to others. The qualitative analysis also shows that it is difficult to transfer knowledge, but instead of the knowledge not being there in time, it is more about the employees not being able to find the knowledge, as there are so many ways in which the knowledge is being transferred. It is also about not having the time to look for it. A really positive point is that the employees feel that when looking for certain knowledge, they can find the person in the organisation who knows the most about the topic. A second positive point from the survey is that
the majority of the respondents don’t agree with the statement that ‘knowledge is power’. However, this does conflict with the qualitative analysis as the observations showed that some of the analysts do feel that they are replaceable if they share much of their knowledge. They apparently belong to the 25% of the respondents that do agree to the statement.

The application of knowledge is in general good within the organisation as the employees are willing to learn and make use of new knowledge. This is probably also due to the relative high amount of high educated employees, who are familiar with continuous learning and therefore won’t resist it. A minor negative point for this process is that the employees are attached to their routines and don’t always like to change them.

The evaluation of knowledge is the process with the lowest score in the survey. Four of the five variables have a rather negative evaluation. The most important one is that the respondents believe that the knowledge workers with an expertise field that no longer contributes to the execution of the strategy, are insufficiently tutored or trained to get their knowledge valuable again. However, the survey also shows that there are not many knowledge workers in the organisation for which 50% of the knowledge is no longer of value for the organisation. These points don't come forth in the qualitative analysis, however what has been shown is that the evaluation of the employees and the projects is not systematically performed, which indicates that it is sometimes unknown when an employee is underperforming.

In figure 11, the knowledge value chain is shown again, but now with a positive or negative indication based on the results of the analyses. The choice for the knowledge activities to implement is dependent on the knowledge processes that need to be improved. In this case the knowledge activities should contribute to improving the creation, transfer and evaluation of knowledge. However another point to keep in mind is that the knowledge activities should also fit the organisational structure and the culture as this contributes to the effectiveness of the activity. The next section gives an analysis of the structure and culture of the organisation.

5.2 Organizational features

After looking at the knowledge processes and activities, we also have to include the structure and culture of NIZO food research in the analysis. These are two aspect that are of high relevance when it comes to the performance of the knowledge processes and the knowledge activities in the organisation.
5.2a Structure

The structure of the organization has already been shown in the case analysis. However, this part is focused on the effects that the structure will have on the knowledge activities and therefore the processes. First of all, NIZO food research is a smaller sized organization with around 160 employees, therefore it also has a rather flat organizational structure, leading to not many opportunities to grow in the organizational hierarchy. See also the next quote:

“NIZO is a very flat organization, which means that when you really want to make a carrier you’re in the wrong place, but if you want to have a technical challenge and like to have the freedom to experiment, NIZO is perfect.” (BS)

The size of the organization has its advantages as it can be seen that the employees are able to work together interdisciplinary and know who can contribute to a project without a whole difficult search in the organization (BS).

The project-based working structure of the organization is more of a problem. As the organization works with projects under contract, this also means that there is a certain limit to the amount of time that should be spend on projects. Everyone working on the projects has to write down the time spend and try to make sure that they don’t exceed the budgeted time, which would lead to negative results for the organization. These hours are the so called billable hours as they are paid for by the customers. From the interviews and the quarterly meetings come forth that around two third of the time is spend on projects and therefore billable, while the rest it time spend on (non-project) meetings and other general activities. The management would like to increase the amount of billable hours as this is where the direct revenues flow from, but this leads to struggles in the organization. As could already be seen before in the knowledge sharing and evaluation sections, the systems brings restrictions with it. This is something that the management should keep in mind.

5.2b Culture

The culture of the organization is also an important point for the effectiveness of the knowledge processes. There are some positive cultural aspects as well as some negative ones and these aspects contribute also to whether a knowledge activity can be successful.

Positive of the NIZO culture is the enthusiasm and drive that the employees show in performing their work tasks. This also comes forth from the interviews where two employees have come back to NIZO food research because of the affection with the work of the organisation, while the possibilities to grow in terms of function and salary are much less than in bigger organisations (int. HB & BS).

Some negative cultural aspects are related to the time management system that NIZO has been using for the last decades. Due to the time restrictions for the projects and the focus on moving from project to project, the pressure to finish is sometimes quite high (BS). This system also has as a result that spontaneous knowledge sharing and other knowledge activities are not performed as there is no time to do it, resulting in a less efficient knowledge value chain.

“There is no culture of supporting the project leaders to have others look into their projects as they directly feel that those have to write the time spend on it also on the project, leading to ‘extra’ expenses. and in general people don’t like it when someone is looking over their shoulder when they are working. ” (NH)
For the culture of NIZO also has to be said that the openness can be much better. In the knowledge activity section could already be seen that there are many ways to save documents and that employees have a personal drive and a drive where documents can be shared. The problem with the personal drives is that no one can get access when someone has (temporarily) left the organisation leading to difficulties. A similar point can be made for the agenda's and mail accounts of the employees, where the people from the secretary have no access while this could enhance the efficiency of arranging meetings and such.

“I don’t think it is necessary that everyone has access to everything, but I believe that it is logical that the people from IDT are able to access your document as the work that you are performing is all for the organisation. I also think that the facilitating employees should get more access to certain things as it enhances the possibilities to perform their jobs.” (MF)

A last important point with regard to both the culture and the working structure of NIZO are the working tasks. NIZO food research is a research institute where a large part of the employees spend their time mostly in a laboratory. This means that they spend less time behind a computer than might be the case in other KIOs. This can have an effect on the use of especially the IT activities and is taken into account in the strategy choice for NIZO food research and with it the implementation of knowledge activities.

5.3 Strategy for NIZO

The analysis of the knowledge management processes, activities, and the structure and culture of NIZO gives inside in the knowledge management strategy that NIZO food research is using now and the possibilities to improve the strategy. In the theoretical background the codification or system oriented strategy and the personalization or human oriented strategy have been discussed. After analysing the knowledge management activities at NIZO food research, there can be said that they make use of both the codification strategy and the personalization strategy. For example, the codification comes back in the fact that all the projects results have to be written down and must be available for everyone inside NIZO food research, while the personalization strategy comes back as the employees are seen as experts and there is a lot of face-to-face contact between the employees which contributes to the effective knowledge circulation. The next quote from a division manager shows that the value of a codification strategy is notified, however the full execution at NIZO food research seems rather impossible due to the extensive expertise fields that reside inside the employees.

“For the project progress, it would be good if ‘thoughts and knowledge’ are written down. This will make it easier to proceed with a project if someone leaves the organisation” (DJ)

The strategy including both codification as well as personalization is taken into account in the choosing of the knowledge activities that can help NIZO food research to improve their knowledge processes. this is discussed in the next sections.
5.3a Implementing knowledge activities

There are a couple of knowledge activities that gained interest when analysing the use at NIZO food research. These where the learning or action reviews for projects, the possibilities to interact and learn though a social network or knowledge base, and the improvement of the document management.

With regard to the two strategies, the document system is especially focussed on codification, while the action reviews and the social network service or knowledge base both represent the two strategies combined. The reason for this is that action reviews stimulate the personal learning process but can also be used to capture valuable learnings on paper. The same goes for the knowledge base or social network service where interaction between employees is important but at the same time knowledge is stored in codified form. The document system is excluded for this research as a change of system was already planned and in progress. Unfortunately this process would take longer that the period of this research, which also made it impossible to observe the effects and include these. Therefore, the focus lies on the action reviews, the social network services and the knowledge base.

(After) Action Review

The action review has been implemented as a tool to improve the knowledge creation, sharing, storage and evaluation processes of the value chain (Young, 2010). This activity contributes to the personalization or human oriented strategy as it is focused on interaction of team members to discuss the progresses made in the project and the possibilities for improvement. The knowledge on the progress of the project is distributed between the project members but the learnings can also be shared with others on the organisation as well as stored for later use or reflection.

The purpose of an after action review is to structurally gather the knowledge and experiences generated in a project, in order to make proper use of them again. The focus is on the learning experiences of the group members from both successful as well as failed activities (DNV-CIBIT, 2004).

There are four main questions that lead the discussion in the action reviews. These questions should be known to the participants beforehand, so that they know what to expect and can prepare some input beforehand. These are the four questions:

1. What should have happened?
2. What did happen in reality?
3. What were the reasons for differences?
4. What can we learn from this experience?

There are some conditions that need to be in place to perform an action review successfully. First of all, the team must be willing to learn from the project or activity. Second is that the action review must be planned shortly after finishing a project or halfway through a project. This is because the memory of the project should be fresh to get the best learning results. Third, the team members should be free to discuss mistakes without being blamed, as that will not improve the process. Fourth, the review must be held when all the team members are (still) available. Fifth and last is that there should be enough trust between the members to be able to discuss the topics freely. This can be managed by using an external facilitator to lead the discussion and make sure everyone is contributing (DNV-CIBIT, 2004).

When action reviews are performed frequently and in a systematic way in an organisation, it can be a key aspect of the internal system of learning and motivation of an organisation. This can be seen in
changes as making unconscious learning more tacit, as well as the help in building trust among team members and overcoming the fear of making mistakes (Ramalingam, 2006).

**The action reviews at NIZO food research**

The implementation of the action reviews at NIZO food research took place by selecting some projects that were on about half of their working tasks or throughput time. The first chosen project was a consortium project and therefore rather large. This project had a time span of two years and was at the time of the review in its tenth month. The review took place with 6 involved employees. The second and third reviews were held at smaller projects with one customer. These reviews took place with three involved employees. In all the reviews, the division manager functioned as the facilitator and the researcher had an observing and note taking role.

The four questions that guide the review meeting were written on flip over pages on which the points made during the meeting could be written. This led to a clear overview of the input that was given for all of the participants. Figure 12 shows the use of the flip-over pages at one of the meetings. After the meetings the result were written down in a document for the participants and a summary with the most important points was made for broader use in the organisation. The advantage of the division manager as facilitator are that the learnings can be used and discussed at a higher level in the organisation, for example at the monthly management/sales meetings.

![Figure 12: The execution of an action review.](image)

The responses of the participants on the review meetings where very good. The first reactions showed that they liked the reflection even though the points mentioned where not all new, but to see them together and formulate some points of action for the remainder of the projects can help improve the processes.

**Social network services and knowledge bases**

A social network service allows people to come in contact with one another under shared interests or causes. In most cases social network services make use of a combination of social technologies such as; newsfeed, message sending, blogs and chat-services. The use of social network services can be
very different, going from online dating and political activism to debating research interests (Ramalingam, 2006).

Some examples of social network services that are very popular at the moment are Facebook and Twitter, providing people with the ability to develop and sustain social and professional networks, as well as to share knowledge between members of their personal networks. A social network site that has a stronger focus on business relations is LinkedIn, which also includes ways to follow companies, apply for jobs, and place job offers.

A knowledge base or wiki is in most cases a collaborative and participative database that is structured to answer the what, why, where, when, who, and how questions for a given knowledge topic. In case of developing a knowledge base for an organization it is important to identify the ‘key knowledge areas’ of the organization as these are the basis of the knowledge bases. Additionally, it is good if each key knowledge area has its own knowledge network or community of practice/interest surrounding it (Young, 2010). What is interesting with a knowledge base or wiki is that it can be edited by everyone in the organisation leading to the creation of new knowledge, expanding the knowledge by discussions and feedback, editing the knowledge into more complete knowledge, and maintaining a history of the revisions (Young, 2010).

As the social network services and the knowledge base have a large overlap in their functions it was decided that only one of these would be implemented. The choice has been made for the social network service as this is less focused on document sharing, even though it can be done, and more on the interaction and the possibilities to easily share knowledge. The chosen network site is Yammer which will be discussed below.

**Yammer**

Yammer is operational since 2008 and its main goal is to provide companies and organisations with a social network site that can be used inside the company or organisation (yammer, 2014). It was supposed to be the business variant of twitter and it has many of the same features as other social network services. The most important of these are the news feeds, where employees can post updates, questions or other things they like to share. The structure allows others to respond to these posts in several ways, by writing a commend, liking it or sharing it even with others. Other features of yammer are the possibilities to create groups that can be joined by other employees in the organisation, the possibilities to chat with each other, and the possibilities to share documents, links and notes.

Yammer is an enterprise social network as it will only allow people with the same email domain to form a network, as for example with @nizo.com. This guaranties that the network is closed to outsiders and makes it possible to share also more confidential information without the fear of leakage.
to competitors. It is also possible to view the site from many different devices, such as computers, tablets and telephones, which makes it more accessible and easy to check when not in the office (yammer, 2014).

**The Yammer experiment at NIZO food research**

For this research, Yammer is being used as a tool to improve some of the knowledge processes of NIZO food research. The idea is that the social network should contribute mostly to the sharing of knowledge inside the organisation. Yammer can be used through a webpage on the computer or as an application on your smartphone or tablet. Some of examples can be seen in figure 13 to 15.

Yammer was already introduced to a small group of employees of NIZO food research by the IDT department in 2013, but it hadn’t been used much and there were only a few employees of the organisation connected. During the interviews and group discussion came forth that only one of the employees from the focus group had used Yammer before, while all others had never used or heard of Yammer before. Therefore, Yammer was introduced and an email was send to the members of the focus group inviting them to make a Yammer account and to try it out in the coming period.

As a social network only attracts attention when there is enough posted, the first inputs were given by the researcher and the internal supervisor to promote the Yammer activities. This input was given on a regular basis, being at least once a week. The activity on Yammer of the employees of the focus group after a period of about two months is shown in table 9.

![figure 14: A posts shown via the Yammer application on a Smartphone.](image)

<table>
<thead>
<tr>
<th>Table 9: The use of Yammer at NIZO food research (7th of May to the 18th of July)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total number</strong></td>
</tr>
<tr>
<td>Number of employees with a Yammer account</td>
</tr>
<tr>
<td>Number of focus group employees (fermentation)</td>
</tr>
<tr>
<td>Total posts</td>
</tr>
<tr>
<td>Number of posts explicitly given as input to boost the Yammer activity</td>
</tr>
<tr>
<td>Number of (spontaneous) posts</td>
</tr>
<tr>
<td>Number of responses to posts</td>
</tr>
</tbody>
</table>

The activities on Yammer show that there are a couple of people from the fermentation group that are especially active. These are mostly project managers, which indicates that they are more used to working behind the computer and have more opportunities to be connected to Yammer, but also have more to tell to a broader group as they have a managing function. The analyst have a more lurking role.
on yammer where they occasionally read through the posts and only respond when they have a question or comment on the topic, but not really posting themselves (group discussions).

Another interesting result is that the activities on Yammer are low when it comes to normal work tasks, but that it is a very good channel to inform each other about special meetings and such. This could be seen with the yammer activity of two project managers at a conference of a couple of days, where they posted the main message from each presentation to keep everyone informed. The project managers liked to do it as it made them listen to the presentations with more focus on the main message and the others from the fermentation group were positive as they liked it better than a report that they would have to read afterwards. Figure 15 shows a yammer post and the positive responses from the conference.

The results of Yammer indicate that it can be a good tool to replace the current conference reports, as it leads to more interaction. However, for the use in the organisation in general, the reactions show that most employees are in favour of just discussing problems directly instead of posting them and having to wait until someone might respond.
6. Conclusion

This research started with the main question which is; *How can knowledge management at NIZO food research be improved?* There are also three sub questions that support the main question. To come to an answer to all of these questions, the knowledge processes of the knowledge value chain and the knowledge activities of NIZO food research have been analysed both qualitatively and quantitatively. There also have been some tests with two chosen knowledge activities that have the potential to support the knowledge processes of NIZO food research. Each of the sub questions are discussed separately first after which the main question is discussed.

The first sub question is concerned with the knowledge processes at NIZO food research and their performance in comparison to other service organisations as well as to the evaluation of the knowledge processes at NIZO food research in 2003. For this question, the quantitative analysis of the knowledge processes is most relevant. The results of this analysis show that NIZO food research scores on average good as the scores are all higher than the reference numbers of the other service organisations, with the exception of the knowledge evaluation process of which the score is similar. NIZO food research can get a competitive advantage from their strong knowledge management performance in comparison to the other service organisation. However, the analysis also shows that NIZO food research scores a bit lower that in 2003, as three of the six knowledge processes have a significantly lower score. These are the knowledge creation, transfer and evaluating processes.

The second sub question of the research is whether there are some processes of activities of less or more importance to the organisation because of its smaller size and the fact that it is a CRO. About the size can be said that the knowledge management processes are all important, but the weights of the knowledge processes are distributed differently. This can clearly be seen with the identification of the existing knowledge process as the employees can find the right knowledge inside the organisation quite easily, while there is no index or database of the fields of expertise of the employees. This also reflects on the differences in the knowledge activities, where apparently an employee database doesn’t need to have priority. The communication methods are also different. In the research came forth that much of the communication is sought through face-to-face contact.

Differences in the knowledge management for the CRO are the emphasis on all the knowledge processes in general. This is due to the high dependence on the knowledge creation, transfer and application of the knowledge in the projects for the customers, which is the core task of a CRO. The organisational background of NIZO food research has shown that they had to focus on all the knowledge processes of the knowledge value chain instead of focussing on just the first knowledge processes after their organisational shift to an CRO. With regard to the knowledge activities in this particular CRO, the organisational features play an important role. A part of the employees at NIZO food research spend much of their working hours in the laboratory, which makes it harder to effectively use IT-based knowledge activities.

The third sub question of the research is whether one of the two knowledge management strategies, of personalization or codification, is more suitable for the efficient knowledge management at the organisation? The results of the research show that the organisation makes more use of the personalization strategy, but the codification strategy is also seen in some of the knowledge activities. The organisational features do play a role in the successful use of the personalization strategy. For example, the size contributes to the personalization strategy as the employees can find each other and have a good view of each other’s expertise. Another feature of this particular CRO is that the employees spend much time in the office or laboratory, arranging meetings and having face-to-face contact is therefore much easier.
Coming back to the main question of the research of how the knowledge management of the organisation can be improved, a couple of things can be concluded. First of all, while NIZO food research is already performing quite well in comparison to other service organisations, there is still room for improvement. All the knowledge management processes score on average neutral, with each between 5 and 7 on a 2 to 10 scale. Also three of the six knowledge processes score lower than in 2003.

The analysis of the organisation shows that the employees have a good view of each other's expertise and they can easily ask each other for help. However, a weakness of the organisation is that knowledge often gets lost when an employee leaves the organisation. While part of the knowledge of the employee is written down, the transfer is lacking due to the complexity of the documentation system. Therefore, the codification strategy should at least be supported by appropriate databases to store knowledge.

The analysis of the knowledge processes and knowledge activities has resulted in the implementation of two relatively new knowledge activities at NIZO food research. From the two implemented knowledge activities, the action reviews show the most positive results. The evaluation of projects have as advantage that learning's can be shared and taken to the next projects and that the project team has the feeling of really finishing the project. The action reviews can also be used on higher levels of the organisation, in for example the management team. This can help to reflect on the decisions of the last period and to support the development of the strategy for the next period. The reflection on the knowledge activities of NIZO food research show that there are other knowledge activities that can contribute to improving the knowledge processes, such as the use of knowledge bases and Voice over internet protocols like Skype.

The different analyses have shown some of the bottlenecks for the organisation and what can be improved. For improvements it's good to think about the knowledge management strategy that the organisation wants to pursue. While it seems from a management perspective nice to have a codification strategy, which makes knowledge more easily retraceable even when an employee has left the organisation, a personalization strategy is more appropriate for the structure and culture of the organisation. The knowledge activities contribute to the knowledge management strategy, which is why they need reflection before and during implementation.
7. Discussion
In this chapter the results of the research are discussed, starting with the validity of the research. After this the theoretical as well as the organisational contributions are discussed, followed by the limitations of the research and suggestions for further research.

The multiple source research method of this paper contributes to the strong construct validity making it possible to establish a chain of evidence. For the composition phase, the draft of the case study report is reviewed by at least one of the key informants. However the external validity is a weakness of this research as the generalizability is low due to the context specific research. The reliability of the research is good as the followed procedures are clear. However, replication of the research in a couple of years will probably lead to different results due to organisation changes and the subject of the research which is a process.

7.1 Theoretical contributions
The theoretical implications of this research lie in contribution that it makes to the limited research that has been performed on the use of knowledge management in small and medium sized enterprises as well as in research organisations (Wong, 2005; Leitner & Warden 2004). In this research, the knowledge management of a CRO of smaller size is analysed in detail to find out what important aspects of knowledge management are for such an organisation and also how the knowledge management can be improved.

For the knowledge management in general can be suggested that each of the knowledge processes of the knowledge value chain is at least as important in a CRO as in an industrial knowledge intensive company. The core business of a CRO is to develop new knowledge and make it applicable for the client company. Due to the high reliance on the knowledge processes it would be logical that each process in the knowledge value chain is at least as important in a CRO.

In previous research was suggested that the need for a knowledge management initiative is less of a priority for SMEs in comparison to the need for it in large organisations (Nunes et al., 2006). The results in this paper suggest that the size of the organisation makes it easier to handle certain knowledge processes, but that they still are important. This can for example be seen with the determination of the needed knowledge; the relative small size of the organisation makes it possible to have a good view of the knowledge and expertise of the organisation, without having a special database. It is also easier to get the knowledge due to the efficient use of face-to-face contact. In larger organisations, this is not as easy as the organisation doesn't have a clear view on the expertise and it is harder to find the right person without a strong expertise database.

In case of the knowledge management strategy, it can be suggested that the size of the organisation also plays a role. For a small or medium sized organisation, a personalization strategy is more logical as the organisation is more dependent on its specific knowledge workers and the employees can find each other quite well. In larger organisations there is a higher need for a codification strategy as it is more difficult to keep track of the knowledge of the employees if it is not written down somewhere.

The research also contributes to the testing of the effectiveness of two knowledge activities at a medium sized CRO. The first were the action reviews which were implemented to improve the knowledge evaluation process. The first action reviews were positively assessed by the participants and the facilitator, which was a division manager.
The second implemented knowledge activity was a social network service named Yammer. This tool has been introduced especially for the transfer of knowledge, but it can also be of effect on the other knowledge management processes. One of the working groups of the organisation has tested the use of Yammer and the results where contradictory. In the regular working environment, the employees only marginally make use of Yammer, as they still prefer to ask questions directly. The smaller size of the organisation contributes to these results as the need for the social network site is not acknowledged. However, the results on the use of Yammer at conferences to get everyone that might be interested involved worked rather good. The employees attending the conference enjoyed thinking about the main purpose of each lecture and stating this on Yammer, while the employees that where performing their usual tasks enjoyed the life report. Both the attendees as the non-attendees though that this was a better way to keep each other posted than the currently used conference reports.

7.2 Organisational contributions

The contribution of this research for the organisation is the analysis of the knowledge management at the organisation. This has led to an evaluation of the strong and weak points of their knowledge management. The knowledge management of the organisation is quite good in comparison to other service businesses, which can lead to a competitive advantage. However, in comparison to the results from 2003, three of the six knowledge processes score lower, which are the creation of knowledge, the transfer of knowledge and the evaluation of knowledge.

The lower score for the creation of knowledge is rather unexpected as this is a core process at NIZO food research. One of the lower scoring variables is that make or buy decisions are not rationally made, which can be seen back in the eagerness of the project leaders to pursue every possible opportunity. An important point that can be improved with the transfer of knowledge is the little explicit and formal attention that is given to sharing knowledge to divisions and employees that may need it to perform their work tasks. For the evaluation of knowledge, one of the lower scoring variables was that the employees believe that the knowledge workers with expertise field that no longer contribute to the execution of the strategy, are insufficiently tutored or trained to get their knowledge valuable again.

In total, the research contributes to an evaluation of the knowledge management processes at the organisation and gives them insight in the possibilities to improve these processes by implementing the right knowledge activities. A start has been made for this by introducing the action reviews and the social network site.

7.3 Strengths and Limitations

The research has some strengths and limitations that need attention. First of all, a strong point of this research lies in the use of several data collection methods, being both qualitative and quantitative. This has led to data triangulation and has provided strong data for the research.

A first limitation of the research is related to the single case-study design. The generalizability of this research is low as the results may only be valid for this particular organisation and are context specific. This means that hard conclusions are difficult to make and instead assumptions about the difference in knowledge management for research organisations vs. industrial organisations, and smaller vs. large organisations are made. Further research on these type of organisations is necessary to support the findings.

A second limitation of this research is that while the knowledge activities are evaluated and two activities have been chosen to implement, the effects of the implemented activities could not yet be
measured in terms of knowledge management process improvement. However the first responses have been taken into account and these where in general rather positive, it is up to the organisation to implement and evaluate the activities in more depth when they have been used for a longer period and have become a part of the working processes at the organisation.

7.4 Recommendations for further research

This also leads to recommendations for further research. A first is that knowledge management initiatives at research organisations or SMEs have to be researched further to find out whether the assumptions made in this research also apply in different contexts. The need for case studies is high to develop theories on the effect that the organisational structure has for the implementation of a knowledge management initiative as well as the effectiveness of the knowledge activities at the organisations.

While this research has been focussed on one organisation, it would also be good to compare between the knowledge management and with it the knowledge management strategies of organisations. This can contribute to the assumptions that the structure and culture of the organisation is related to the codification or personalization strategy of the organisation and the results that come forth from using one or a combination of the strategies.
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Appendix A Survey questions (in Dutch)

Dag NIZO medewerk(st)er.

Deze vragenlijst is onderdeel van een onderzoek naar het kennismanagement binnen NIZO. Graag wil ik u vragen om de enquête zo goed mogelijk in te vullen. De vragenlijst zal een minuut of 15 van uw tijd in beslag nemen. Uw antwoorden blijven anoniem en mocht u geïnteresseerd zijn in de uitkomsten, deze zullen binnen een paar weken op het intranet komen.

U kunt beginnen door op de start knop te klikken.

Pagina 2
1. Hoe lang bent u in dienst van NIZO?

☐ < 1 jaar
☐ 1-3 jaar
☐ 3-5 jaar
☐ 5-10 jaar
☐ 10-15 jaar
☐ 15-20 jaar
☐ > 20 jaar

2. Onder welke divisie/afdeling werkt u binnen NIZO?

☐ Flavour and texture
☐ Health
☐ Processing and safety
☐ Processing center
☐ Program management
☐ Staff/Technical

3. Wat is uw functie binnen het bedrijf?

☐ Business Development Manager
☐ Medewerker projecten
☐ Ondersteunend
☐ Projectleider
☐ Scientist
☐ Werkgroep
4. Bent u naast NIZO nog actief bij andere organisaties

☐ Nee
☐ Ja, bij een universiteit
☐ Ja, bij een onderzoeksinstuut
☐ Ja, bij een bedrijf
☐ Ja, bij

Pagina 3

5. Een organisatie dient expliciete doelen te hebben t.a.v. het plannen, besturen en beheren van de productiefactor kennis.

☐ ☐ ☐ ☐ ☐

☐ Nee
☐ ja

6. Onze organisatie heeft expliciete doelen gesteld t.a.v. het plannen, besturen en beheren van de productiefactor kennis.

☐ ☐ ☐ ☐ ☐

7. Vaststellen benodigde kennis

☐ ☐ ☐ ☐ ☐

De strategie van onze organisatie is zo duidelijk dat we daaruit kunnen afleiden welke kennis nodig is om die strategie te realiseren.

Het expliciet vaststellen van de benodigde kennis om de strategie te realiseren, is bij ons een gesystematiseerd routineproces.

We weten welke kennis wij nodig hebben om onze strategie te realiseren.

Soms volgen wij de omgekeerde weg: gegeven de aard en het niveau van de beschikbare kennis wordt vastgesteld welke strategische kansen op basis daarvan in de markt gecreëerd zouden kunnen worden.

Pagina 4

8. Inventariseren bestaande kennis

☐ ☐ ☐ ☐ ☐

85
Wij weten op welke gebieden wij meer kennis in huis hebben dan onze belangrijkste concurrenten.

Het is mij bekend welke kenniswerkers in mijn werkomgeving beschikken over voor ons waardevolle maar schaarse kennis.

9. Als een bepaalde vraag van een klant bij mij binnenkomt, dan kan ik zeggen wie in mijn werkomgeving over de meeste kennis beschikt om die vraag te beantwoorden.

Als een bepaalde vraag van een klant bij mij binnenkomt, dan kan ik zeggen waar in onze organisatie zich de meeste kennis bevindt om die vraag te beantwoorden.

10. Wij beschikken over een formele - al dan niet geautomatiseerde - index/database waarin opgezocht kan worden welke kennis waar in de organisatie aanwezig is.

Pagina 5

11. Ontwikkelen nieuwe kennis

Omdat wij enerzijds weten welke kennis er voor de realisatie van onze strategie nodig is en anderzijds weten welke kennis wij in huis hebben, weten wij ook welke (nieuwe) kennis wij moeten ontwikkelen of acquiëren. Kortom: de kennisleemtes zijn bekend.

12. Beslissingen over make or buy of het samen met een externe partner ontwikkelen van nieuwe benodigde kennis, worden hier expliciet en op voornamelijk rationele gronden genomen.
13. Wij beschikken over formele kennisontwikkelingsprocedures zoals kennisontwikkelingspilot studies, -projecten, -programma's, en dergelijke.

In onze organisatie wordt ook spontaan nieuwe kennis ontwikkeld die niet direct voor de realisatie van de vigerende (=huidige) strategie nodig is (motieven: bijvoorbeeld technology push of hobbyisme).

De in de voorgaande vraag bedoelde spontane kennisontwikkelingsactiviteiten beslaan gemiddeld tussen de 10 en 20 % van de totale capaciteit die voor het ontwikkelen van nieuwe kennis beschikbaar is.

Wij hebben goede contacten met onderzoeksinstituten die een reputatie hebben op kennisgebieden die voor ons van strategisch belang zijn.

Het komt wel eens voor dat men op 2 verschillende plaatsen in de organisatie tegelijkertijd bezig is dezelfde nieuwe kennis te ontwikkelen.

Het komt wel eens voor dat bij een bepaalde afdeling of groep een kennisachterstand is ontstaan die alleen tegen relatief hoge kosten weer ingelopen kan worden.

Ongeacht het al dan niet aanwezig zijn van een lange termijn strategie, wordt er bij ons periodiek en gestructureerd nagedacht over de vraag welke kennis de organisatie over 5 à 10 jaar in huis zou moeten hebben.

Pagina 6

14. Kennis delen

Wij besteden expliciet en formeel veel aandacht aan het verspreiden van beschikbare kennis naar afdelingen en medewerkers waarvan verwacht wordt dat zij die kennis voor de uitvoering van hun taken nodig hebben.

De cultuur, de sfeer en het samenwerkingsklimaat in onze organisatie is
van dien aard dat kenniswerkers zich vrij voelen om hun kennis spontaan en informeel met anderen te delen.

Het delen van kennis met anderen, kan de positie van de betreffende kenniswerker in de organisatie verzwakken; kennis is immers macht.

Voor een kenniswerker loont het bij ons niet de moeite om zijn/haar kennis met anderen te delen omdat hij/zij er in het algemeen weinig tot niets voor terugkrijgt.

Iemand die voor zijn werk op zoek gaat naar bepaalde kennis, komt in de meeste gevallen terecht bij diegenen in de organisatie die over dat onderwerp het meeste weet.

Ten aanzien van het verwerven en verspreiden van kennis, geldt in onze organisatie voor iedere kenniswerker dat hij zowel een haal- als een brengplicht heeft.

Het komt wel eens voor dat kostbare fouten worden gemaakt omdat benodigde kennis niet op tijd op de juiste plaats beschikbaar was.

Wij leren van elkaars fouten.

15. Kennisdeling wordt in onze organisatie gefaciliteerd via interne lezingen, seminars, discussiebijeenkomsten, en dergelijke.

Kennisdeling wordt in onze organisatie gefaciliteerd via opleidingen en cursussen.

Kennisdeling wordt in onze organisatie gefaciliteerd via rapporten, manuals, instructiebladen en andere documenten.

Kennisdeling wordt in onze organisatie gefaciliteerd via case-evaluaties van afgesloten (gelukte of mislukte) projecten.

Kennisdeling wordt in onze organisatie gefaciliteerd via training-on-the-job in meester-gezel-leerling verband.
Kennisdeling wordt in onze organisatie gefaciliteerd via rotatie van waardevolle schaarse kennisdragers over verschillende afdelingen.

Kennisdeling wordt in onze organisatie gefaciliteerd via archief-, bibliotheek- en documentatieservices/diensten.

Kennisdeling wordt in onze organisatie gefaciliteerd via informatie technologie (databases, intranet, groupware).

Kennisdeling wordt in onze organisatie gefaciliteerd via een communicatie bevorderende inrichting van het gebouw.

Kennisdeling wordt in onze organisatie gefaciliteerd via informele face-to-face contacten.

Pagina 7

16. Kennis toepassen

Nieuw ontwikkelde of geacquireerde kennis wordt, nadat die verspreid is, doorgaans snel spontaan toegepast door de kenniswerkers waarvoor die kennis bestemd is.

komt zelden voor

komt zeer vaak voor

17. Een oorzaak van weerstand om nieuwe kennis snel toe te passen, is dat de kenniswerkers waarvoor de nieuwe kennis bestemd is, onvoldoende betrokken zijn geweest bij de ontwikkeling van die nieuwe kennis; not invented here syndroom.

Een oorzaak van weerstand om nieuwe kennis snel toe te passen, is dat de nieuwe kennis volgens de professionals niet bijdraagt aan een betere of snellere uitvoering van de aan hen opgelegde taken.

Een oorzaak van weerstand om nieuwe kennis snel toe te passen, is dat kenniswerkers te zeer gehecht zijn aan hun routines en gewoonten.

Een oorzaak van weerstand om nieuwe kennis snel toe te passen, is dat senior kenniswerkers niet geleerd hebben te leren en daarom vinden dat de nieuwe kennis vooral iets is voor
jongeren en voor nieuwe medewerkers.

### Pagina 8

#### 18. Kennis evalueren

<table>
<thead>
<tr>
<th></th>
<th>oneens</th>
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<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Omdat wij weten welke kennis wij voor de realisering van onze strategie nodig hebben en welke kennis wij in huis hebben, weten wij ook welke in de organisatie beschikbare kennis niet langer van belang is voor de uitvoering van de strategie.</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kenniswerkers die voor het overgrote deel over kennis beschikken die voor de uitvoering van de strategie niet (meer) van belang is, worden het onderwerp van coachings-, trainings-, (om)scholings- of andere leerprogramma's om het rendement op de kennis van die medewerkers (weer) op een aanvaardbaar niveau te brengen.</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Er zijn in het primaire proces van onze organisatie geen kenniswerkers te vinden waarvoor geldt dat meer dan 50% van hun kennis niet (meer) van belang is voor de uitvoering van onze strategie.</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Er wordt in onze organisatie nauwelijks (collectieve) archiefruimte of geheugencapaciteit van centrale computers in beslag genomen voor het bewaren van kennis die we zelden of niet meer gebruiken.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Er wordt in onze organisatie nauwelijks (collectieve) ruimte in beslag genomen door apparatuur, machines, opstellingen en installaties waar zelden of geen gebruik van gemaakt wordt.</td>
<td></td>
<td></td>
<td></td>
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<td></td>
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</tr>
</tbody>
</table>

### Pagina 9

19. Hoeveel gebruikt u de volgende (niet-IT) toepassingen (dit kan op het werk zijn maar ook thuis)? En denkt u dat de toepassing bij kan dragen aan de kennis processen binnen NIZO?

<table>
<thead>
<tr>
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<th>nooit/zelden</th>
<th>Vaak</th>
<th>nee</th>
<th>Ja</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brainstormsessies</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Face-to-face</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
contact/overleg

Action reviews (tussentijd of afsluitende reflectie meeting voor projecten)

Peer assist (feedback van medewerkers buiten het project)

| 20. Hoeveel gebruikt u de volgende IT toepassingen (dit kan op het werk zijn maar ook thuis)? En denkt u dat de toepassing bij kan dragen aan de kennis processen binnen NIZO? |
|---|---|---|---|---|
| nooit/zelden | vaak | nee | ja |
| Telefonie | | | |
| Mail | | | |
| Skype/Lync/facetime | | | |
| Zoekmachines zoals Google | | | |
| Intranet | | | |
| Facebook | | | |
| Twitter | | | |
| Yammer | | | |
| LinkedIn | | | |
| Wiki's | | | |
| Blogs | | | |

Pagina 10

Dank voor uw bijdrage aan het onderzoek.
### Appendix B Means of the process variables

**Statistics**

<table>
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<tr>
<th>Determine Needed knowledge 1</th>
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<th>Determine Needed knowledge 3</th>
<th>Determine Needed knowledge 4</th>
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**Statistics**

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**Statistics**

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### Statistics

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### Statistics

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<td>.889</td>
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</tbody>
</table>
Appendix C Knowledge activities

The tables below show an overview of the knowledge activities that have been taken into consideration in the research process, as well as the observed use and possible expected value that can be achieved when investing in the tools. The scaling is a result of the observations, interviews and group discussions.

<table>
<thead>
<tr>
<th>Non IT Tools</th>
<th>How to use or used at NIZO</th>
<th>Usage*</th>
<th>Expected value when investing in **</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Brainstorming</td>
<td>In the definition phase of a project, brainstorming can lead to knowledge creation.</td>
<td>Regularly</td>
<td>Low</td>
</tr>
<tr>
<td>2. Learning and Idea Capture</td>
<td>Explicitly writing down learnings during a project or other work tasks</td>
<td>Sometimes</td>
<td>Normal</td>
</tr>
<tr>
<td>3. Peer Assist</td>
<td>Asking some other employees to give feedback on a project in which they are not involved.</td>
<td>Sometimes</td>
<td>Low</td>
</tr>
<tr>
<td>4. Learning Reviews</td>
<td>Reflecting on the working processes during a project</td>
<td>Never</td>
<td>High</td>
</tr>
<tr>
<td>5. After Action Review</td>
<td>Reflecting on the working processes at the end of a project</td>
<td>Sometimes</td>
<td>High</td>
</tr>
<tr>
<td>6. Storytelling</td>
<td>Telling about projects as a story that can easily be followed</td>
<td>Regularly</td>
<td>Low</td>
</tr>
<tr>
<td>7. Collaborative Physical Workspace</td>
<td>Working places that invite people to be creative and work together</td>
<td>Regularly</td>
<td>Low</td>
</tr>
<tr>
<td>8. APO KMAT or knowledge managementscan</td>
<td>Performing a knowledge management scan to see the bottlenecks</td>
<td>Sometimes</td>
<td>Normal</td>
</tr>
<tr>
<td>9. Knowledge Café</td>
<td>Specific discussion form for large groups where everyone should be able to contribute</td>
<td>Never</td>
<td>Low</td>
</tr>
<tr>
<td>10. Community of Practice</td>
<td>Groups of people with similar interests in a certain topic</td>
<td>Regularly</td>
<td>Normal</td>
</tr>
<tr>
<td>11. Taxonomy</td>
<td>A hierarchical classification of entities of interest to NIZO</td>
<td>Regularly</td>
<td>Low</td>
</tr>
</tbody>
</table>

*The usage of the tool in NIZO now is indicated with a 3 point scale (never, sometimes, regularly)

**The expected value is indicated according to the following three point scale (low, normal, high)
<table>
<thead>
<tr>
<th></th>
<th></th>
<th>document sharing</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>16. Voice and Voice-over-Internet Protocol (VOIP)</strong></td>
<td>Can be used as a more direct form of contact than email or telephony.</td>
<td>Sometimes</td>
<td>Normal</td>
<td></td>
</tr>
<tr>
<td><strong>17. Advanced Search Tools</strong></td>
<td>Advanced search tools to browse through all the data of NIZO can help to locate knowledge.</td>
<td>Regularly</td>
<td>Normal</td>
<td></td>
</tr>
<tr>
<td><strong>18. Building Knowledge Clusters</strong></td>
<td>Food valley is a knowledge clusters and can contribute to better external knowledge sharing</td>
<td>Regularly</td>
<td>Normal</td>
<td></td>
</tr>
<tr>
<td><strong>19. Expert Locator</strong></td>
<td>A knowledge manager can be appointed, which should now the expertise of the employees</td>
<td>Never</td>
<td>Normal</td>
<td></td>
</tr>
<tr>
<td><strong>20. Collaborative Virtual Workspaces</strong></td>
<td>Virtual workspaces where you can work on and discuss issues with multiple employees at a time</td>
<td>Never</td>
<td>Normal</td>
<td></td>
</tr>
</tbody>
</table>

*The usage of the tool in NIZO now is indicated with a 3 point scale (never, sometimes, regularly)  
**The expected value is indicated according to the following three point scale (low, normal, high)