

# Exploring organisational knowledge creation

What is the practical value of Nonaka's Hypertext model and how can it be applied?

## **Master Thesis**

Business Administration

Human Resource Management

School of Management and Governance

University of Twente

## **Author**

J.M. Constandse

## **Supervisors**

Prof. Dr. J.C. Looise

Ir. A.A.R. Veenendaal

## **Date and place of publication**

January 2013

Enschede, the Netherlands



## Abstract

Knowledge creation models frequently suffer from a narrow scope, or a too broad approach. The objective of this paper is to take one of these models, namely the Hypertext organisation (Nonaka, 1994) and bring it closer to practice by increasing its fit with a practical situation. The ultimate aim of this study is to provide a conclusion about the value and applicability of this model for knowledge creation in knowledge intensive companies.

An extensive review of Nonaka's contribution to knowledge management literature and adjacent publications has led to a comprehensive reconstruction of the Hypertext model and its potential shortcomings. Subsequently, a case study of a knowledge intensive company was conducted using semi-structured group interviews among 16 respondents who were selected using a combination of quota sampling and self-selection. The respondents were asked to discuss the current method of knowledge creation at the company, the individual elements of the reconstructed Hypertext model in relation to knowledge creation at the company and their perceptions of value and applicability of the model for knowledge creation at the company. The interview outcomes have led to eight suggested changes which are aimed to improve the practical relevance of the model.

The main conclusions in this paper are that the Hypertext model is an abstract and idealised representation of organisational knowledge creation which relies on poorly supported and partially unproven constructs and relations, but nevertheless holds considerable merit for managing organisational knowledge creation. Several constructs and relations appear to be influenced by Japanese culture, while others are expected to more accurately portray reality when configured to follow a different order. Despite this criticism, the reception of the model among the respondents in the case study was largely positive as many elements and relations were familiar or perceived to be valuable. Several respondents have expressed their intention to immediately apply some of the lessons learned from the interviews in practice.

The overall judgment of the respondents was that the applicability and value of the model is relatively high. However, the universality of the model and the assessment of theoretical shortcomings potentially negatively affect the applicability of the model. By implementing the proposed changes, this paper presents an evolved Hypertext model which holds greater practical value than its precursor.



## Acknowledgement

This thesis is the culmination of the research I have done as part of my graduation for the Master Business Administration at the University of Twente. Having chosen the master track Human Resource Management, the study I have conducted focuses on how to manage organisational knowledge creation, which by extension is the management of human resources.

I would like to use this opportunity to thank my supervisors, Prof. Dr. Jan Kees Looise and Ir. André Veenendaal, for their support and insightful comments. The way in which Prof. Looise has provided guidance during the first month of this research has proven to be invaluable in establishing a working relationship and coming to a successful conclusion. Furthermore, my thanks go out to Dr. Martijn van Velzen for how he has coached me prior to Prof. Looise taking over the supervision. I am intensely grateful for the patience he has showed and the way he has motivated me to become a better student and researcher.

I also would like to thank my parents, family, friends and colleagues who have helped me out in more than one occasion. You have all kept me on track and your feedback has proven to be very helpful in completing my studies at the University of Twente.

I am grateful that my former employer has supplied me with the perfect working environment to work on this thesis. Without expecting any type of compensation he has allowed me to use the company's resources and given me the opportunity to work in a distraction free environment.

Finally, I wish to express my gratitude to the participants in the case study who have allowed me to obtain useful data to perform my analysis with.

Joeri Constandse



# Index

Abstract .....	i
Acknowledgement.....	iii
1. Introduction.....	1
1.1. Knowledge creation is necessary, but how? .....	1
1.2. Problem statement and research questions .....	2
1.3. Research design.....	3
1.4. Case selection.....	4
1.5. Relevance .....	5
1.6. Organisation of the thesis .....	5
2. The Hypertext organisation design .....	7
2.1. Introduction to the Hypertext organisation design .....	7
2.2. Underlying principles.....	9
2.2.1. The knowledge typology .....	9
2.2.2. Modes of knowledge creation.....	12
2.2.3. The knowledge creation spiral .....	17
2.2.4. Knowledge scaling .....	19
2.2.5. Self-organising teams .....	21
2.2.6. Managing organisational knowledge creation .....	23
2.2.7. Middle-up-down management .....	25
2.3. Returning to the Hypertext organisation .....	27
2.4. Potential shortcomings .....	32
2.5. Conclusion .....	35
3. Methodology .....	38
3.1. Introduction of the case company .....	38
3.2. Research methodology.....	40
3.3. Operationalization.....	44

4.	Results of the case study .....	50
4.1.	The current method of knowledge creation .....	50
4.2.	How the Hypertext model relates to the case company.....	53
4.3.	Applicability and value of the model for the case company .....	58
5.	Assessing the case study outcomes .....	61
5.1.	Differences between the case company and the Hypertext model.....	61
5.2.	Similarities between the case company and the Hypertext model .....	62
5.3.	Value and applicability for the case company.....	63
6.	Conclusion and discussion.....	65
6.1.	Research question outcomes .....	65
6.1.1.	The main elements of the model and its contribution to knowledge creation .....	65
6.1.2.	Operationalizing and implementing the model in practice.....	66
6.1.3.	Value and applicability for knowledge intensive companies .....	67
6.1.4.	Conclusions regarding the applicability of the model.....	68
6.2.	Increasing the model's fit with the practical setting.....	70
6.2.1.	Amending the model to bring it closer to practice .....	70
6.2.2.	Suggestions to improve knowledge creation at the case company .....	76
6.3.	Contributions.....	78
6.4.	Limitations and suggestions for follow up research.....	79
	References.....	82
	Appendices .....	86
A.1.	Interview protocol .....	86
A.2.	Interview briefing .....	90



# 1. Introduction

## 1.1. Knowledge creation is necessary, but how?

The importance of knowledge as an organisational resource has been emphasised by Grant (1996) in his work on the knowledge-based theory of the firm. Knowledge should be seen as an intangible asset which is unique, causally ambiguous and hard to imitate or substitute. The resource based view attributes competitive advantage to the possession of these characteristics (Barney, 1991; Kogut & Zander, 1992; Cabrera & Cabrera, 2002). Kogut and Zander (1992) argue that the sharing and transfer of knowledge of individuals and groups within an organisation is the reason why firms exist. Inter-organisational knowledge diffusion, however, can lead to erosion of competitive advantages (Teece, 2000; Coff, Coff & Eastvold, 2006). The sustainability of the competitive advantage from knowledge resources must therefore be attributed to the ability to create new knowledge (Grant, 1996; Nonaka, Toyama & Konno, 2000; Turner & Makhija, 2006). The outcomes of knowledge creation can be threefold: (1) product and process innovations with an enhanced understanding or “justified true belief”, (2) an enhanced capacity to act, and (3) the ability to act, define, and solve problems (Nonaka & von Krogh, 2009).

The currently available models describing knowledge creation are often incomplete due to unevenly distributed support for specific aspects of these models (e.g. Nonaka, 1991). Sometimes they are based on misinterpretation of important premises (e.g. Coff, Coff & Eastvold, 2006), or inadequately explain concepts with crucial importance (e.g. Argote & Ingram, 2000). If authors provide examples of operationalization, they are frequently vague or appear to incompletely translate theory into practice (e.g. Nonaka, 1994). Other publications contain methodological shortcomings (e.g. Song, Almeida & Wu, 2003; Menon & Pfeffer, 2003), or confuse readers by using concept labels with differing contextual meanings (e.g. Kogut & Zander, 1992 vs. Bhatt, 2001; Polanyi, 1966 vs. Coff, Coff & Eastvold, 2006). Choi and Lee (2002) have stated that despite the voluminous discussion about knowledge management strategies, there is relatively little empirical evidence available.

At the same time there is no denying that most of these models hold value in the field of knowledge management research. Several articles (Nelson & Winter, 1982; Nonaka, 1991; Starbuck, 1992; Kogut & Zander, 1992; Burt, 1995; Grant, 1996; Teece, Pisano & Shuen, 1997) can be considered to have formed a foundation upon which other researchers have been able to build their own theories. Judging by the number of times these articles have been referred to in other publications, one can assume that they are held in high regard. Unfortunately, this does not implicitly lead to comprehensiveness or practical applicability.

The influence knowledge has on competitiveness, the distribution of competences and the availability of tools that assist knowledge transfer have increased the importance of effective knowledge transfer within firms (Teece, 2000). But without knowing what the practical value and applicability is of models which stimulate knowledge creation effectiveness, how should knowledge creation be shaped?

## 1.2. Problem statement and research questions

The practical applicability and by extension the value of knowledge management models remains unclear and forms a hole in existing knowledge management theory. An assessment of a model's applicability can have implications for the perceived value of the model and lead to better informed implementation decisions.

This paper takes one of the knowledge creation models, namely the Hypertext organisation (Nonaka, 1994) and brings it closer to practice by amending it to increase its fit with a practical situation. The Hypertext model was chosen because it builds on elements of knowledge management that have been widely adopted by other researchers, despite some of them suffering from vague explanations and lack of empirical testing. With what appear to be shaky foundations, the Hypertext organisational model presents an organisation design tailored for knowledge creation. At first glance the model offers a solution for any organisation looking to optimise its knowledge creation activities, but considering the aforementioned, what is the real value and applicability of the Hypertext model?

This study will provide a basis for operationalization and implementation in a practical setting. To reach this goal, we will critically examine the model and provide a detailed description of its various elements. An assessment of the model's applicability will be easier to perform when an understanding is created of how the model can be operationalized and implemented in practice. Next, a conclusion will be drawn regarding the value and applicability of the model in a particular practical setting (knowledge intensive companies, a choice which will be elaborated on in section 1.4.). Finally, through combining empirical data and the outcomes of the literature review, a conclusion will be drawn about the applicability of the model for knowledge creation.

To sum up, the research questions in this paper are:

1. What are the main elements of Nonaka's Hypertext organisation model and what does it contribute to knowledge creation?
2. How can the model be operationalized and implemented in practice?

3. What is the value and applicability of the model for knowledge creation in knowledge intensive companies?
4. Which conclusions can be drawn regarding the applicability of the model?

### 1.3. Research design

This study follows a research design in which an assessment of Nonaka's contribution to knowledge management literature forms the basis. This assessment includes adjacent publications from other authors. The literature review culminates in the construction of a comprehensive explanation of the Hypertext model which stays as close to Nonaka's intentions as possible. Using this reconstructed model, a list of its potential shortcomings is formulated.

The second phase of this research involves conducting a case study using semi-structured group interviews. These interviews can be divided into three segments. The first segment covers the current method of knowledge creation at the case company (see section 1.4.), in which the respondents are asked to describe how knowledge is being created, if this method fits the knowledge requirements of the company and how they would propose to improve knowledge creation effectiveness.

Following the first segment is an in-depth explanation of the reconstructed Hypertext model and the way its elements are conceptualised to work in unison. The second segment of the interview focuses on the model and facilitates discussions about how the model's elements are similar to how the company currently works and how the respondents would see other elements operate in practice. The third segment of the interviews involves the measuring of perceptions of value and applicability of the model for knowledge creation at the case company. The respondents are asked to discuss their expectations of fit between the company's knowledge requirements and the Hypertext model, and how they would envision bringing the model closer to practice.

Using the interview outcomes, suggestions are made to bring the model closer to practice. These suggestions lead to the construction of an improved version of the Hypertext model. Furthermore, based on the case study and the literature review a list is constructed of suggestions to improve the knowledge creation processes at the case company. Finally, an overall verdict about value and applicability of the reconstructed Hypertext model is formulated, using the literature review and the case study combined.

## 1.4. Case selection

This study focuses on how knowledge creation is managed in knowledge intensive companies and ascertains the value and applicability of the Hypertext model in this setting. The choice for knowledge intensive companies is made because of the importance of effectively and efficiently creating knowledge in this type of organisation. Swart and Kinnie (2003) state that knowledge intensive firms gain competitive advantage with the human and social capital they possess. Human capital includes individual tacit and explicit knowledge (Nelson & Winter, 1982). It is therefore likely that knowledge creation models are highly relevant to knowledge intensive companies. Changing the Hypertext model to bring it closer to practice will also have a larger impact on these companies than others because of the important role knowledge creation plays for these companies.

The case company is a major Dutch internet agency employing around 90 people. Following the criteria for knowledge intensive firms set out by Swart and Kinnie (2003), the case company can be described as being knowledge intensive, because most of the work at the company is of an intellectual nature and college-level educated workers form a major part of the workforce. Furthermore, Starbuck (1992) describes knowledge intensive firms as companies in which knowledge has more importance than other resources in maintaining the firm's competitive position, which also applies to the case company.

The company was selected based on how the researcher has perceived the company while being employed at the company in the years prior to the study. The company's affiliation with knowledge creation and the perceived pragmatic approach to managing knowledge creation make this company a suitable basis to compare the model with. Without being aware of how the Hypertext model is constructed, several elements have been observed to be in place at the company prior to the study taking place. The company relies heavily on dialogue and teamwork to share knowledge, similar to how Nonaka has conceptualised the *socialisation* and *externalisation* modes of knowledge creation. Furthermore, the company has adopted an organisational structure which shows strong similarities with Nonaka's *project-system layer*, in which self-organising teams enjoy high degrees of autonomy, cross-fertilisation and self-transcendence. A final similarity between the model and the case company's pragmatic method of knowledge creation has been observed to be the role of top management in determining a broad overall direction after which middle management works with entrepreneurial individuals to translate the ambitious goals of top management to practice.

## 1.5. Relevance

This study is of value to the practice of knowledge management for four reasons. Firstly, the proposed changes this study offers to bring the Hypertext model closer to practice amend the model to be easier to apply in knowledge intensive companies. The improved model is a more accurate representation of practical knowledge creation in the setting of knowledge intensive companies. Secondly, in conducting the interviews, decision makers at the case company are sparked to look into ways to manage the way knowledge creation takes place at the company. This new interest is planned to result in the hosting of a workshop to present this study's findings to a larger audience at the case company and discuss ways to improve its knowledge creation process. Thirdly, this study provides suggestions to improve knowledge creation at the case company. While these suggestions were not part of the original goal of this study, an analysis of the interview outcomes and constructing a list of suggestions to improve the model has led to a realisation that there is an opportunity for quick gains at the company and companies which face similar conditions. The fourth source for practical relevance is that this study will draw conclusions about the practical applicability and value of the model in the setting of a knowledge intensive company, which enables managers to take better informed implementation decisions.

## 1.6. Organisation of the thesis

This paper is structured to follow the order of the research questions. The second chapter will explain the principles that underlie Nonaka's Hypertext organisation model and how the model is designed to affect the practice of knowledge creation. Chapter two will culminate in an interpretation of how Nonaka has intended the individual elements of the Hypertext model to work together. This interpretation is a reconstruction of the model using the original publication in which the model was presented (Nonaka, 1994) and adjacent publications. Using the reconstructed model, chapter two will end with an assessment of the merits and potential shortcomings of the model, and will provide answers to the first two research questions.

Chapter three will introduce the case company, elaborate on the research methodology and the operationalization of constructs.

The fourth chapter will present the research findings by discussing the most relevant quotes, following the three stages of the interviews. Firstly, the current method of knowledge creation at the case company will be discussed. Following this, the interview outcomes concerning the way the Hypertext model relates to the case company are presented. Chapter four will conclude with the participant's perceptions of applicability and value of the model for knowledge creation at the case

company.

The fifth chapter will elaborate on the observed differences and similarities between the case company's knowledge creation method and the Hypertext model. The fifth chapter will cap off with a statement about the value and applicability of the Hypertext model in the setting of the case company, thus answering the third research question.

The sixth and final chapter will present the conclusions of this study. The four research questions are answered and changes are made to the model in order to bring it closer to practice. Furthermore, the sixth chapter will contain suggestions to improve the knowledge creation activities at the case company, an examination of the contributions of this study to knowledge management theory and a discussion of this study's limitations and potential subjects for follow-up research

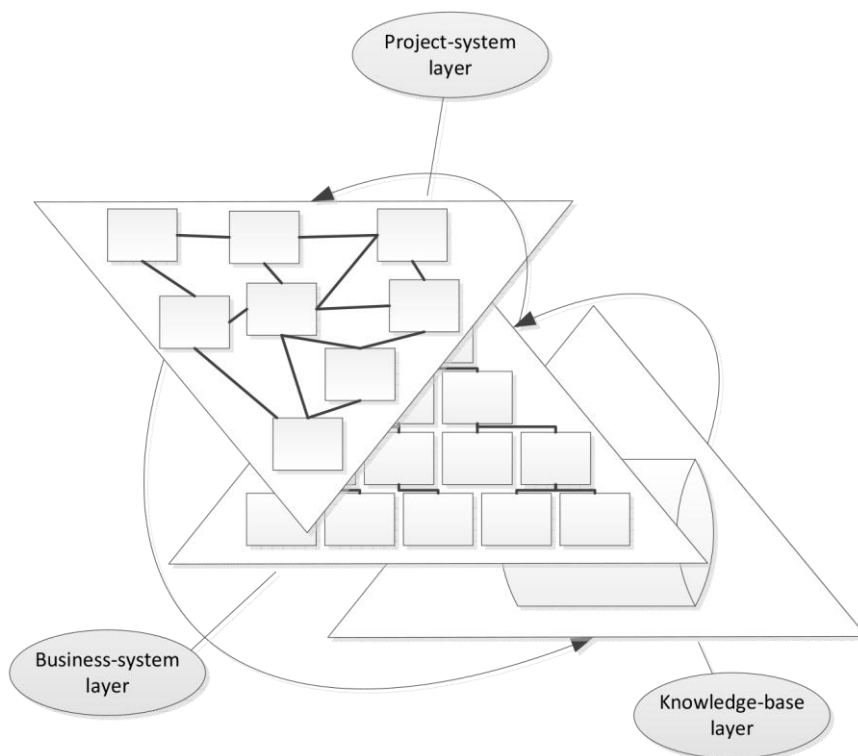
## 2. The Hypertext organisation design

The Hypertext organisation is an organisational architecture that is expected to improve the efficiency of the knowledge creation process. The design consists of a three-layered organisation, in which employees cycle from a hierarchical top-down organisation into a flat team-based organisation and a supporting knowledge base. How these layers fit together will be explained in section 2.1. This chapter is structured in a fashion where the Hypertext model is briefly introduced, after which the underlying principles are examined. It is concluded with an in-depth assessment of how the model functions and what the potential shortcomings are.

### 2.1. Introduction to the Hypertext organisation design

Nonaka (1994) has coined a new organisational architecture which combines the efficiency and stability of a hierarchical bureaucratic organisation with the flexibility of the flat, cross-functional task-force organisation. This new architecture is intended to combine the advantages these structures have on knowledge creation effectiveness. The Hypertext organisation consists of three layers (see figure 1).

Figure 1: Hypertext Organisation (Nonaka, 1994)



The bottom layer of the Hypertext organisation is known as the *knowledge-base layer*, in which tacit and explicit knowledge are embedded. This tacit knowledge can be associated with organisational

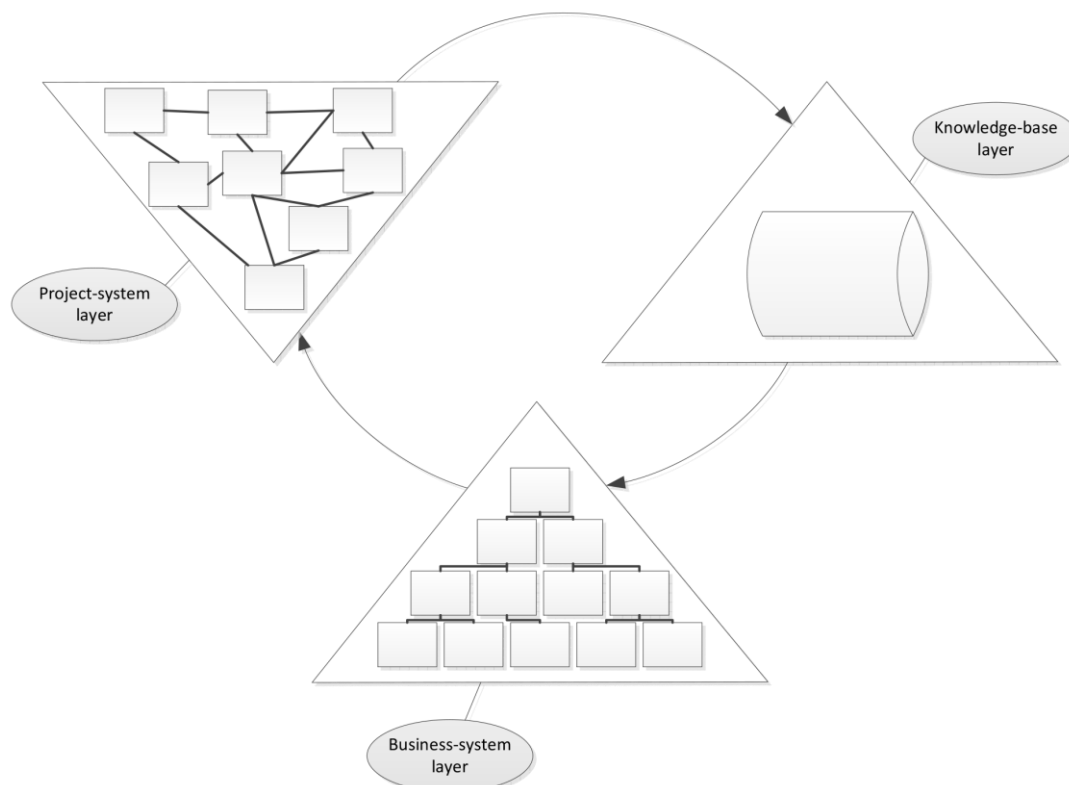
culture and procedures, while the explicit knowledge has taken form in documents, filing systems, or digital databases.

The layer on top of the knowledge-base is called the *business-system layer*. This is where routine operations are carried out in a hierarchical, bureaucratic organisation. This layer has all the characteristics of a top-down organisation.

The top layer is known as the *project-system layer*. Multiple knowledge creating self-organising project teams make up this layer. The teams are loosely linked to facilitate an interconnectedness that improves the knowledge creation process. They share the same corporate vision that underlies the knowledge creation efforts.

Organisational knowledge creation is conceptualised as a perpetual dynamic cycle of knowledge and information flowing through the three layers (see figure 2). The project teams in the top layer are comprised of members from diverse functions and departments from the business-system layer. The teams cooperate in their efforts to work towards the knowledge goals set out by the company management. When a team completes the task that has been set out for it, it is disassembled. The project team members then move to the knowledge-base layer to create an inventory in which the outcomes of their knowledge creation activities are stored. They move back to the business system layer when they finish their documenting and resume their routine operations until they are called upon for another project.

**Figure 2: Flow through the layers of the Hypertext Organisation (based on Nonaka, 1994)**





The Hypertext organisation design relies on the notion that knowledge can be either tacit or explicit, depending on the relative ease with which knowledge can be articulated or codified. This typology forms the basis upon which the knowledge creation process is conceptualised as knowledge moving through a sequence of conversions between tacit and explicit, where it gains magnitude and momentum. This sequence of conversions forms a circle, or a spiral of ever growing knowledge assets. The spiral is the result of implementing several triggers; knowledge creation enhancing conditions and specific knowledge creation activities that together form an intricate network of relations.

The complexity of this network and the assumptions that lie at the foundation of the Hypertext organisation design, require the reader to understand the underlying principles, before explaining how the building blocks are integrated to form a whole. Section 2.2. will discuss these elements by diving into the deepest level of analysis and moving upwards toward a reconstruction of the model. While presenting the underlying elements, each item will be critically examined and discussed while introducing relevant alternative theories.

A visual representation of the conceptualised relations is provided in section 2.3. This chapter concludes with an assessment of the potential shortcomings of the model based on the literature review and answers to the first two research questions.

## 2.2. Underlying principles

### 2.2.1. The knowledge typology

Knowledge is defined using several classifications. Examples of such classifications are component and architectural knowledge (Tallman et al., 2004), tacit and specific knowledge (Coff, Coff & Eastvold, 2006), information and know-how (Kogut & Zander, 1992), and tacit and explicit knowledge (Polanyi, 1966; Nonaka, 1991). These classifications are similar in that they assign a label to knowledge types, based on the value of this knowledge. The distinction between tacit and explicit knowledge has influenced the field of knowledge management considerably. It is a classification which is based on the ease with which the knowledge can be disseminated. The assumption that knowledge can be explicit or tacit has in recent years developed into a proposition that knowledge should not be identified as either explicit or tacit, but can be placed on a scale that ranges from explicit to tacit (Ambrosini & Bowman, 2001) to acknowledge the existence of knowledge which exhibits characteristics of both tacit and explicit knowledge.

In 1966 Polanyi explained that we know more than we can tell. From a Gestalt-psychology angle he explains that we unawaresly possess knowledge which as a result of our unawareness is difficult or impossible to articulate. This type of knowledge is tacit knowledge.

To elaborate on what is tacit knowledge, Polanyi (1966) made an interesting reference to Plato's *Meno*: "*we take for granted that solutions to great problems are great discoveries. But seeing a solution to a problem is not being able to see something that is hidden, but to see something that other people are not aware of seeing*" ... "[Plato] says that to search for the solution of a problem is an absurdity; for either you know what you are looking for, and then there is no problem; or you do not know what you are looking for, and then you cannot expect to find anything." In Poe's Purloined Letter there is a momentous document in front of everybody and as a result of it being available it is overlooked by everybody. In terms of *Meno* this means that if all knowledge is explicit (easily articulated), we cannot know a problem or look for a solution to it. Therefore, if problems exist and discoveries are made to solve them, there must be a knowing of something we cannot tell. This assumption hints at a type of knowledge that we are unaware of knowing or unable to articulate. Polanyi (1966) calls this type of knowledge *tacit knowledge*.

Nonaka (1991) describes tacit knowledge as being highly personal, hard to formalise and difficult to communicate. It is deeply rooted in action and in an individual's commitment to a specific context. Tacit knowledge consists partly of technical skill and knowhow which has been developed over years of practice. The cognitive dimension of tacit knowledge lies in its composition of mental models, beliefs, and perspectives, which are difficult to explain because the holders of this knowledge take it for granted. Ambrosini and Bowman (2001) attribute tacit knowledge with specificity, because this type of knowledge is acquired in a particular setting. Additionally, Ambrosini and Bowman (2001) explain that the personal trait of tacit knowledge is caused by the degree to which the knowledge has become ingrained in people and organisations, which lead to the knowledge becoming implicit and taken for granted. The specificity and the personal nature of tacit knowledge render it difficult for outsiders to imitate or copy (Nonaka, 1991; Kogut & Zander, 1992; Nonaka, 1994; Ambrosini & Bowman, 2001; Coff, Coff & Eastvold, 2006)

Kogut and Zander (1992) have influenced the current understanding of what is tacit knowledge. Instead of using the construct label "tacit knowledge", they use the term *know-how*. Know-how was described by Von Hippel (1988) as "... the accumulated practical skill or expertise that allows one to do something smoothly and efficiently". Kogut and Zander use the term *information* for knowledge that can be transmitted without loss of integrity once the syntactical rules required for deciphering it are known. *Information* is placed on the opposite of *know-how* on the knowledge attribute scale. Knowledge as information implies knowing *what* something means, while knowledge as know-how

implies knowing *how* to do something. The distinction between information and know-how is comparable to that made between declarative knowledge (a statement that provides a description) and procedural knowledge (a statement to describe a process).

If *information* (Kogut & Zander, 1992) is a type of knowledge that can be transmitted without loss of integrity, it is essentially the same thing as Nonaka's (1991) *explicit knowledge*. Nonaka describes explicit knowledge as formal and systematic, which makes it relatively easy to communicate and share, for example through product specifications or scientific formulae.

When comparing the typologies of Nonaka (1991, 1994), Kogut and Zander (1992) and Ambrosini and Bowman (2001), it is apparent that Nonaka's division of tacit and explicit knowledge is a valid one. It is however cut short in its explanation and leaves the reader wondering what is truly meant. The other authors are much more elaborate in explaining the difference between these constructs. Ambrosini and Bowman (2001) for example offer several gradations of tacitness and explicitness, a proposition which was later supported by Nonaka (Nonaka, von Krogh and Voelpel, 2006; Nonaka & von Krogh, 2009). Furthermore, Nonaka (1991, 1994) rarely uses practical examples of the difference between tacitness and explicitness, as opposed to Kogut and Zander (1992), Ambrosini and Bowman (2001), Turner and Makhija (2006) and Coff, Coff and Eastvold (2006). Kogut and Zander's explanation (1991) of know-how and information, constructs which in many ways have the same meaning as tacit and explicit knowledge, is much more easily understood than the typology Nonaka uses.

If one were to exclusively use Nonaka's explanation (1994) of tacit and explicit knowledge, the comprehension of these constructs would be very limited. This drawback can be overcome by including articles from other authors who have adopted and modified these constructs or using a larger selection of Nonaka's work. This raises the question if Nonaka's distinction between tacit and explicit knowledge forms a stable enough foundation for the knowledge creation model that will be explained in the following sections.

In closing, the distinction between explicit and tacit knowledge lies in the way the knowledge was created and the ease with which it can be articulated. The awareness of possessing knowledge plays a role in labelling knowledge along a spectrum that ranges from explicit to tacit, with explicit knowledge being a type of knowledge of which individuals are consciously aware of possessing it, while this awareness does not apply to tacit knowledge. An understanding of the differences between explicit and tacit knowledge is important before moving on to the knowledge creation spiral, which is the most important element in the Hypertext organisational model.

### 2.2.2. Modes of knowledge creation

Nonaka (1991, 1994) describes four phases (figure 3) in organisational knowledge creation that exist in dynamic interaction with each other:

1. From tacit to tacit; *socialisation*
2. From tacit to explicit; *externalisation*
3. From explicit to explicit; *combination*
4. From explicit to tacit; *internalisation*

Because tacit knowledge is acquired through experience and experimentation, it is difficult to share this type of knowledge without common experiences. Transferring tacit knowledge therefore takes place during a long process of observation, imitation, and practice. Creating tacit knowledge through shared experience is called *socialisation*, while creating tacit knowledge through experimentation with explicit knowledge is called *internalisation*.

Nonaka (1994) explains that new explicit knowledge can be created through social processes that combine different bodies of explicit knowledge held by individuals and by using dialogue with metaphors and analogies to articulate tacit knowledge. The reconfiguring, combining and recontextualizing of several bodies of explicit knowledge will lead to new insights and solutions for the problems we experience. This process of creating new explicit knowledge from several bodies of existing explicit knowledge is called *combination*. Articulating tacit knowledge to make it explicit is called *externalisation*.

Socialisation and combination don't affect the tacit or explicit nature of the knowledge involved. They are techniques of transferring and creating through reconfiguration of knowledge. There are two types of knowledge conversion: from explicit to tacit (*internalisation*) and from tacit to explicit (*externalisation*). Explicit knowledge and tacit knowledge are complementary and can expand over time through a process of mutual interaction. Nonaka (1994) explains that metaphors play an important role in externalisation and action is deeply related to internalisation. Internalisation is comparable to the traditional definition of learning – acquiring tacit knowledge from sources of explicit knowledge, or skills and know-how from textbooks.

The processes of socialisation, internalisation and combination are part of the theories of

**Figure 3: Modes of knowledge creation (amended from Nonaka, 1994)**

		To	
		Tacit knowledge	Explicit knowledge
From	Tacit knowledge	Socialisation	Externalisation
	Explicit knowledge	Internalisation	Combination

organisational culture, organisational learning and information processing respectively.

Externalisation however, is not coupled as easily with any organisational theories. Converting tacit knowledge into explicit knowledge is a difficult process which has received some attention from scholars, but the way this process can take shape remains largely a mystery. Nonaka (1991, 1994) expresses that using metaphors can help in converting tacit knowledge into explicit knowledge, but doesn't provide any empirical evidence to support this claim. He is also vague in explaining how this process would take shape. Ambrosini and Bowman (2001) support Nonaka's assertion (1994) that metaphors are useful in transmitting tacit knowledge. If something cannot easily be put into words, then perhaps it can be explained through telling a story about an occurrence in which the subject plays a role. The authors call this *storytelling*.

Using metaphors or storytelling when direct language is available is discouraged. One way to prevent the overuse of metaphors is to ask to reformulate an explanation. If the second explanation is another metaphor, instead of a "regular" expression, the original metaphor is appropriate for the situation.

Metaphors can be used to explain something intuitive to people who are grounded in different contexts and with different experiences, through the use of imagination and symbols without the need for analysis or generalisation (Nonaka, 1991, 1994). The process of deciphering a metaphor by the audience is the first step of converting tacit knowledge into explicit knowledge.

Analogies are more structured than metaphors because they aren't driven by intuition and images that are at first glance remotely linked to each other. Analogies form a more structured process of reconciling contradictions and making distinctions, and they highlight the similarities between the contradicting terms in metaphors. This reduces the ambiguity of the metaphors.

What is not explained is what the value is of using a metaphor before moving to an analogy. What is the reason for forcing the expression of contradicting terms and connecting these terms in a later phase? This may be where mental models come into play. Mental models that include schemata, paradigms, beliefs, and perspectives are understood to help us perceive and define the world around us (Nonaka, 1994 p.16). But this explanation is taken out of context, because the author originally uses it to describe the cognitive element of tacit knowledge. Nonaka potentially attributes value to the transition from metaphor to analogy in the role mental models play during the interpretation and reconstruction of the contradicting terms in the metaphor. If this is true, there is a loss of integrity in the message that is being conveyed. If the transition from tacit to explicit involves a two-step process in which interpretation plays a key role, the message will change due to the influence mental models have on the act of interpreting. Even though this line of thought is speculative and a considerable deviation from that of Nonaka, it can be concluded that there is a potential hole in his reasoning. If

he were more concise in his elaborate explanation of the role metaphors play in articulating tacit knowledge, it may have been easier to understand. It appears that Ambrosini and Bowman's (2001) suggestion to use storytelling and cognitive (causal) mapping as techniques to articulate tacit knowledge would be a better option, as these are less complex and not influenced by the aforementioned threat to the message integrity.

A second point of criticism can be raised against the way the process of socialisation is explained (Nonaka, 1991, p. 98-99). Socialisation, or the transfer of tacit knowledge without converting it into explicit knowledge, is described using an example of an electrical appliance manufacturer's quest of designing a bread-making machine for home use. What follows is an anecdote of how the designers were unable to deliver a machine that would produce high quality bread. In order to improve their design, one staff member went into an apprenticeship with a master baker and over time has learnt the craft of baking high quality bread. Because tacit knowledge is rooted in action (Kogut & Zander, 1992; Ambrosini & Bowman, 2001), Nonaka (1991, p. 98-99) chose to explain the transfer of tacit knowledge by writing about the baker's apprentice learning how the kneading technique influences the quality of the bread. It was a twisting motion during the stretching of the dough that was missing from the bread-making machine's design.

This is a poor example of how tacit knowledge can be transferred. It actually describes how the master baker performs his job differently from how a layman would do it, by performing an action that could have easily been put into words. In this example the tacit knowledge is not transferred through the accumulation of years of hands-on experience, but learning from a simple observation. This reasoning is furthered by Ribeiro and Collins (2007). They argue that the notion of knowledge conversion from tacit to explicit (externalisation) is conceptually flawed if based on the case of the bread-making machine because tacit knowledge has not become embedded into the machine as a result of the designer's apprenticeship with a master baker (Ribeiro & Collins, 2007, p. 1418).

Gourlay (2006) shares the sentiment that Nonaka (1991, 1994) has insufficiently explained the process of socialisation by using an improper example. Here however, the focus of the criticism is on whether the taste or kneading was at issue in producing high quality bread. In reference to a bread making handbook, Gourlay states that the taste of bread is affected by the raw ingredients, the dough maturation process and the baking, but not by the kneading. He concludes that the example used by Nonaka is faulty because of the assumption that the twisting of the dough is the secret to baking high quality bread. Instead, the improvement to the bread-maker design is likely attributed to incidental problem solving during the lengthy design process (Gourlay, 2006, p. 1417). The potential for an incorrect attribution of success undermines Nonaka's example, which leaves the conclusion that the process of socialisation is insufficiently explained.

Nonaka's explanation of the process of combination is also insufficient: *"An individual can also combine discrete pieces of explicit knowledge into a whole. For example, when a comptroller of a company collects information from throughout the organisation and puts it together in a financial report, the report is new knowledge in the sense that it synthesises information from many different sources. But this combination does not really extend the company's existing knowledge base either"* (Nonaka, 1991, p. 99). In theoretical terms combination is described as the creation of new knowledge through merging and reconfiguring existing knowledge. Nonaka chose to use a weak example of how several sources of existing knowledge are combined in a single document. This document is seen as the new source of knowledge. He admits that this new source of knowledge does not add to the company's knowledge endowment, but instead of providing a better explanation, he continues to explain the process of externalisation; omitting to provide a concise elaboration of how combination works.

In his 1994 article, Nonaka explains that *"The reconfiguring of existing information through the sorting, adding, recategorizing, and recontextualizing of explicit knowledge can lead to new knowledge."* This does not significantly alter the state with which this construct is explained in the previous publication, leading to the conclusion that it is unclear how the process of combination works. Nonaka (1991, 1994) has described the construct in theoretical terms and by using a single example, but does not produce evidence of knowledge creation through the reconfiguration and combination of existing knowledge.

Internalisation is explained using an example where the comptroller's summary of data causes a revision of the company's financial control system (Nonaka, 1991, p. 99). The revised financial control system becomes a part of the organisation's internal environment: a new status-quo which, over time, is taken for granted by the employees. The new financial control system will become a part of the toolset and resources necessary for the employees to do their jobs.

The transition from explicit to tacit does not occur at the intersection between delivering the comptroller's dataset and the formulation of a new financial control system, but at the point where the employees start subconsciously performing their jobs in accordance with the behaviour that is stimulated by the new financial control system. The knowledge has changed from being entirely explicit (the comptroller's dataset) to being largely tacit (the subconscious awareness of the financial control system, which leads to a change in employee behaviour). In essence this can be seen as a good example of how explicit knowledge is converted into tacit knowledge. Unfortunately the formulation of the example appears to put too much emphasis on the influence the comptroller's dataset has on the revision of the financial control system, because a relatively simple source of knowledge inspires the creation of a more complex type of knowledge. This distracts the reader from

what the author is really trying to bring across. If Nonaka had chosen to include an additional example of how internalisation works, or abstained from mentioning the comptroller's dataset, it may have worked better in explaining the construct.

Choi and Lee (2002) have examined the link between knowledge management strategies and the modes of knowledge creation, and found evidence for the way socialisation, externalisation, combination and internalisation work. The authors have categorised knowledge management strategies in human and system strategies, a typology which shows overlap with the distinction between tacit and explicit knowledge. Empirical testing shows that knowledge management strategies need to be adjusted to fit the knowledge creation process within the company to improve corporate performance. The human strategy is found to be most suitable for socialisation and internalisation. The system strategy is found to be most suitable for combination. Choi and Lee (2002) state that Bloodgood and Salisbury (2001) and Riggins and Rhee (1999) have found the system strategy to be suitable for externalisation as well, which completes the linking between the knowledge creation modes and the two knowledge management strategies.

In a confirmatory factor analysis using survey data from 105 middle managers from firms in the Tokyo area, Nonaka et al. (1994) have found empirical support for the existence of all four modes of knowledge creation. An interesting outcome here is that Nonaka et al. (1994) did not find evidence for the use of dialogue and metaphor in the externalisation phase. It is also noteworthy that there are several threats to the study's statistical conclusion validity and the external validity due to low statistical power, homogeneity of the sampled units, and the potential for an interaction of the causal relationship with the sampled units.

What can be drawn from this is that the conceptualisation of the four modes of knowledge creation is sound, though the way they are explained raise more questions than they solve. Nonaka et al. (1994) have proven that the constructs *socialisation*, *externalisation*, *combination* and *integration* are valid. Choi and Lee (2002) have proven that there is a significant relation between the type of behaviour observed and the knowledge creation mode which formed the context in which the observation is made. This relation is as Nonaka has hypothesised in 1991.

In conclusion it can be noted that the four phases of organisational knowledge creation (Nonaka, 1991, 1994) are insufficiently explained, but empirically proven in several occasions. The validity of the four modes has a great impact on the perceived value of the Hypertext organisational model, as the constructs of tacit and explicit knowledge, and the four phases of organisational knowledge creation function as the foundation upon which the model is built. What follows is an elaboration on how these phases are hypothesised to work in dynamic interaction with each other.



### 2.2.3. The knowledge creation spiral

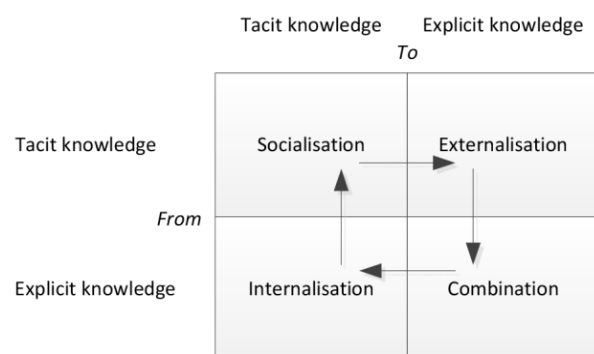
Knowledge creation can take place in each of the four aforementioned modes. However, the central theme of the model is the dynamic interaction between the modes. The interaction between the modes is necessary because without it, problems can arise. Nonaka (1994) provides an example by explaining that pure combination leads to a superficial interpretation of existing knowledge which has little to do with the here-and-now reality. Pure socialisation limits the “sharability” of the tacit knowledge and keeps this knowledge bound to the context in which it was created.

Organisational knowledge creation takes place when the four modes are managed to form a perpetual cycle. Knowledge creation in a sequence of knowledge creation modes can be seen as knowledge shifting through the modes. These shifts are triggered by certain events. The triggering conditions are:

- Socialisation starts with the building of a *team* or a *field of interaction* in which experiences and perspectives are shared
- Externalisation starts after several rounds of meaningful *dialogue* in which a sophisticated use of metaphors is used to enable the articulation of tacit knowledge.
- Combination is triggered by *coordination* between team members and the rest of the organisation, and *documentation* of existing knowledge.
- Internalisation takes place when team members assimilate knowledge in a trial-and-error fashion. This *experimentation* can trigger internalisation.

The cycle (see figure 4) can be seen as a spiral if the outcomes of the knowledge creation process are assumed to be a form of progress. Progress resulting from knowledge creation causes the starting point of the knowledge creation cycle to move upwards. But since the knowledge creation cycle does not have a clear beginning or end, the starting point is continually shifting, which transforms the cycle into a spiral. Because the knowledge creation starts at the individual level and expands through interaction, it transcends sectional, departmental, divisional and ultimately organisational boundaries (Nonaka, Toyama & Konno, 2000). The incrementally increasing unit size of knowledge and the expansion across organisational units causes the cycle to become a spiral.

Figure 4: Knowledge creation spiral (Nonaka, 1994)



What is missing from Nonaka's work is that the hypothesised causal relations between the triggering conditions and the modes of knowledge creation are lacking empirical support. Nonaka (1994) supports the propositions with the anecdotal evidence that he uses to describe the four modes of knowledge creation (see subsection 2.2.1.) and fails to deliver more compelling evidence, such as the work of Nonaka et al. (1994), Riggins and Rhee (1999), Bloodgood and Salisbury (2001) and Choi and Lee (2002) in the context of the four modes of knowledge creation. Furthermore, in his elaboration the author does not provide the evidence first hand. The hypothesised triggering conditions are in effect the same as the actual behaviour that is being stimulated. It is easy to assume that behaviour will be witnessed after introducing said behaviour to a setting. This leads to the conclusion that the proposed triggering conditions are insufficiently supported. This shortcoming can be solved by an inclusion of empirical data which points at a cause and effect relationship between the triggering conditions and the modes of knowledge creation.

It is also unclear how Nonaka (1994) attributes power to the interaction between tacit and explicit knowledge conversion modes. He provides examples of focusing on pure combination or pure socialisation, which can prove problematic, but there is no mention of effects when focusing on internalisation or externalisation.

The argument for the knowledge creation spiral (Nonaka, 1991, 1994) implicitly prescribes an order in which the modes of knowledge creation should take place. Figure 4 displays the spiral as a clockwise motion. Forcing a different order appears to be impossible because the outcome of the socialisation phase is used as the input for the externalisation phase, which in turn supplies the input for the combination phase, and so on. Nonaka (1991, 1994) attributes a sequential nature to the process of knowledge creation by aligning the knowledge creation modes in this order. Just five years earlier Nonaka made an argument for abandoning sequential development processes in the context of product development (Takeuchi & Nonaka, 1986; Nonaka, 1988b). The context from which this petition is taken differs slightly from the setting that is being discussed in this study, but the main arguments can be carried over. Parallel development should be adopted over sequential development to reduce the development cycle time, while increasing development efficiency and preventing the "next bench" syndrome<sup>1</sup>.

Taking into account the expected benefits of adopting a parallel development process, perhaps the spiral of knowledge creation can be optimised by not viewing it as a spiral and reconnecting the knowledge creation modes in a chaotic or random fashion (figure 5). If knowledge creation can take

---

<sup>1</sup> This construct is explained as a situation in sequential development where products are designed based on the feedback provided by the co-worker at the next bench, after asking what kind of product he or she would like to see (Takeuchi & Nonaka, 1986). Because this issue is outside of the scope of this study, it will not be elaborated on.

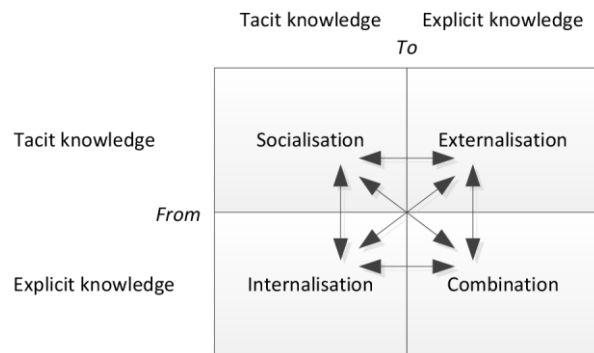
place in multiple knowledge creation modes simultaneously, perhaps the outcome of this process will benefit from the advantages that are hinted at by Takeuchi and Nonaka (1986).

The knowledge creation spiral suffers from a similar problem as the four modes of knowledge creation: an insufficient explanation of constructs. This problem is in part carried over by the fundamental role the four modes of

knowledge creation have in the knowledge creation spiral, but the way the theory is presented, is not improved. Furthermore, the order in which the modes of knowledge creation are suggested to take place is an interesting topic for discussion, as an argument is made for switching from a spiral in which the modes have sequential interdependence, to a chaos with parallel interdependence.

The knowledge creation spiral forms the core of the Hypertext organisation design. It is argued (e.g. Nonaka, 1988a, 1988b, 1991, 1994; Nonaka, von Krogh & Voelpel, 2006; Nonaka, Toyama & Konno, 2000) that implementing the triggering conditions for the knowledge creation modes is necessary, but not sufficient to optimise organisational knowledge creation activities. Subsections 2.2.4. through 2.2.7. will supplement the knowledge creation spiral with measures that are expected to improve knowledge creation effectiveness.

**Figure 5: Suggested alternative interdependence in knowledge creation spiral**



#### 2.2.4. Knowledge scaling

Knowledge is created by individuals. An organisation cannot create knowledge without individuals within this organisation. Kogut and Zander (1992) argue that the sharing and transfer of knowledge of individuals and groups within an organisation is the reason why firms exist. Organisational knowledge creation is a process of amplifying the creation of knowledge by the individuals within the organisation and maintaining this knowledge within the knowledge network of the organisation (Nonaka, 1994; Arian, 2009). The enlargement of an individual's knowledge plays a vital role in coming to a model for knowledge creation which builds on the four modes of knowledge creation and the spiral in which they function. The concept of enlarging an individual's knowledge is multidimensional because it can be explained from the different interpretations of the term *enlarging*. This subsection will elaborate on the enlargement of an individual's knowledge from the perspectives of increasing the availability of a knowledge resource in the organisation (Coff, Coff & Eastvold, 2006) and enlargement of knowledge within the individual through an interaction between

experience and rationality (Nonaka, 1994). The first explanation of the enlargement of an individual's knowledge isn't included in Nonaka's argument for the Hypertext organisational design, but is used in this study because it offers valuable insight into the potential drawbacks of externalisation, the codification of tacit knowledge, and the dissemination of knowledge.

Knowledge transfer is a multiplication effort, because unlike in a basic transaction relationship, the knowledge source does not lose the amount of knowledge the receiver gains. Disseminating knowledge is therefore a way of enlarging an individual's knowledge within an organisational context. Every time knowledge is transferred from one actor to another, its volume grows. As a result, an organisation is more capable of matching the knowledge resource availability with the resource requirement.

Coff, Coff and Eastvold (2006) state that the value of tacit knowledge is derived from its inimitability. Leveraging tacit knowledge means that the valuable resource can be used more widely throughout the organisation. Because tacit knowledge is often firm-specific, which means that a market for tacit knowledge is unfeasible. If knowledge is abundant, the resource isn't scarce and as such not expected to be a source of competitive advantage. Furthermore, the tacit nature is expected to make it hard for the firm to find prospective employees who possess this resource (Coff, Coff & Eastvold, 2006). To overcome situations in which the demand for tacit knowledge surpasses the supply, tacit knowledge has to be scaled up. If the competitive advantage originates from the possession of particular tacit knowledge, scaled up tacit knowledge can strengthen the advantage. Coff, Coff and Eastvold (2006) anticipate limitations to the scaling of tacit knowledge. They expect the strategic value of tacit knowledge to diminish if the knowledge is scaled up to where it becomes available to competitors. A factor adding to this effect is the requirement of partially codifying tacit knowledge to lubricate the dissemination process. Codified knowledge is more easily accessible by competitors by hiring people away from the originating firm. In conclusion, the enlarging an individual's knowledge can assist an organisation in fulfilling its knowledge resource requirements, while at the same time opening up possibilities for the knowledge to spill over to competitors (Coff, Coff & Eastvold, 2006).

Nonaka (1994) sees the enlargement of individual knowledge as an interaction between experience and rationality, after which it is crystallised into unique, personal perspectives. These personal perspectives on knowledge are based on individual beliefs and value systems, and play a role in the interpretation of shared experiences in the conceptualisation.

The way Nonaka (1994) explains the enlargement of individual knowledge focuses on improving the quality of knowledge through increasing the variety of personal experiences and *knowledge experience*. Having varied but related experiences enables the individual to connect and integrate distant knowledge sources to create new perspectives. Monotonous or routine tasks on the other

hand, are expected to inhibit creative thinking and the formation of new knowledge (Nonaka, 1994). *Knowledge experience* is described as “an embodiment of knowledge through a deep personal commitment into bodily experience” (Nonaka, 1994, p. 22). This notion is derived from oriental culture and from Descartes. In reference to Varela et. al (1991), Nonaka explains embodiment as “a reflection in which body and mind have been brought together”. Commitment to bodily experience is described using Nishida (1960) as “an intentional self-involvement in the object and situation which transcends the subject-object distinction, thereby providing access to ‘pure experience’” (Nonaka, 1994, p. 22). In this paper, knowledge experience is interpreted as the merging of the individual’s perspectives with the knowledge, to become intuitive instead of rational. Knowledge experience reflects a true commitment to knowledge.

Nonaka (1994) goes on to explain that improvements to knowledge quality through having varied experiences and the *knowledge experience* have to be balanced by the ability to reflect on experience. The author calls this *knowledge of rationality*. Knowledge of rationality has a place in the combination phase of knowledge creation. Reflection is necessary to create discrete declarative knowledge and ignores the importance of commitment by centring on reinterpreting existing explicit knowledge.

Concluding from Nonaka’s assessment, it can be said that enlarging individual knowledge involves improving the knowledge quality through having varied experiences in the creation process, having high commitment to knowledge through unifying the individual with the knowledge (knowledge experience), and being able to reflect on experience (knowledge of rationality) while combining perspectives to form new knowledge.

#### 2.2.5. Self-organising teams

Socialisation can be facilitated by the establishment of a *knowledge creation field* or *self-organising team* in which collaboration leads to new concepts (Nonaka, 1994). This field can cross organisational boundaries, as shown by examples from Japanese industry where suppliers are involved in various stages of new product development, and customers in the case of new product planning (Dyer & Nobeoka, 1998). The notion of a field or context in which knowledge creation takes place is supported in several publications (e.g. von Krogh, 1998; Grant, 1996; Tanriverdi & Iacono, 1998; Nonaka, Toyama & Konno, 2000; Alavi & Leidner, 2001; Nonaka, von Krogh & Voelpel, 2006).

Takeuchi and Nonaka (1986) describe self-organizing teams as project teams that take on a self-organising character as they are driven to a state of *zero-information*. What they mean by this is that the team cannot rely on prior knowledge. A state of zero-information introduces ambiguity and

fluctuation to the organisation. Over time, the uncertain situation will develop into a new dynamic order and the project team will begin to operate like a start-up company by taking initiatives and risks, and developing an independent agenda.

Project teams become self-organising when they enjoy autonomy, become self-transcendent and exhibit cross-fertilisation (Takeuchi & Nonaka, 1986; Nonaka, 1988a; Nonaka, Toyama & Konno, 2000). Three examples of successful project teams are provided to support the argument for autonomy (IBM's Boca Raton operations, the Honda City project and NEC's PC 8000 development – Takeuchi & Nonaka, 1986, p. 139-140). In these cases the influence of top management on the daily activities of the team members is limited to providing guidance, resources and moral support. The teams are free to make their own decisions. Nonaka, Toyama and Konno (2000) link *autonomy* to increases in the motivation of organisation members to create new knowledge, the commitment of individuals to the knowledge creation process and the organisation, and it is expected that autonomy improves the chances of accessing valuable information held by individuals.

*Self-transcendence* is explained as a process in which “one reaches out beyond the boundaries of one's own existence” (Nonaka, Toyama & Konno, 2000). Individuals can transcend themselves in each of the four modes of knowledge creation through diminishing barriers between individuals (promoting socialisation), integrating individual intentions and ideas into the group's mental world (promoting externalisation), recontextualising knowledge which transcends the group level (promoting combination), and individuals accessing the knowledge realm of the group (promoting internalisation) (Nonaka, Toyama & Konno, 2000). Self-transcendence can be achieved by setting challenging targets in which contradictions have to be solved (Nonaka, 1988a).

Self-transcendence of project teams means that the teams devise ways to challenge prevailing ideas and override the status quo from what appear to be contradictory goals, to make big discoveries. The teams are enveloped in a relentless quest for elevating their own goals throughout the development process (Takeuchi & Nonaka, 1986).

The third characteristic displayed by self-organising teams is *cross-fertilisation*, which describes the interaction between team members coming from various functionally specialised backgrounds. The process of cross-fertilisation is excellently illustrated by a quote from one of the FX-3500 project team members at Fuji-Xerox: “*When all the team members are located in one large room, someone's information becomes yours, without even trying. You then start thinking in terms of what's best or second best for that group at large and not only about where you stand. If everyone understands the other person's position, then each of us is more willing to give in, or at least to try to talk to each other. Initiatives emerge as a result*” (Takeuchi & Nonaka, 1986, p. 140).

Self-organising teams can trigger knowledge creation through building mutual trust among members. This will accelerate the sharing of tacit knowledge among members. The sharing of experiences to help build common perspectives is an operationalization of the *socialisation* phase of the knowledge creation spiral.

Common perspective can also be built by conceptualising the shared tacit knowledge through continuous dialogue. This is the *externalisation* phase of the knowledge creation spiral. An important thing to note in the context of creating common perspective is that the dialogue should always leave room for revision or useful negotiation; participants should be able to express ideas and opinions freely.

Although the knowledge creation field construct is exhaustively discussed by Nonaka and several authors with whom he has collaborated, the discussions do not contain references to empirical testing of the causal relations. Nonaka, Toyama and Konno (2000) have conceptually developed the knowledge creation field construct into a more detailed understanding of the social aspects of knowledge development and relabelled the construct as *Ba*. *Ba* appears to be grounded in Japanese culture, which may have led to the authors taking the construct's validity for granted. It is plausible that being embedded in a setting where the proposed causal relations are taken for granted has caused the omission of providing empirical evidence to support the anecdotal claims made in this context.

#### 2.2.6. Managing organisational knowledge creation

To promote an organisation-wide climate for effective knowledge creation, Nonaka (1994) proposes that organisations create conditions of creative chaos, redundancy of information, and requisite variety. Nonaka, Toyama and Konno (2000) introduce the fourth condition of love, care, trust and commitment to emphasise its role in the building of information redundancy.

*Creative chaos* can be generated out of environmental fluctuation (Nonaka, 1994) or by creating an ambitious but ambiguous vision (Nonaka, 1988a). Environmental fluctuation or ambitious but ambiguous tasks force the employees to adopt a new perspective on the challenges they face. They will have to harmonise the contradictions in their task to give new meaning and “think outside of the box”. The sense of crisis forces a breakdown of routines and habits, which prevents path-dependence (Nonaka, Toyama & Konno, 2000). Top management has to instigate this process, by creating an ambitious but ambiguous vision and allowing self-organising teams the freedom to reconsider fundamental thinking and come up with novel ways of tackling problems.

Organisational members will have to reflect upon their actions and focus their attention towards

forming and solving new problems. Without this reflection, the fluctuation will not lead to creative chaos, but to destructive chaos<sup>2</sup>. For the chaos to be creative, it is important that there is an emphasis on reflection-in-action through which inconsistencies are resolved (Nonaka, 1988a). An example of the creation of creative chaos comes from Nonaka's 1988 case description of the development of the Honda City car (Nonaka, 1988b, p.10)<sup>3</sup>, "*... Some say Honda not only puts researchers upstairs without a ladder, but also sets the first floor on fire*". This quote is a metaphor for how the researchers are introduced to the problem of finding themselves upstairs, without a ladder. By setting the first floor on fire, the creation of chaos, the researchers are forced to come up with novel ideas of tackling the problem.

*Redundancy of information* is the conscious overlapping of company information, business activities and management responsibilities to speed up concept creation through promoting the sharing of tacit knowledge and helping organisational members understanding their role in the organisation (Nonaka, 1994; Nonaka, Toyama & Konno, 2000). Redundancy of information is caused by sharing of information which is not immediately required by individuals. The sharing of this "extra" information promotes sharing of individual tacit knowledge. The overlapping information helps members sense what others are trying to articulate. Information redundancy can also help to reduce the impact of managerial hierarchy and promote mutual trust through eliminating cheating by organisational members (Nonaka, 1994).

Information redundancy can be built into the organisation by adopting a policy in which information overlap and internal competition are harmonised. An example being the creation of multiple self-organising teams, tasked with the same problem. The reflective process in which the most useful outcome is determined, allows the creation of additional information redundancy. The competitive aspect of the development process forces team members to feel a sense of urgency (creative chaos). Strategic rotation is another way to build information redundancy into the organisation. Some management styles advocate job rotation, cycling workers across various workstations to stimulate the perception of job variety and increase their understanding of other tasks within the production process.

Information redundancy increases the amount of information to be processed and can lead to

---

<sup>2</sup> From Nonaka's explanation of creative chaos (Nonaka, 1988a; Nonaka, 1994; Nonaka, Toyama & Konno, 2000) it remains unclear how to prevent destructive chaos.

<sup>3</sup> This example was originally used by Takeuchi & Nonaka (1986). While explaining the introduction of tension in self-organising teams, an executive in charge of development at Honda is quoted to have said: "It's like putting the team members on the second floor, removing the ladder, and telling them to jump or else. I believe creativity is born by pushing people against the wall and pressuring them almost to the extreme" (Takeuchi & Nonaka, 1986, p. 139)



information overload (Nonaka, Toyama & Konno, 2000). For efficiency it is important that members should know who owns which information and they should be related to the least number of colleagues so that they are not loaded with information in the excess of each one's cognitive capacity (Nonaka, 1994).

*Requisite variety* is the result of finding an optimum in team composition. Nonaka (1994) explains this concept using Ashby (1956), who proposes that organisations can maximise efficiency by creating a degree of internal diversity that matches the diversity it must process. If the organisation faces high diversity in the activities it wishes to carry out, the efficiency will be higher if there is a high degree of diversity among the people performing these tasks. In other words, the team composition is conducive to knowledge creation effectiveness.

Requisite variety can be realised in two ways (Nonaka, Toyama & Konno, 2000). The first is by using a flat and flexible organisational structure in which the units are interlinked with an information network. This provides timely and equal access to the varied knowledge stock. The second way to realise requisite variety is by using a personnel rotation system which enables employees to develop overlapping knowledge to deal with the changing environmental requirements.

The building of interpersonal *love, care, trust and commitment* is emphasised by Nonaka, Toyama and Konno (2000) to facilitate knowledge sharing and for the self-transcending process of knowledge creation to occur. An atmosphere in which employees feel safe in sharing their knowledge prevents the monopolising of knowledge assets by individuals. Organisational leaders must therefore work to establish high employee commitment to sharing and creating knowledge, based on the knowledge vision of the organisation.

Love, care, trust and commitment can be built by inspiring team members to become committed to their goal of knowledge creation. They need to be selfless and altruistic in this respect. Positive thinking is expected to prevent the creation of personal barriers that inhibit the sharing of knowledge.

#### 2.2.7. Middle-up-down management

In a 1988 article Nonaka discusses the development of the Honda City, an at the time ground breaking concept which was conceived by an autonomous team of young engineers. The case is used as an example of a new type of organisation design, which combines aspects of top-down and bottom-up management.

Middle-up-down management combines the progressive knowledge creation from bottom-up management, while promoting knowledge dissemination through the use of a hierarchical structure,

akin top-down management. More importantly, knowledge creation is likened to a parallel motion instead of a sequential motion, which has efficiency implications.

In middle-up-down management middle managers form the core of the management style, as opposed to top management (top-down management) or entrepreneurial individuals (bottom-up management). The role of top management is to determine an overall direction and create time budgets. Middle managers work within these constraints to translate the many visions of entrepreneurial individuals upwards through the organisational hierarchy. While moving these visions upwards, the middle is responsible for establishing a larger vision which is influential in the creation of future individual visions. Middle management works with upper and lower level personnel to complete this task.

Top management can influence middle management through the selection of staffing for middle management. This is an important aspect of the corporate strategy. Top management stipulates a broad direction, which the middle will use as a basis to create knowledge with. This vision should be chaos inducing by consisting of highly ambitious goals, while being open to multiple interpretations. It is often formulated in contradicting terms (Nonaka, 1988a, 1991, 1994). Organisational chaos and fluctuation positively affect information-creation activities (Nonaka, 1988a). These types of visions can take shape in the form of initiating limit-pursuing projects, key technology projects that will be relevant in the future, or development of new products and markets (Nonaka, 1988a).

In an interaction with the top, the middle secures the resources they require for the knowledge creation. This is where top-down style planning and bottom-up style knowledge creation comes into play when moving from the broad direction to stricter concepts. In other words, the top lays out the conceptual foundations and measurement units which lie at the basis of the resource allocation, while the middle turns it into reality. This middle is often comprised of multidisciplinary teams, led by middle management. By serving as the starting point of the knowledge creation process, middle management serves to reduce chaos and fluctuation. They can be seen as the change agent in the organisation's process of self-renewal (Nonaka, 1988a; Ulrich, 1998).

Communication plays a role in realising the vision of the entrepreneurial middle. They have to survive the criticism from other group members to realise this vision. Ideas must challenge the stability of the organisation, while involving both the top and bottom of the firm. Vision realisation firstly involves the establishment of creative chaos, amplifying this chaos and focusing on specific contradictions to solve the problem. After creating chaos and solving contradictions, self-organising teams are formed that try to create a new meaning out of chaos.

During the synchronisation of concept creation, information travels upwards and downwards from the organisational middle. This process is likened to passing the ball laterally in a rugby game, where all the team members move forward synchronously (Takeuchi & Nonaka, 1986).

A final element of middle-up-down management is the creation of new order through the transfer of learning and unlearning. *Unlearning* is Nonaka's interpretation of preventing path-dependent behaviour. *Path dependence* is a firm's tendency to keep doing what it is already doing (Kogut & Zander, 1991). In path dependence, knowledge advances on the same basis as it was created; using the current information and ways of doing things. *Unlearning* means purposefully moving away from current conventions and creating new ways of doing things.

In closing, middle-up-down management combines the high intensity of organisational knowledge creation from bottom-up management with the responsiveness that results from organisational hierarchies in top-down management. It does so by concentrating all knowledge creation activities around the organisational middle, using self-organising teams, while operating in a hierarchical organisational structure. These contradicting aspects form a metaphor for the creation of chaos and establishing contradictions to promote creative behaviour.

### 2.3. Returning to the Hypertext organisation

The underlying principles of the Hypertext organisation design have been explained in detail in the preceding section. This section will combine these principles and construct the model from its building blocks.

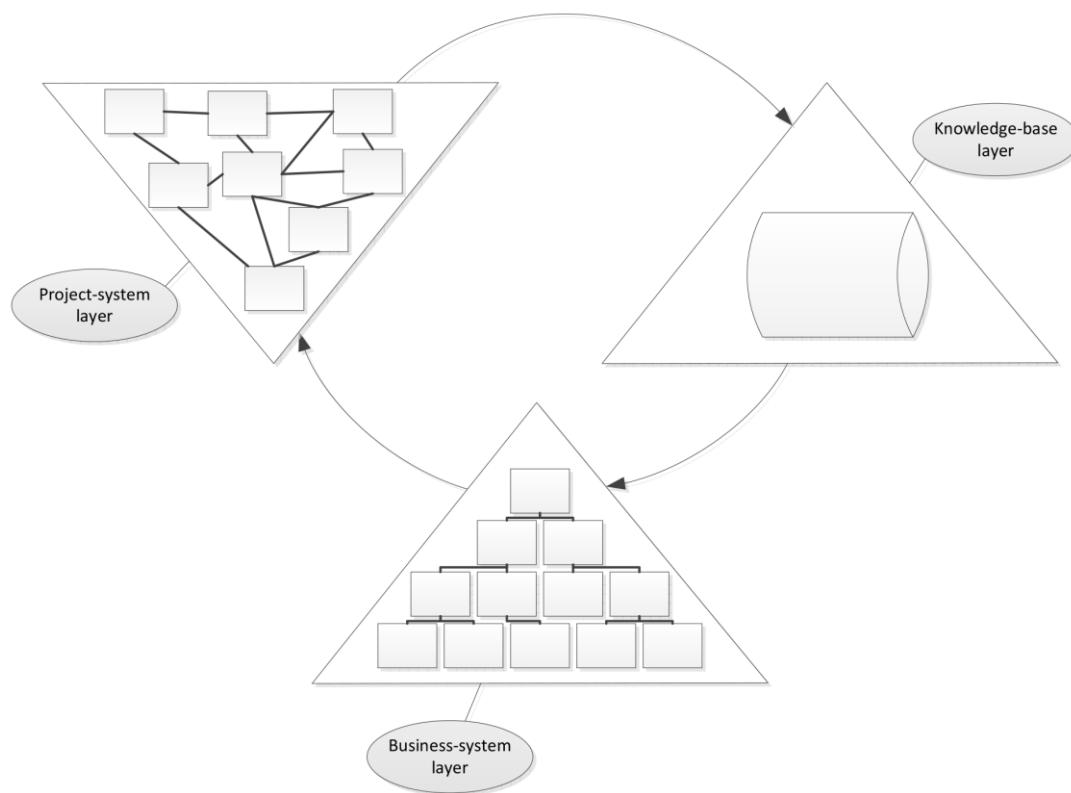
The Hypertext organisation design (figure 6) has been introduced as a three-layered organisation in which employees create knowledge using the knowledge creation spiral, while moving through these layers. The business-system layer and the project-system layer's complementing characteristics support the processes of combination and internalisation (business-system layer), and socialisation and externalisation (project-system layer). The knowledge-base layer functions as an organisational knowledge repository in which newly created knowledge is stored and from which it will be distributed back into the organisation.

Self-organising teams are created from the business-system layer, to create knowledge using socialisation and externalisation in the project-system layer. When this task is completed, the team members move to the knowledge-base layer to document and store their findings, before returning to the business-system layer. The knowledge creation process is continued in this layer, but this time focusing on combination and internalisation. Employees remain in the business-system layer until they are called upon to form a new self-organising team and move to the project-system layer. The knowledge creation process is seen as a spiral (see 2.2.3.) in which the four modes of knowledge creation (see 2.2.2.) function interdependently to increase the knowledge assets in overall size (see

2.2.4.) and branching them out to form new knowledge assets (see 2.2.2.). All the while, the knowledge assets move back and forth in the tacit-explicit continuum (see 2.2.1.).

The Hypertext organisation structurally supports the middle-up-down management model (see 2.2.7.) and embodies the cyclical motion of knowledge creation in a stream of employees throughout the organisation structure. It provides the organisation with the ability to acquire, create, exploit and accumulate new knowledge continuously, in a cyclical process. Being able to switch between “contexts” of knowledge creation enables the Hypertext organisation to respond to changing internal and external knowledge requirements.

**Figure 6: Reimagined Hypertext Organisation (based on Nonaka, 1994)**



It is unclear to which degree the organisation can move through the three layers. From what is written, one can conclude that the shifts between the organisational layers can apply to the organisation as a whole, which would mean that the entire organisation moves into the project-system layer simultaneously. On the other hand, Nonaka’s explanation (1994) can also be interpreted as a scenario where only parts of the organisation move into the project-system layer. In the latter case all layers are occupied at any given moment. A third interpretation is that the Hypertext organisation design should be viewed as a non-practical, stylised view of the organisation. If the conceptualisation of three different layers is dropped because a practical distinction between the layers is based on aspects such as the level of autonomy, self-transcendence and cross-fertilisation,

what is left is a model that can be implemented in practice without the impact of having to move (parts of) the organisation. If Nonaka had meant for the model to be viewed in this light, it is expected he would have explained it as such. This leads to the conclusion that this third interpretation is potentially distant from what is intended.

How the individual building blocks from the preceding sections fall into place is also not thoroughly explained by Nonaka (1994). By piecing the elements together one can come to an understanding of how the author has envisioned the model. The article would benefit from a greater emphasis on the coherence between the model's elements. Because of this lack of clarity, the following explanatory segment is based on an interpretation of Nonaka (1991, 1994):

In the project-system layer the modes of socialisation and externalisation take place after being triggered by the creation of self-organising teams and promoting inter- and intra-team dialogue and discussion. After a period of documenting and storing the new knowledge in the knowledge-base layer, the business-system layer is where the modes of combination and internalisation take place through coordination between employees and applying the newly created knowledge. These modes are triggered by the documenting of the new knowledge and by experimenting with the new knowledge in day-to-day activities.

In the project-system layer the top management sets out the overall direction and creates budgets. The direction should be formulated in ambitious, but ambiguous goals; examples are provided as "limit pursuing projects", "key technology projects" and "new product or market development". The ambitious, but ambiguous goals lead to a goal interpretation where contradictions have to be solved. The goal interpretation and potential environmental fluctuation introduce creative chaos to the organisation, which is expected to be conducive to knowledge creation effectiveness. The knowledge creation effectiveness is further enhanced by love, care, trust and commitment, redundancy of information, and requisite variety. Requisite variety also has an effect on cross fertilisation in self-organising teams, which helps in *unlearning*.

The parallel operating self-organising teams are led by middle managers, who secure the resources that top management has made available and form the main communication hub between the upper and lower organisational levels. The middle management is also responsible for chaos reduction and the creation of a new order from the ambitious, but ambiguous goals. They do this together with the members of the self-organising teams by harmonising the contradicting terms and attaching meaning to the task with which they have been entrusted. In this way, the middle management serves as a change agent. The factors affecting the effectiveness and efficiency of knowledge creation in self-organising teams are cross fertilisation, autonomy and self-transcendence.

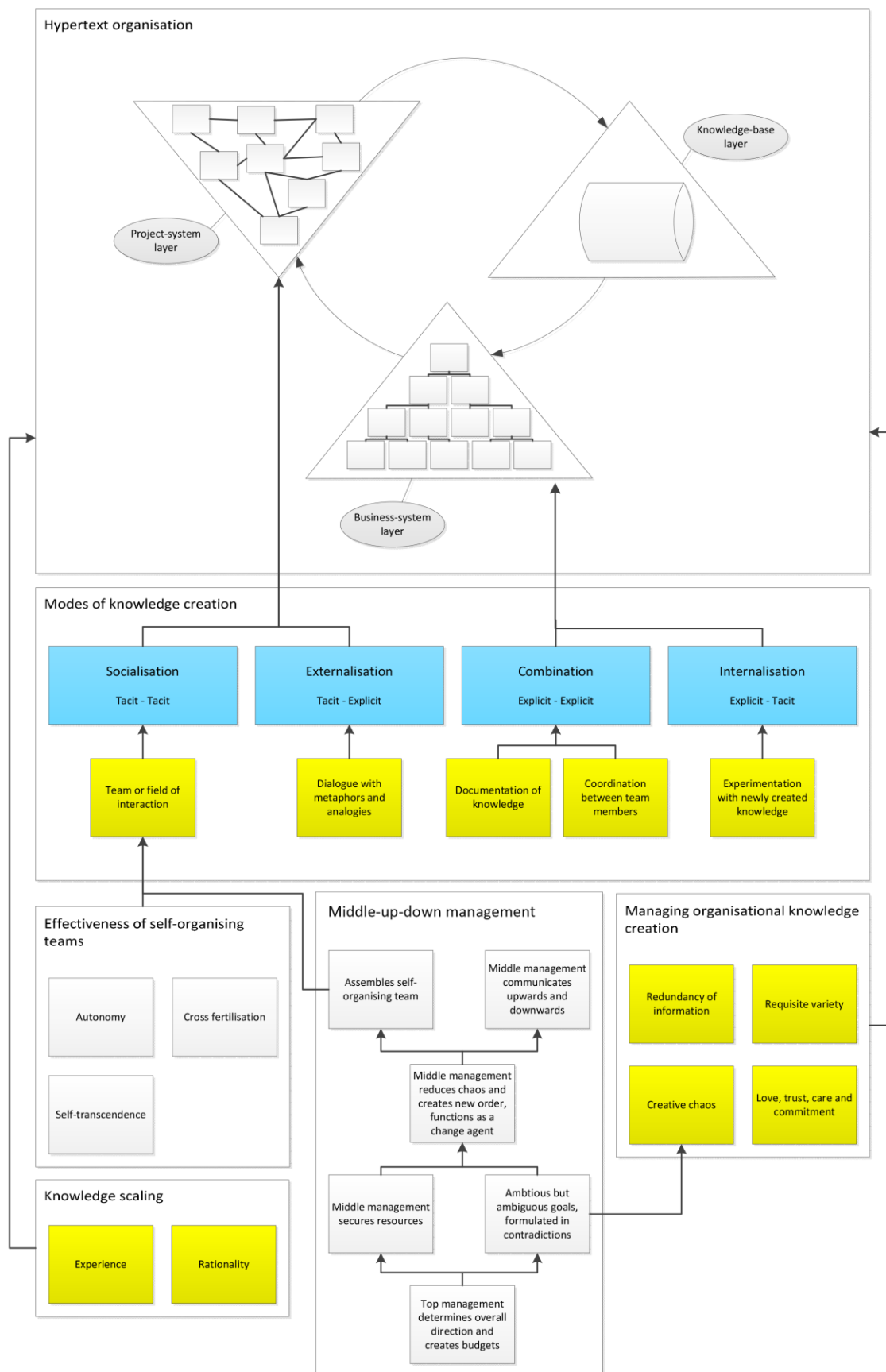
How knowledge creation through combination and internalisation in the hierarchy of the business-system layer takes place is not exhaustively discussed by Nonaka, apart from the elaboration he has provided on the processes of combination and internalisation. The suggested causal relation between organisational hierarchy, or top-down management, and combination and internalisation (Nonaka, 1988b), is hypothesised to stem from absence of information and decision problems at lower organisational levels, which reduces the opportunity to explore solutions, or deviate from the path that has been set out by the top management. Under the top-down management system, there is a low personal interaction with information, which negatively affects the amount of knowledge absorption and accumulation. From these arguments it is clear that top-down management is ill-equipped for socialisation or externalisation and more suitable for combination and internalisation. Prerequisites for this side of the Hypertext organisation design are the processes of coordination among employees and documentation of existing knowledge (combination process), and promoting experimentation with newly created knowledge in a trial-and-error fashion (internalisation process).

A network of the most important conceptualised relations in the Hypertext organisation design is provided in figure 7. Note that the arrows don't indicate causal relations, but serve to connect constructs with their underlying principles or triggering mechanisms.

The items are grouped to highlight their interconnectedness and context in the model. Several boxes have been coloured to emphasise their position in the network. The four modes of knowledge creation have been coloured blue and form the central assumption on which the Hypertext organisation is built. *Socialisation* and *externalisation* are linked to the *project-system layer* because this layer is intended to stimulate these two modes of knowledge creation. Similarly, *combination* and *internalisation* are linked to the *business-system layer*. Within the *modes of knowledge creation*-container there are an additional five (yellow) boxes depicting the triggering conditions for each of the modes.

The containers *effectiveness of self-organising teams*, *middle-up-down management*, *managing organisational knowledge creation* and *knowledge scaling* are placed below *modes of knowledge creation* for layout purposes. These items are important for the successful implementation of the Hypertext organisation in a direct relation or indirect via the *modes of knowledge creation*.

**Figure 7: Network of conceptualised relations in the Hypertext organisation design, based on an interpretation of Nonaka (1988a, 1988b, 1991, 1994)**



## 2.4. Potential shortcomings

Having explained Nonaka's (1994) Hypertext organisation design in sections 2.2. and 2.3., it is time for reflection. This section will discuss where the Hypertext model falls short and provides an overview of the discussion surrounding the assumptions that lie at the foundation of the model.

Table 1 presents the main elements in Nonaka's Hypertext organisation design and gives a summary of the discussions that surround these elements in the context of this study. The main points of criticism on the Hypertext organisation design can be summed up as the insufficient explanation of constructs and of the causal relations between constructs, the relative absence of empirical support for proposed relations, the potential for a moderating effect of Japanese culture on the proposed relations, and the choice for sequential knowledge creation being incongruent with Nonaka's preference for parallel development.

**Table 1: Overview of discussion surrounding main elements in Hypertext organisation design**

Knowledge typology	Related to the assumption that lie at the basis of the modes of knowledge creation.
<ul style="list-style-type: none"> <li>• Tacit knowledge – inarticulable</li> <li>• Explicit knowledge – articulable</li> </ul>	<ul style="list-style-type: none"> <li>• Constructs are insufficiently explained in comparison to other authors explaining the same construct. Without these alternative sources, comprehension of this typology will be limited.</li> <li>• The eventual adoption of the concept of tacit-explicit continuum resolved the issue of describing tacit and explicit knowledge as discrete constructs.</li> </ul>
Modes of knowledge creation	Form the foundation for the knowledge creation spiral.
<ul style="list-style-type: none"> <li>• Socialisation, from tacit to tacit</li> <li>• Externalisation, from tacit to explicit</li> <li>• Combination, from explicit to explicit</li> <li>• Internalisation, from explicit to tacit</li> </ul>	<ul style="list-style-type: none"> <li>• The process of socialisation is insufficiently explained using poor examples.</li> <li>• The process of externalisation has been discussed to great lengths, but Nonaka never clearly explains how tacit knowledge is converted into explicit knowledge. The process of packaging tacit knowledge in metaphor, converting this metaphor into analogy, and finally attaching meaning to the analogy, has the potential of damaging the message integrity.</li> <li>• Nonaka (1991, p. 99) admits to providing a poor example of how the process of combination functions, but omits to provide an alternative, more suitable explanation.</li> <li>• The process of internalisation is explained using a convoluted example which shrouded the explaining elements in unnecessary details.</li> </ul> <p>Nonetheless, the validity of all four modes has been proven in several instances of empirical testing. These instances, however, did not find support for the use of dialogue and metaphor in the externalisation phase.</p>



<b>Knowledge creation spiral</b>		<b>A primary element of the Hypertext organisation design.</b>	
Knowledge assets moving through the modes of knowledge creation in a sequential fashion. Triggered by the creation of self-organising teams, promoting dialogue with metaphors and analogies, documentation and coordination between team members, and experimentation with knowledge assets.		<ul style="list-style-type: none"> <li>• The criticism on the modes of knowledge creation is carried over to the knowledge creation spiral, because the latter builds on the former.</li> <li>• Nonaka (1994) mentions that a focus on pure combination or socialisation can prove problematic, but doesn't explain the effects of focusing on pure internalisation or externalisation.</li> <li>• The causal relation between the proposed triggering mechanisms and the resulting modes of knowledge creation are not elaborated on or proven through empirical testing.</li> <li>• The order in which the modes of knowledge creation take place is taken for granted as a sequential process with a set order. Based on the findings of Choi and Lee (2002) and Nonaka's own argument for parallel development (Takeuchi &amp; Nonaka, 1986), it may prove beneficial to explore alternative orders, or abandoning the sequential order for a parallel interpretation.</li> </ul>	
<b>Self-organising teams</b>		<b>Result of creating fields of interaction, facilitates socialisation, led by middle management, plays essential role in knowledge creation in the Hypertext organisation design.</b>	
Teams led by middle management that are tasked with ambitious but ambiguous goals. Display high levels of autonomy, self-transcendence and cross-fertilisation.		<p>The causal relations between the proposed supporting conditions and improvements to knowledge creation effectiveness are taken for granted too easily. Furthermore, these relations may be subject to moderating effects from the Japanese culture in which the theory is constructed.</p>	
<b>Middle-up-down management</b>		<b>Self-organising teams and by extension the knowledge creation spiral and Hypertext organisation design.</b>	
A hybrid management type that combines knowledge creation implications from top-down and bottom-up management styles. Middle managers form a communication hub by communicating top management vision downwards and the ideas of entrepreneurial individuals upwards.		<ul style="list-style-type: none"> <li>• An argument is made for parallel knowledge creation in middle-up-down management, whereas Nonaka shies away from this mechanism further on.</li> <li>• Middle-up-down management is presented in a purely conceptual fashion, lacking empirical grounding. The above criticism on validity also applies here.</li> </ul>	
<b>Managing organisational knowledge creation</b>		<b>Organisation-wide knowledge creation, the knowledge creation spiral.</b>	
Redundancy of information, requisite variety, creative chaos and love, trust, care and commitment; factors which stimulate organisational knowledge creation.		Information redundancy may lead to information overload, as has been suggested by Nonaka, Toyama and Konno (2000).	

Knowledge scaling	Organisation-wide knowledge creation, the knowledge creation spiral.
<p>Increasing knowledge asset volume by sharing knowledge. Knowledge scaling often requires the codification of tacit knowledge, which may lead to an erosion of competitive advantage due to increasing the imitability. Knowledge scaling increases the potential the knowledge asset availability to match or surpass the knowledge resource demand within the organisation.</p> <p>Conceptualised by Nonaka as the scaling of individual knowledge by crystallising knowledge into unique, personal perspectives, through an interaction between experience and rationality.</p>	<ul style="list-style-type: none"> <li>• There is an argument to be made against the scaling of tacit knowledge because it can lead to the deterioration of the strategic value of knowledge. The current consensus is that the positive effects of knowledge scaling outweigh the potential negative effects.</li> <li>• Nonaka's conceptualisation is to a great extent grounded in traditional Japanese philosophy and may not be applicable to western management.</li> </ul>

The shortcoming of insufficient explanation of constructs and relations has been partially addressed by including studies that have examined similar subjects and reviewing Nonaka's work in the context of an understanding that increases over time, through multiple publications. Testing and empirically proving the validity of these constructs and the relations between them will significantly add to the validity of the model as a whole. Overcoming this issue requires that all the constructs are sufficiently explained, using proper examples and avoiding that certain constructs can be interpreted in multiple ways. It will be difficult to prove the validity of constructs like tacit and explicit knowledge and the absence of other constructs that can potentially complement this knowledge typology. This difficulty stems from the current technological limitation of not being able to accurately measure how human cognitive processing functions, without resorting to unethical procedures. We are therefore limited to social constructs of what we believe to be the truth.

Similarly, the constructs that make up the knowledge creation spiral (socialisation, externalisation, combination and internalisation) deserve a more concise explanation that moves away from the current vagueness and frequent use of anecdotes. The triggering conditions that are suggested to actuate the four modes are similar to the expected resulting behaviour, which creates doubt about the validity of these relations. Finally, the examples that have been provided to explain the four modes leave room for improvement. In several occasions the chosen examples achieve the exact opposite of providing clarity.

These empirical issues have will not be solved in this study. The vastness of the testing that should be performed to support all the proposed relations places this type of research outside of the realm of reasonable expectations for a master thesis. The assertion that there is an insufficient explanation of constructs and partial support for the relations between constructs leads to a problem within this research. It is difficult to explain the elements of the Hypertext model based on the way they have been presented by Nonaka without causing a bias when measuring perceptions of value and applicability. This issue cannot be entirely circumvented in the research design, but attempts will be made to explain the model in detail, while staying neutral.

The comment about the potential for a moderating effect of Japanese culture on the proposed relations is provoked by the explanation provided to the process of knowledge scaling through experience and rationality, where knowledge is suggested to become a bodily experience through deep personal commitment (Nonaka, 1994, p. 22). The variable *Japanese culture* potentially holds a moderating effect on the relationship between the independent variable *knowledge scaling technique* and the dependent variable *knowledge scaling outcome* because Japanese culture may be the variable which allows the causal relationship between independent and dependent variable to take place. If the variable *Japanese culture* is left out of this causal equation, it is possible that the relation does not exist as Nonaka has described it. Nonaka's explanation of the relation is therefore potentially distant from the distinction "westerners" make between body and mind, to the extent that Nonaka's elaboration on the enlargement of an individual's knowledge (Nonaka, 1994, p. 21-22) becomes alienating. It is however an interesting subject to study in a follow-up, because new perspectives are by definition uncovered by exploring unfamiliar territory. More detailed suggestions for follow-up studies will be provided in section 6.4.

The third potential shortcoming of the Hypertext model is formed by the decision to shape knowledge creation as a sequence with a set order in which processes take place. The knowledge creation spiral, and the shifts from the business-system layer to the project-system-layer and the knowledge-base layer are difficult to interpret in an order that deviates from how Nonaka (1991, 1994) has described them. As has been mentioned toward the end of subsection 2.2.3. this is striking, because of the author's apparent preference<sup>4</sup> for parallel processing. A suggestion has been made to modify the conceptualisation of the knowledge creation spiral in subsection 2.2.3., which will be returned to in section 6.4.

## 2.5. Conclusion

The main elements of Nonaka's Hypertext organisation design are (1) the three-layered organisation design with which the context in which knowledge is created is adapted to support the type of knowledge creation activities that take place, (2) the combination of top-down and bottom-up management's knowledge creation characteristics in middle-up-down management, and (3) the knowledge creation spiral that is conceptualised as a sequence of phases in which knowledge shifts from tacit to explicit and back, while gaining in magnitude and momentum with every phase.

---

<sup>4</sup> The assumption of a preference is based on the standpoint Nonaka has taken on sequential development (Takeuchi & Nonaka, 1986) and attributing middle-up-down management with the advantage of facilitating knowledge creation in a parallel motion (Nonaka, 1988b).

The model contributes to knowledge creation theory by noting that knowledge creation can take place in four modes where knowledge assets shift from tacit to explicit and back. These modes can be managed to form a spiral where knowledge assets grow and gain momentum with the passing of every mode. The notion of these conversion modes is novel and since its initial publication (Nonaka, 1991) has had considerable influence on the way knowledge management theory approaches the process of knowledge creation.

The second contribution to knowledge management theory stems from another forbearer (Nonaka, 1988b), in which the knowledge management effects of top-down and bottom-up management are assessed and combined into the hybrid form of middle-up-down management. This new type appoints the middle management as a change agent by positioning it as a central hub where the visions and directions of top management and initiatives of entrepreneurial individuals meet. Middle-up-down management proposes the use of self-organising teams which operate in a situation of creative chaos to become less path dependent and truly innovative.

The third contribution to knowledge management theory is to be found in the way the model is furnished with knowledge creation enhancing conditions, which include creative chaos, redundancy of information, requisite variety, and love, trust, care and commitment. These conditions are conceptualised to form a set of facilitators which together should support the knowledge creation spiral.

The fourth and final contribution to knowledge management theory is the solution Nonaka (1991) provides to the problem of converting tacit knowledge into explicit knowledge. Through the use of delicate metaphors and analogies, unarticulable knowledge can finally be transferred. It must be noted that this principle is received with scepticism (e.g. Ambrosini & Bowman, 2001; Gourlay, 2006). Ambrosini and Bowman (2001) propose storytelling and cognitive mapping as alternative methods of transferring tacit knowledge.

The model can be implemented in practice by firstly emphasising knowledge scaling through gaining experience with newly created knowledge and rationally reflecting on improving processes and designs. Furthermore, an environment should be created that is conducive to successful knowledge creation. This entails an internal environment with *requisite variety, redundancy of information, creative chaos* and high *love, trust, care and commitment*.

The organisation should be aware of the knowledge requirements they are facing and manage their knowledge creation activities to match these requirements. This means facilitating the sharing of tacit knowledge through the creation of fields of interaction (self-organising teams), the conversion of tacit to explicit knowledge through the promotion of dialogue, the sharing of explicit knowledge by endorsing the documentation of existing knowledge and coordination between team members,

and the conversion of explicit to tacit knowledge by allowing experimentation with newly created knowledge. Following the triggering mechanisms for the four modes of knowledge creation forces the organisation to move through the three layers of the Hypertext model. The creation of self-organising teams moves the organisation into the project-system layer, the documentation and storing of knowledge moves the organisation to the knowledge base layer, while the coordination between team members returns the organisation to the business-system layer.

In closing the Hypertext organisation model can be described as a considerably complex and revolutionary organisation design. By letting the company cycle through the design based on the knowledge requirements it faces, the organisation can combine knowledge creation aspects of rigid top-down organisations with those of flexible bottom-up organisations. The model is constructed from building blocks that have separately had great influence on the direction knowledge management literature has taken in the last twenty years. These building blocks are also the main shortcoming of the Hypertext organisation model, because there is little empirical support for the validity of the constructs and the relationships between them.

The model is currently built on what appear to be shaky foundations. The rationale is sound, and initial empirical testing has proven supportive of the hypothesised relations, but there remain several holes in the conceptualisation. But the nature of the aforementioned theoretical shortcomings does not warrant writing the model off as having low value for knowledge creation. Though the construct validity and the implied causal relations remain to be tested, they all appear to be very plausible. Addressing these theoretical issues will strengthen the model's position in knowledge management theory, but remains outside of the scope of this study. Alternatively, assessing the model's value and applicability from a practical standpoint will also contribute to knowledge management theory. The value and applicability of the model for knowledge creation in knowledge intensive companies will be tested in the remainder of this paper.

### 3. Methodology

After the presentation and theoretical exploration of the model in the previous chapter, this chapter discusses how the model's value and applicability will be tested in practice. The chapter starts with an introduction of the case company in which the study was conducted, followed by an overview of the research methodology and the operationalization.

#### 3.1. Introduction of the case company

The case company was selected because of the importance knowledge creation has in the quality of its service offering and the company's reliance on innovative capacity. Knowledge is the primary resource the company uses in the production of its services. By extension, the organisation's capacity to create new knowledge is of great importance in protecting its competitive position. This company has characteristics of a knowledge intensive company because most work at the company is of an intellectual nature and college-level educated workers form a major part of the workforce (Swart & Kinnie, 2003). It can be said that knowledge has more importance than other resources in protecting the firm's competitive position. Following Starbuck (1992), this characteristic qualifies the case company as a knowledge intensive company. The case company can be classified as a NACE division 72.2 company in the European Foundation for the Improvement of Living and Working Conditions' definition of knowledge-intensive businesses (European Foundation for the Improvement of Living and Working Conditions, 2005).

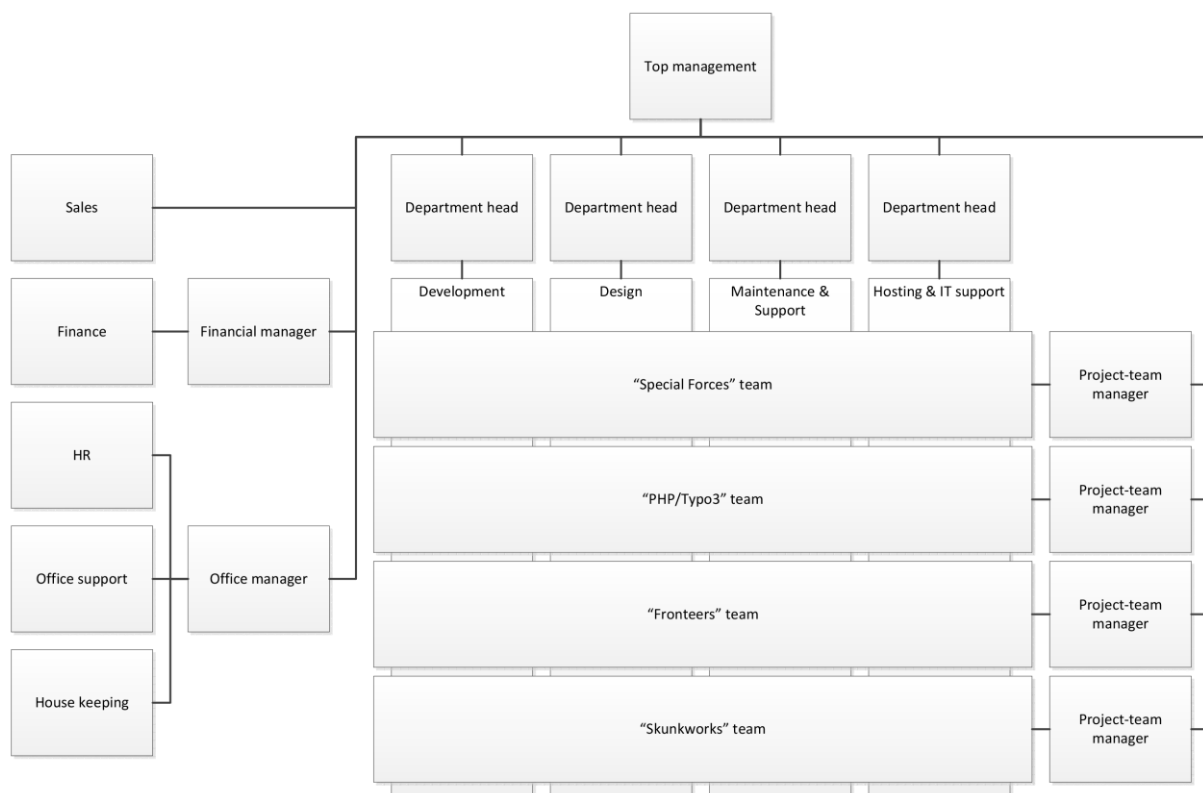
The case company's classification as a knowledge intensive company means that changes to the Hypertext model in bringing it closer to practice will likely have a stronger effect on this type of organisation than companies from other business sectors. Furthermore, it is expected that respondents from this type of organisation have a strong affiliation with knowledge creation, which should result in more exhaustive input for the topics that are discussed in this study.

In the years prior to the study, participative observations were made of the company's pragmatic style of knowledge creation, which appears to be a result of stimulating labour satisfaction and a reliance on individual competences. The company's management was not aware of the Hypertext model before this study was conducted, but several elements of the model have been witnessed to be in place already, which make the case company a relevant setting to generalise the model to. Teamwork and dialogue are the main drivers for knowledge dissemination, similar to how Nonaka has conceptualised the triggers for *socialisation* and *externalisation*. The organisational structure also shows strong similarities with how Nonaka has described the project-system layer. Self-organising

teams at the case company enjoy high levels of autonomy, cross-fertilisation and self-transcendence. The company's top management is responsible for determining a broad overall direction, after which the middle management works with entrepreneurial individuals to translate these ambitious and sometimes ambiguous goals into reality. The aspects of a pragmatic approach to knowledge management and the observed similarities between the company and elements of the model render this case company a suitable selection to conduct this research in.

The case company was established in the early 90's and is considered an internet pioneer in the Netherlands. The organisation's original focus was on software products catered for schools. This later developed into award winning websites and web applications for some of the largest Dutch companies. They currently employ around 90 people, of whom around 20% are in managing positions. The company is based in Enschede (NL) and are an integral part of the CeeCee, an industrial cluster of companies from various creative industries.

**Figure 8: Case company organisation design**



The organisation is designed along a matrix in which five departments can be distinguished based on activities (figure 8). Each of these departments is managed by a department head. Overlapping these departments are four project teams which are tasked with developing web applications for particular industries (2 teams), specialised in short running internet-campaigns (1 team), and a team to take on various smaller projects (1 team). The project teams are led by one or more middle managers.

Besides these project teams, there are departments responsible for service and maintenance, and hosting and IT support. Finally, there is financial and support staff who form a separate department.

The ability to efficiently create new knowledge plays an integral role in the way the case company competes with other organisations in the internet sector. The company prides itself for employing highly talented personnel and is able to keep turnover low, among others through offering a one-of-a-kind benefits program.

The case company exhibits many characteristics of middle-up-down management. The project-team managers are the combining factor that shape knowledge creation activities and relay this to top management. This all occurs within the strategic goals of the organisation, which are formulated by the company's top and middle management combined. The project teams enjoy high autonomy, high environmental fluctuation, medium levels of knowledge sharing, and medium levels of strategic rotation. The management style can be described as supportive.

### 3.2. Research methodology

The case study is performed using participative observation and informal in-depth interviews during the first months of the study, with semi-structured group interviews nearing the end. The in-depth interviews were helpful in formulating the research questions, while the participative observation assisted in discovering background information about the case company. The semi-structured group interviews serve as the primary data collecting method.

Semi-structured interviews are chosen over other methods of data collecting because it will be easier to find respondents willing to sacrifice 45 minutes of their time to talk about their work, than administering questionnaires or performing experiments that potentially take longer. This type of interview also leaves room for storytelling when the interviewees are unable to formulate their answers without the use of metaphors. Additionally, it may prove useful to change the order of the interview topics, depending on the flow of the interview; structured interviews don't offer this advantage. Unstructured interviews were discarded as an option, because too much freedom during the interviewing process may affect the usefulness of the outcomes.

The interviews have taken place in a meeting room at the case company's office. This location is a familiar setting for the interviewees and should not have a negative effect on their comfort level, such as would be the case if an unfamiliar location was chosen. A low comfort level of interviewees can adversely affect the validity of the interview outcomes. Other reasons why a meeting room at



the case company's office is a suitable location to perform the interviews are that there should be few to no interruptions during the process and it saves the respondents effort and time to travel to an alternative location.

The interviews were scheduled to take place on separate days and were processed immediately afterwards. This prevented the loss of data or confusing outcomes across different interviews.

A total of five interviews have been conducted with groups of around three interviewees. The group format is chosen to allow discussions to develop between the participants and the effect this may have on the completeness of the answers (Krueger, 1994). The interviewees will be able to help each other in formulating answers and can inspire others to articulate aspects that would not have been mentioned in a one-on-one interview. The interview topics may be perceived to be distant from the respondents due to them being taken for granted, or subconsciously accepted. The discussions that may develop within the groups are expected to lead to a formulation of answers that otherwise would not have been articulated as easily. This can be compared to articulating tacit knowledge, because the respondents are assumed to be aware of their role in organisational knowledge creation, but may experience difficulties in expressing what they know because the awareness exists at a subconscious level.

A second advantage emerges from the respondents being surrounded by their peers while being interviewed. Being among peers is expected to reduce respondent anxiety levels while being interviewed, whereas a typical one-on-one interview does not have this advantage. Lower anxiety levels are expected to lead to more open discussions and high quality answers.

A third reason for using group interviews is that the groups are sampled from existing teams. The inter-respondent familiarity and teamwork that results from this purposive sampling is expected to improve the discussions and deliver meaningful, in-depth answers (Krueger, 1994). The sampling also makes it easier for the respondents to relate to the interview items concerning self-organising teams. The fourth reason for using group interviews as the primary method of data collection is that this approach lessens the time investment for data collection, while still covering a sufficient number of respondents to be representative of the target population (Saunders, Lewis & Thornhill, 2009). As has been explained above, the case company is divided in a number of project teams and by interviewing small groups of members from each of these teams and one group of members from the departments Maintenance & Support and Hosting & IT support, it is assumed that the interview outcomes are a good representation of the consensus on these topics in the organisation.

The foremost disadvantage of using group interviews is that the interviewer has to take notes while also being responsible for moderating the discussions (Sim, 1998). This can cause a cognitive overload, which reduces the efficiency with which the discussion is led, or negatively affect the

quality of the notes that are taken. An attempt is made to overcome this issue by limiting the group sizes to around three respondents and using an audio recording device to capture the entirety of the answers provided during each interview. The interviewer can use timestamps to use as a memento for interesting segments in the audio recording.

A second potential downside of the format of group interviews is that there will be less opportunity to build rapport with the participants (Saunders, Lewis & Thornhill, 2009), because the interviewer's attention has to be divided over more than one person. This problem is overcome due to the interviewer having been employed at the case company in the two years prior to the study and as a result a sense of familiarity and trust between the interviewer and interviewees is expected.

The third potential downside is that there may be instances where a single respondent will dominate the discussions, limiting the other respondents in expressing their opinions (Reed & Payton, 1997). This is addressed by the interviewer through inhibiting the dominant respondent by asking the others to provide their personal perspectives on items raised by the dominant respondent.

Related to the third downside is the issue that discussions may lead to a false consensus because the respondent groups all contained a middle manager from the respective project teams (Reed & Payton, 1997). This fourth downside is caused by the respondents potentially experiencing an asymmetrical power distribution within the group, which can lead to agreeing to concessions in a discussion where they would otherwise have reached a different outcome. However, it is expected that the familiarity and informal communication between middle managers and entrepreneurial individuals, which has been witnessed across all project teams in the case company through participative observation, will make the respondents feel comfortable in standing by their own opinion when their manager favours a different opinion.

The discussion topics are standardised across all interviews, though formulation and order has varied according to how the interview progressed. The interview protocol is presented in appendix A.1.

The interviews have been recorded using a digital audio recording device. In addition to the audio files, notes have been taken, which have helped in reconstructing the discussions after the interviews were conducted.

Each session is planned to last around 45 minutes, in which 14 topics are discussed. Prior to the sessions, the respondents have received a list of the interview topics by e-mail (see appendix A.2.), which allowed them to prepare for the interview. This is expected to lead to more complete answers, while at the same time preventing uncomfortable surprises from coming up during the interviews.

The respondents are informed that the research outcomes may be of limited value to their person and the company they work for, so there are no indirect effects of declining participation on the way they are viewed by their peers or their supervisor.

The interview questions are open ended and clearly formulated. The use of complex terms or jargon has been minimised to prevent the misinterpretation of interview questions and the answers provided. The respondents were encouraged to think out loud or to use storytelling to aid them in the construction of their answers. Probing will be used to obtain exhaustive answers.

A pilot interview was conducted with a single respondent who has been kept outside of the research population due to not meeting the tenure requirement. The outcomes of this interview have not been included in the analysis. The interviewee in the pilot interview is experienced with academic research and has volunteered to participate in a pilot because she feels a personal connection with the subject and wanted to assist the researcher in improving the planned interview process. The pilot interview was used to optimise the research questions and to improve the interview protocol to stay within the time constraints, while keeping the quality of the answers high. The pilot interview has also provided an opportunity for the researcher to practice the dual role of moderating the discussions and taking notes, to test the audio recording device, and to become accustomed to the flow of the interviews.

The sampling of respondents is a combination of quota sampling and self-selection, based on the organisational design of the case company. With exception of the supporting staff, each team has been contacted to delegate three volunteers for the interviews. Nineteen respondents were approached to participate in this study, of whom eighteen agreed to be interviewed. The final sample was cut down to sixteen respondents because of scheduling difficulties.

The group sizes are kept small to circumvent the aforementioned cognitive overload from affecting the interviewer. Furthermore, since the interview topic is relatively complex, a smaller group allows each respondent more time to express his or her personal opinion.

The sampling occurred from a population of workers with a minimum tenure of 1 year with the case company. This selection basis ensures that the respondents are familiar with the way the company operates, how knowledge creation takes place and they have sufficient experience with working in teams for the expected advantages of using group interviews to take place.

Each set of three respondents included at least one person that is involved in the strategic decision making at the company. This person usually holds a managing role within the team.

The respondents participated in the interviews outside office hours and have received no compensation for their efforts. Their motivation can be seen as a personal favour to the researcher. The sampling basis forms a weakness to this research design. But having motivated respondents who are likely to be more proficient in articulating their thoughts on an abstract subject than the mean respondent at the case company, in addition to reaching all relevant teams and departments in the company, creates the advantage of obtaining data of higher quality than if this selection method was

not used. The expected increase in quality of data is expected to outweigh the aforementioned weaknesses.

The interviews have been conducted using the Dutch language. The outcomes have been translated to English by the researcher. There is a potential for loss of answer integrity during the translation process, because the translation is not performed by a professional translation agency. It is expected that the impact this has on the internal validity will not be of a magnitude to warrant the expenses for a professional translation.

The interviews have been selectively transcribed, focusing on the important comments and omitting the banter. The transcriptions were styled to consist out of individual quotes which can be used to support particular assumptions. These quotes were categorised based on subject to obtain an overview of the outcomes for each discussion topic. The most interesting and exhaustive quotes are published in chapter 4. Prior to publishing the quotes, the respondents have had the opportunity to critique the transcriptions. This leads to awareness of what has been included in the final paper and prevents inaccuracies as a result of misinterpretations.

The interview outcomes are used to support claims about the applicability of Nonaka's Hypertext organisational model. Furthermore, it has served as the basis upon which conclusions are drawn about the value of said model. The exploratory nature of this study implies that the conclusions hold limited external validity.

### 3.3. Operationalization

The constructs to be measured in this study are derived from the third research question "What is the value and applicability of the model for knowledge creation in knowledge intensive companies?" This is a double-barrelled question, containing the constructs *value* and *applicability*.

Determining the value or applicability of something requires a frame of reference. Without this, assertions have limited significance. The value of the Hypertext organisation model will therefore be evaluated in relation to the current method of knowledge creation.

A true measurement of the value and applicability of this model is ideally performed using quantitative data, stemming from an experimental implementation of the system, while using a control group. A difference in knowledge creation effectiveness can then be observed in terms of income generated from new products, or in terms of money saved due to process improvements over a given period of time. Such a research design would involve segmenting the organisation into experimental and control groups, which leads to complicated sampling issues and the potential for

serious disruptive effects on the organisation's continuity. To prevent this situation from arising, this study measures perceptions of value and applicability as substitutes for actual value and applicability. Because the methodological choices in this study place it loosely in the realism paradigm, the measurement of perceptions as a substitute for the measurement of the actual constructs is allowed, if the perceptions "provide a window to a reality beyond these perceptions" (Healy & Perry, 2000). In other words, because the constructs which are of interest in this study, value and applicability of a model for organisational knowledge creation, are complex social constructions with fuzzy boundaries, measuring perceptions of these constructs is a useful and valid method of measurement. Measuring perceptions of value and performance as a substitute to measuring actual value and performance is particularly prevalent in customer satisfaction research. Several authors (e.g. Hornik, 1984; Katz, Larson & Larson, 1991; Burton, Sheather & Roberts, 2003) have proven the existence of a strong correlation between these constructs. Although the field of customer satisfaction research is arguably different from knowledge management theory, a case can be made for the similarity in researching the value of an item or idea without actually administering this item or idea. The correlation between perception and reality forms the second basis which justifies the choice to measure perceptions of value and applicability in this paper as substitutes to actual value and applicability.

The interviews are divided into three parts, an introduction with a discussion of the current method of knowledge creation (interview questions 1-4, appendix A.1.), an in-depth explanation of the Hypertext model with a discussion about how the Hypertext model relates to the case company (interview questions 5-8, appendix A.1.), and a discussion of the applicability and value of the Hypertext model for knowledge creation at the case company (interview questions 9-13, appendix A.1.).

#### *The discussion of the current method of knowledge creation*

The topic is introduced by explaining that commercial organisations can be seen as networks in which resources are converted into products or services with a higher value than the sum of the resources. These resources need to be managed for them to be available during the process of adding value. Resources should be available in sufficient quantities, at the right time. Knowledge is a resource and knowledge management is the process which ensures that this resource is optimally available to the organisation. Knowledge creation can be seen as a collection of processes in which the knowledge resource is created. Correct knowledge management ensures that knowledge creation outcomes are sufficient to sustain the process of adding value.

Following this introduction, the questions in table 2 are used to ask the respondents to describe how knowledge is being created at the company, their perception of fit between the method of

knowledge creation and the knowledge resource requirements the case company faces, and if they had suggestions to improve knowledge creation effectiveness at the case company. It must be noted that due to the semi-structured nature of the interviews, each discussion item is introduced with one or more of the listed questions. Over the course of the five group interviews, all listed questions are been asked, but not all questions are asked in every interview.

**Table 2: Discussion of the current method of knowledge creation**

Items	Questioning
Knowledge creation at the case company	<ul style="list-style-type: none"> <li>• How is knowledge created at the case company?</li> <li>• Where do new ideas originate?</li> <li>• How are these new ideas developed?</li> <li>• Who is involved in idea generation?</li> <li>• Who is involved in the development of ideas?</li> <li>• Who decides which ideas to pursue?</li> <li>• How is knowledge being shared?</li> <li>• Can you name examples of methods of knowledge dissemination?</li> <li>• Which method of knowledge sharing is most prevalent?</li> <li>• What do you think is the reason for using this method of knowledge sharing?</li> <li>• Why do you think that knowledge sharing is important, or not important for your work?</li> <li>• How is knowledge being documented?</li> <li>• Is there a centralised knowledge repository?</li> <li>• Which method of knowledge documentation is most prevalent?</li> <li>• What do you think is the reason for using this method of knowledge documentation?</li> <li>• Why do you think that knowledge documentation is important, or not important for your work?</li> </ul>
Perception of fit between the current method of knowledge creation and the knowledge resource requirements of the case company	<ul style="list-style-type: none"> <li>• Why do you feel that the practice of knowledge creation fits the knowledge requirements in the organisation?</li> <li>• Can you name situations where you felt that the organisation was unable to deliver the service they would have liked to deliver because of a shortage in innovative ideas?</li> <li>• Can you give examples of situations where there were problems in service delivery because specific knowledge wasn't available to the organisation?</li> </ul>
Improving the current method of knowledge creation at the case company	<ul style="list-style-type: none"> <li>• Why do you think the current method of knowledge creation is a suitable method for the requirements the organisation faces, or why do you think it is unsuitable?</li> <li>• What do you think should be changed to improve the current method of knowledge creation?</li> </ul>

### *The discussion about how the Hypertext model relates to the case company*

The Hypertext model was introduced using an A-4 printout of figure 1. The model was shown to construct the organisation along three layers: a knowledge-base layer, a business-system layer and a project-system layer. The organisation is envisioned to move through these three layers during the knowledge creation process. Any presumptions of priority or power-preference of the three layers in figure 1 were eliminated by explaining that the diagonal stacking of the layers was done for layout purposes.

An A-3 printout of the reconstructed model (figure 7) is then presented to show the expanded interpretation of the three layers. After an explanation of the model and the relations between all the items in figure 7, in which attempts are made to be as unbiased as possible, the respondents were given the formal opportunity to ask questions about constructs and their relations. Where necessary, additional examples are provided to shape a complete understanding of how the model functions, again with minimum bias. When all respondents in the group claim to understand the functioning of each construct and the items which lie at the core of the model, they are asked to discuss the items from the reconstructed Hypertext model (figure 7) using the questions in table 3. As is the case in the first part of the interviews, not all questions in table 3 are presented during each interview. Depending on the way the discussions develop and the exhaustiveness of the provided answers, some of the questions are omitted, though all questions are asked over the course of the five group interviews.

**Table 3: Discussion about how the Hypertext model relates to the case company**

Items	Questioning
The tacit-explicit continuum	<ul style="list-style-type: none"> <li>• Can you name examples of how tacit and explicit knowledge play a role in your work?</li> <li>• Can you name examples of knowledge assets which possess tacit and explicit qualities at the same time?</li> <li>• Comparing tacit and explicit knowledge, which type of knowledge would you say is most important for your work and why?</li> </ul>
The four modes of knowledge creation	<ul style="list-style-type: none"> <li>• Can you name examples of situations where knowledge was created in each of these four modes?</li> <li>• Why do you expect that each of the four modes are most effective in the business-system layer, or the project-system layer?</li> <li>• How do you perceive the prevalence of each type of knowledge creation in the case company?</li> <li>• Do you have a preference for any of the four modes of knowledge creation and why?</li> </ul>
Triggers for the four modes of knowledge creation	<ul style="list-style-type: none"> <li>• Do you recognise each of these five triggers and can you provide a practical example of how these have taken place?</li> <li>• Why do you think each of these triggering conditions are important for knowledge creation?</li> <li>• How does the prevalence of each of these triggers at the case company match the perception of importance that you have placed on these items?</li> <li>• Can you relate each of these triggers to the modes of knowledge creation they are meant to instigate?</li> <li>• Can you relate the creation of a field of interaction to the organisation moving from the business-system layer to the project-system layer and can you provide an example?</li> <li>• Can you relate the documentation and storing of knowledge to the organisation moving from the project-system layer to the knowledge-base layer and can you provide an example?</li> <li>• Can you relate the coordination between team members to the organisation moving from the knowledge-base layer to the business-system layer and can you provide an example?</li> </ul>

Managing organisational knowledge creation	<ul style="list-style-type: none"> <li>• Why do you think each of these four stimulating factors are important to knowledge creation?</li> <li>• How does each of these four stimulating factors play a role in knowledge creation at the case company?</li> <li>• Do you think any of these four stimulating factors should receive more or less attention at the case company and why?</li> </ul>
Middle-up-down management	<ul style="list-style-type: none"> <li>• Do you recognise elements of middle-up-down management in practice?</li> <li>• What do you think of ambitious but ambiguous goal setting?</li> <li>• Do you think top-management functions chaos inducing at the case company?</li> <li>• Can you relate to middle managers having a pivotal role in upward and downward communication?</li> <li>• Do you think middle managers reduce chaos in their teams?</li> </ul>
Effectiveness of self-organising teams	<ul style="list-style-type: none"> <li>• Do you think autonomy, cross fertilisation and self-transcendence are conducive to knowledge creation in self-organising teams?</li> <li>• How do you perceive the levels of autonomy, cross fertilisation and self-transcendence in your team?</li> <li>• Do you think any of these items should receive more or less attention at the case company and why?</li> </ul>
Knowledge scaling	<ul style="list-style-type: none"> <li>• Can you relate to knowledge scaling as the embodiment of knowledge through a merger between body and soul during continuous exposure to the knowledge subject?</li> <li>• How do you think knowledge is scaled up at the case company?</li> </ul>
Centralised knowledge repository	<ul style="list-style-type: none"> <li>• What is your position on the storage of newly created knowledge in a central organisational knowledge repository?</li> <li>• What do you think are the shortcomings and advantages of this approach?</li> <li>• How would you improve the usability of a central organisational knowledge repository?</li> <li>• How would you increase the effectiveness of using a central organisational knowledge repository?</li> </ul>
Business-system layer as a top-down organisation	<ul style="list-style-type: none"> <li>• Why do you think knowledge creation under typical top-down management can be a success or failure?</li> </ul>
Project-system layer as a middle-up-down organisation	<ul style="list-style-type: none"> <li>• Why do you think knowledge creation in project teams can be a success or failure?</li> </ul>
Comparing the model to practice (1)	<ul style="list-style-type: none"> <li>• Can you name items which you feel uncomfortable with?</li> <li>• Are there items or relations in the model which you believe to have different outcomes than how they were explained?</li> </ul>

### *The discussion about the applicability and value of the model for the case company*

The third part of the interviews discusses respondents' opinions on how the model will be suitable for knowledge creation at the company and how they think the adoption of this model will improve their knowledge creation effectiveness. This is discussed using the questions in table 4. Similarly to the first and second parts of the interview, not all questions listed in table 4 are presented in each interview. Depending on the way the discussions develop and the exhaustiveness of the provided



answers, some of the questions are omitted, though all questions are asked over the course of the five group interviews.

**Table 4: Discussion about the applicability and value of the model for the case company**

Items	Questioning
Comparing the model to practice (2)	<ul style="list-style-type: none"> <li>• How do you expect your involvement in knowledge creation to change if this model is implemented in its original form at the case company?</li> <li>• Do you think this change will be a positive or negative development and why?</li> </ul>
Suitability of the model for the case company	<ul style="list-style-type: none"> <li>• Why do you think the model in its original form can be a suitable, or unsuitable, system of knowledge creation for the organisation?</li> </ul>
Bringing the model closer to practice	<ul style="list-style-type: none"> <li>• How do you think the model should be changed to increase its fit with the organisation's requirements?</li> <li>• How do you think the Hypertext model should be changed to increase the knowledge creation output?</li> </ul>
Perceptions of value and applicability	<ul style="list-style-type: none"> <li>• After discussing these topics, how would you judge the model in terms of applicability?</li> <li>• How would you judge the model in terms of value?</li> </ul>

## 4. Results of the case study

This chapter presents the findings of the group interviews by highlighting and discussing the segments which are most relevant to the goal of this study. The chapter is divided into three sections, based on the three segments of the interviews. The current method of knowledge creation is discussed in section 4.1., how the model relates to the case company is presented in section 4.2., and the applicability and value of the model for the case company is discussed in section 4.3. The case study outcomes and their implications are assessed in chapter 5.

### 4.1. The current method of knowledge creation

Knowledge creation at the case company frequently originates at the level of the entrepreneurial individual, stemming from an intrinsic motivation and deep commitment to technological developments in the workers' respective fields.

*[RLE - Medior System Administrator] "Knowledge creation in our department occurs naturally. It comes from a personal interest in technology and enthusiasm about our jobs; a motivation which shows in how we research technology even outside of office hours. If a particular technology or software solution can be of value to the way we perform our responsibilities within the department, we will discuss it in a group. Sometimes this leads to a concept, which is then presented to our department head. Frequently he will see the merit in these initiatives and will let us develop it further.*

*Another example of how knowledge creation at our company is the result of individuals taking the initiative is how a designer from the Skunkworks team regularly organises an event called "Area 25", where employees can come into the office on the weekend to work on developing their own projects and helping each other out with the issues they are experiencing. This is all unpaid labour and stems from a personal interest in technology and progressing knowledge."*

The outcomes of these individual initiatives form the input for team-level discussions, where the middle manager chooses to either endorse the further development of this knowledge within the team, or to advice against the pursuit of the technology. [RLE] and other respondents have explained that discussions about new technology or knowledge is usually held among a small group of team members, which has a potential downside of missing valuable insights from other team members. The motivation to develop knowledge and skills into directions adjacent to the current functional

specialties requires ambitious team members with high personal commitment to knowledge creation.

New knowledge is also sourced externally through visiting seminars and gatherings of industry professionals, and the strategic hiring of staff with skill or expertise with technology which the company wishes to develop its knowledge in. Several respondents have expressed their support for external knowledge acquisition as an important way in which new ideas enter the organisation.

*[SRA - Senior Software Engineer, Team Coordinator] “We’re talking about the creation of knowledge, but when applied to our company, I’d rather speak of expanding our knowledge into new areas. Most new knowledge comes into the organisation through strategic hiring of staff with experience in particular areas. So we’re either reproducing what we have already done and know, or we look to fulfil the knowledge requirements through staffing or searching the internet for solutions to our problems.*

*An example of knowledge acquisition through hiring is that we recruited a JAVA-developer who had significant experience with the Scrum methodology. At the time we were not equipped to apply that technique in our organisation correctly and he just had so much to teach us. Nowadays most of our teams use this method.”*

The above quote from respondent [SRA] is interesting because it hints at an understanding of the distinction between exploitative and explorative learning (Kang & Snell, 2009) and declares his doubts about the high level of path dependence he thinks the case company is currently experiencing.

Team specific knowledge repositories are used to document and store newly developed knowledge.

*[JZA – Software Engineer] “Knowledge documentation and storing is performed using wiki’s. Everything is supposed to be available, but we’re having a hard time finding specific entries. We know we possess the knowledge, but the tough part is finding out who possesses it, where it can be found and how it can be recovered.”*

According to [JZA] and a large majority of the other respondents, this method of documentation and storage is not as effective as it should be to adequately address the knowledge requirements the organisation sometimes faces.

Next to using open wiki’s for documentation, another driver of knowledge dissemination is the prevalence of informal interpersonal communication and frequent team level meetings. The

consensus among the respondents is that these factors are the best way to share knowledge and create a sense of belonging to a team.

*[ESC – Developer] “Team level meetings and departmental (functional) meetings help in transferring knowledge. We also have weekly meetings with the entire organisation to stay informed of what’s happening in the organisation and where we’re going. Sometimes the meetings are used to present new findings, or the development of technology or knowledge that can be of use to the entire company. The meetings are open to people from all levels of the organisation, from board members to housekeeping.”*

*[LLI – Interaction Designer] “The transfer of knowledge through workshops and team-level meetings is usually the result of private initiative. It is promoted by the company and somewhat expected, but some colleagues prefer not to spend time on knowledge transfer, because it takes us away from doing activities that positively affect personal productivity.”*

The negative sentiment for knowledge sharing which [LLI] has expressed, has led to an interesting discussion during the group interview, providing outcomes which have echoed throughout other interviews.

*[FDO – Project Manager] “We should focus more on knowledge dissemination to make sure that we can respond more flexibly in these situations. Knowledge sharing should receive greater emphasis by rewarding the activity. In our company the primary performance indicator is declarability and since knowledge sharing is not a declarable activity, it does not receive the attention it deserves.”*

The value of sharing and storing knowledge is recognised among all respondents. They agree that there should be a larger emphasis on stimulating knowledge sharing and the embedding of knowledge into the organisational memory. Reasons for why this behaviour is low in the organisation can be found in the myopic performance indicator and the sentiment that documenting knowledge is not a “fun” thing to do.

Avoiding the sharing or documenting of knowledge (the latter is quite prevalent according to the respondents) can lead to a situation of low knowledge redundancy. This can prove problematic in situations of unexpected labour mobility or long term absenteeism. Furthermore, if certain knowledge assets are not made available to the rest of the organisation, they aren’t optimally used to create value or new knowledge.

To prevent problems from arising due to low redundancy of knowledge, one project manager has explained that within his team every knowledge asset should be held by at a minimum two members.

This should ensure that crucial knowledge remains available to the team, even when someone leaves the organisation.

The overall innovative capability of the organisation, in both process and product innovation, has been described by various respondents to be low. There is a risk-avoiding strategy of adopting new technologies only when they have proven to offer viable market opportunities. This vision can reduce the employee's perception of challenge and labour satisfaction.

*[GRO – Medior UNIX System Administrator] “We’re not really a company which performs fundamental innovations. We focus on the tried-and-tested markets and deliver mainly services that are currently in high demand. I think it’s a bit of a shame that we’re not more innovative, because it makes our jobs less challenging. But on the other hand this is easier. You don’t have to invent the wheel every time and you can just do what others have already done before. This requires less effort and is therefore cheaper to deliver.”*

*[SRA] “I feel that our knowledge growth stagnates as the company grows ever larger. There is still growth, but it focuses on what we were already doing, instead of covering new areas.”*

## 4.2. How the Hypertext model relates to the case company

Although the majority of the respondents could name examples of *combination* and *internalisation* taking place in the organisation, many felt the strongest affection towards *socialisation*.

*[JSI – Front End Developer] “I feel most comfortable with the mode of socialisation. I’ve learned my trade by watching others and copying them. I also use internet sources to find solutions for practical problems I face in my work. Then I just adapt and implement these solutions. This makes me more capable in performing my tasks.”*

*[JKR – Developer] “I am a great proponent of the mode of socialisation. For example, by putting a front-end developer with low experience together with one with high experience, this is the best way for them to learn on-the-job.”*

The preference for socialisation may stem from an apparent preference for an organic organisational structure with an emphasis on multifunctional project teams.

The perception of creative chaos is found to be a powerful facilitator of knowledge creation at the case company.

*[JSI] "Before I joined this organisation I worked at a company with a typical top-down approach. There were very strict directives from upper management and we had little discretionary freedom in performing our tasks. Here however, I experience much more freedom when doing my job. I get the feeling that my insights are truly valued, but this also makes me a little uncertain about what is expected of me. I find that this uncertainty brings out the best in me; it enables me to become more creative and come up with more new ideas."*

Freedom and uncertainty, as well as experiencing pressure from working under strict time restrictions and being exposed to high expectations about the service level, were supported by the respondents to be conducive to knowledge creation. Concluding from the reactions, it can be said that the element of creative chaos is in place at the case company.

When discussing *love, trust, care and commitment* there were some frivolities about using *love* as a facilitator for knowledge creation. One respondent went as far as to say that the organisation should be a professional environment and not "*degrade into a hippie commune*". A case can be made for removing the word *love* from this construct, because it is detached from how westerners would describe a professional relationship at the workplace.

When focusing on *trust, care and commitment*, it became easier to relate this construct to how it can promote knowledge sharing within the organisation.

*[RCO – Developer] "I think the most important factor for knowledge sharing is the atmosphere in which the knowledge is being shared. A friendly culture and atmosphere really helps."*

*In the past six months I have done a number of projects with a developer from another team. Looking back on this period I realise that when you trust each other, become accustomed to working together and committed to delivering a high quality product as a duo, most knowledge sharing occurs naturally. If I for example know that I won't be in tomorrow and know what he will be working on, then I will just send him a message of what I have done today, which issues I have encountered, how I have solved them and where he can continue tomorrow. If an interpersonal bond was absent, I probably wouldn't have written this message and just have packed up my stuff at 17:00h."*

*[SRA] "Interpersonal trust and being able to objectively assess different viewpoints is important to progress your own knowledge. Being able to change your own approach or step outside of your comfort zone is the most important thing when trying to work together to achieve a common goal. Unfortunately I can name a number of colleagues who don't really fit*

*this mould, which leads to a reliance on old habits. Overall I'd say the interpersonal trust and commitment to the organisational goals is high. You can tell it is by looking at how we work and communicate with each other."*

An example of how cross fertilisation plays a role in project teams at the case company is provided by a respondent who has joined a project team for the duration of a particular project.

*[GRO] "I am a member of the "Hosting & IT Support" department, but recently my workstation has been relocated to join the PHP/Typo3 team. Comparing working in this multifunctional team to the homogeneous composition of my usual surroundings, I can feel the difference in knowledge creation. My colleagues in the PHP/Typo3 team have much more varied backgrounds in the type of education they have had and the different projects they have worked on. I think that this characteristic allows an inflow of perspectives which would not have taken place if the team lacked this type of functional diversity."*

Another similarity between the model and the case company was discovered when discussing the practice of middle-up-down management.

*[JWA – Senior Project Manager] "We have a restaurant-style menu of services we offer and areas we are experienced in. This document is used as an example to show potential clients what we can do for them. The items on this list also serve as a guideline for what we wish to excel in and develop our knowledge further.*

*The menu is constructed by the upper management and several senior members from middle management, such as me. There were a hand full of meetings with employees from varied layers of the organisation where they had the opportunity to express their wishes regarding this menu, but I would say the document is primarily written by the top of the organisational hierarchy."*

This example describes how the overall direction is determined by upper management. The restaurant-style menu functions as a broad guideline for how the case company's services materialise. Middle management holds a crucial role in the communication of these general directions to the knowledge developing lower end of the organisation. When asked if the middle managers can be considered to be an essential hub in the communication paths, the respondents uniformly agreed that their managers formed the main channel through which they communicated their ideas upwards and received guidance from the organisational top.

The perception of value of using a middle-up-down management approach at the case company was highlighted by several respondents.

*[RCO] "I think it's important for the self-organising teams to have someone in the function of a controller. I for example, tend to use freedom to come up with novel ideas, but I frequently stray from the path and end up with solutions to problems that are quite distant from what may be viewed as productive or value-added. If there is someone that can keep me on track, my time would have been better spent. But this person shouldn't dominate the process, because that would inhibit the creative processes. But this type of reflection can certainly help in adjusting the knowledge creation process to keep its value high."*

In section 4.1. there is mention of how wiki's, informal interpersonal communication and team, department, and organisation level meetings are used to document, store and share knowledge. Another driver of knowledge dissemination is the prevalence of informal interpersonal communication and frequent team level meetings. The consensus among the respondents is that these factors are the best way to share knowledge and create a sense of belonging to a team, but these actions are not performed as frequently or concisely as some people would prefer it to be. This perception is further supported by the following statement:

*[GRO] "A colleague of mine has some particular knowledge which is very valuable for our department. We continuously ask him to share his knowledge, but he keeps avoiding the topic. He may think it's too much of a hassle to share his ideas, if he can just do it himself anyway. He usually responds by saying that one can just look it up on the internet. The commitment to share knowledge apparently isn't equal among all employees. In particular when it's in the form of a presentation; something he doesn't like to do. On the other hand, if I ask him for a personal favour to help me with this item, I know he'll be there to lend a hand."*

Apart from the effect it has on the creation of knowledge redundancy and the sharing of knowledge, documentation and storing of newly created knowledge forms a trigger for the combination mode in the knowledge creation spiral, and it moves the organisation out of the project-system layer.

Without application of this trigger it is expected that the organisation can't make this shift, which means that the spiral of knowledge creation and the accompanying structural cycle in the Hypertext organisation don't come to fruition at the case company.

After introducing the topic of using the triggers for the knowledge creation modes as actuators for the switch between being self-organising and experiencing top-down management, the respondents recognised a subtle implementation of the triggers *creation of a field of interaction* and *coordination between team members*. The implementation of these triggers was operationalized by the respondents as the formation of self-organising teams, and situations where project managers exerted pressure to reduce chaos in their teams and come to clear definitions of responsibilities.



They identified this type of pressure as a mechanism which is likely to take place during situations of crisis, or nearing deadlines. The respondents have also expressed that a switch to the business-system layer very rarely takes place at the case company, estimating that the organisation is best compared to the project-system layer for about 90% of the time.

By not moving out of the project-system layer, it is expected that the benefits of a top-down management philosophy on *combination* and *internalisation* will not take place. The triggering mechanism for internalisation is the experimentation with newly created knowledge.

Experimentation has been claimed by some respondents to be something they would like to see more formal support for from higher management.

*[JWA] "There is not enough room in our organisation to experiment with newly created knowledge. We're not providing the freedom for our people to do so. It would be beneficial if we focus more on facilitating experimentation in our teams, as well as documentation. By having a larger emphasis on these aspects, I think my team will fit into the Hypertext cycle. By standardising some of our responsibilities and the way we do things in our team, I hope we will create more time to venture into new areas and to experiment with newly created knowledge."*

With low frequency of documentation and experimentation, the modes of combination and internalisation are expected to play only a small role in the knowledge creation process at the case company.

The composition of the knowledge creation spiral proved to be an interesting topic for discussion. Several questions were raised about the order in which the modes are to take place and the potential for overlap between the individual modes.

*[JZA] "The knowledge creation spiral doesn't take place in this order in my case. I think the modes of internalisation and socialisation have overlap. For example, if someone has read something and learned from this, he will discuss this with a colleague. From this discussion, questions arise from the tacit knowledge they hold, which leads to new knowledge creation. Perhaps it's a form of combination. I think that these questions originate at the subconscious level."*

*[RLE] "The model as a whole appears to be very plausible and logically constructed. But I think there are some elements in the model that may be too deterministic to be translated into practice. The knowledge creation spiral for example, I think you can't really speak of four separate modes of knowledge creation. There are grey-areas in between the four modes, in*

*which I think much of the knowledge creation can also take place. If the tacit/explicit distinction is seen as a continuum, then this devalues the four modes of knowledge creation as discrete constructs.*

*For example, if I'm working with a server and I'm experiencing a problem, I may use the documentation we have for this particular type of technology, while I also use my experience with this technology to overcome the issue. Solving the problem is then an application of explicit and tacit knowledge simultaneously. The new knowledge I created while addressing the issue with this server is the result of an overlapping mode of knowledge creation which lies between the modes of internalisation and socialisation."*

The example [RLE] has provided to support his opinion is not sufficient to claim that there must be an overlap between the four modes of knowledge creation, because he describes how he solves a problem using a combination of tacit and explicit knowledge sources, rather than creating knowledge in a combination of two modes. But what can be drawn from the above two quotes is that some respondents believe that the four modes of knowledge creation should not be seen as discrete constructs, but rather as being part of a continuum, similar to how Nonaka has explained the tacit-explicit continuum (Nonaka, von Krogh and Voelpel, 2006; Nonaka & von Krogh, 2009). This leads to the conclusion that knowledge creation in practice does not take place in four separate modes as is conceptualised (Nonaka, 1991; Nonaka, 1994), but in instances which have characteristics of more than one knowledge creation mode. This assertion will be returned to in subsection 6.2.1.

#### 4.3. Applicability and value of the model for the case company

A general assessment of fit between the method of knowledge creation and the knowledge requirements the organisation faces is provided by Team Coordinator [SRA]:

*[SRA] "Our knowledge creation method does not fit our knowledge requirements because we have become too slow to adapt to changes. We just can't flexibly adapt to the variability in knowledge demands we are facing. The price of our services decreases as our knowledge level increases. With a low or highly specific knowledge base, we may become unable to compete in this highly variable market."*

Other interview outcomes about the perceived value and applicability of the model for the case company referred to much of what has been presented in sections 4.1. and 4.2., and can be summarised as a positive sentiment. An expectancy of high applicability and value is caused by the wish to provide the knowledge creation process with more structure through better documentation

and storing of knowledge, improving knowledge dissemination and finding a better balance in how the four modes of knowledge take place at the case company.

This being said, some respondents judge the Hypertext model in its current form as being too general to be of real value to the case company. They believe that the model is constructed to be as widely applicable as possible and should be brought closer to practice to be of real value to the case company.

After the interviews were conducted, several respondents have expressed that they experienced the discussions as an eye-opener, because through participating in this study they have gained some awareness of what goes on in knowledge creation. Now that they have gained this awareness, they intend to rely less on the current pragmatic approach to knowledge creation and will look into practices such as the Hypertext model.

*[JWA] "I think there is considerable value in this model. It can be brought into practice by subtly working the triggers for the four modes of knowledge creation. I also think that this interview has made the three of us more aware of what knowledge creation is and how we can improve the practice of knowledge creation in our team. I can conclude that we need to spend more time in the documentation phase and we need to allow more experimentation with existing and newly created knowledge. Furthermore, I would like to receive a copy of this poster, so I can use it to create awareness of the knowledge creation process among my team."*

Concluding chapter 4, the case company's method of knowledge creation can be summarised as a pragmatic approach to solving problems, supported by an enthusiastic workforce which is highly motivated and committed to developing their knowledge, even outside of office hours. Next to the internal development of knowledge, the organisation relies on external sourcing through visiting seminars and workshops, and selective hiring.

The organisation uses wiki's to document and store knowledge. Other forms of knowledge sharing include informal interpersonal communication and frequent team level meetings. There is a negative sentiment towards knowledge sharing, and in particular documenting and storing of newly created knowledge, which may be caused by myopic performance indicators and not experiencing labour satisfaction in the act of documenting newly created knowledge.

The negative sentiment towards knowledge sharing and documentation leads to low knowledge redundancy. This can cause problems of not being able to use knowledge assets in situations of unexpected labour mobility or long term absenteeism. A protection against this vulnerability has been found in enforcing a policy of having a minimum of two team members in possession of every

crucial knowledge asset.

The organisation is perceived to have become too large and sluggish to be able to flexibly adapt to changes in the market and technology. This factor can have serious detrimental effects for the organisation's potential in the fast moving internet sector.

Finally, it was brought up by several respondents that the innovative capability of the organisation is purposefully kept low, as a risk-avoidance strategy. This policy is met with resistance by several respondents, who have expressed that the late adoption of new technologies makes their jobs less challenging. A reliance on developing knowledge which the organisation already possesses, path dependence, has been highlighted as a factor which may lead to stagnation in knowledge growth.

## 5. Assessing the case study outcomes

Following the results of the case study in chapter 4, this chapter presents an analysis of the outcomes in terms of the differences between the case company and the Hypertext model (section 5.1.), the similarities (section 5.2.) and an assessment of the model's value and applicability, based on the interview outcomes (section 5.3). The purpose of this chapter is to come to a clear basis upon which to formulate suggestions to improve the model and answer the four research questions in chapter 6.

### 5.1. Differences between the case company and the Hypertext model

The differences between the Hypertext model and the case company can be explained as a combination of factors which prevent the knowledge creation process at the case company to take place in accordance to how Nonaka (1994) has modelled it.

Documentation has been described by respondents as an essential element of knowledge sharing which regrettably receives little attention in practice due to a myopic performance indicator, poor project planning and a general dislike of this type of labour at various levels of the organisation. The employer appears unable to change this negative attitude, despite many respondents claiming to value proper documentation and storage of newly created knowledge. Low documentation adversely affects the process of combination and inhibits the organisation in moving from the project-system layer through the knowledge-base layer into the business-system layer.

Coordination between team members through clearly defining responsibilities among team members in an effort to reduce chaos in situations of crisis, is recognised by a number of respondents, while others claim that this does not play a significant role in their respective teams. Low coordination also adversely affects the process of combination and inhibits the organisation in moving into the business-system layer.

Because personal initiative in knowledge creation is held in high regard, experimentation with new knowledge is mentioned to be an aspect the company wants to focus more on. One project manager has stated that he intends to restructure his team's development process in order to better facilitate the processes of documentation and experimentation. But this claim may have been triggered by discussing the Hypertext model, which reduces the validity of this statement. Facilitating more experimentation will positively affect the internalisation mode of knowledge creation.

With low levels of documentation, coordination and the current perception of how experimentation takes place in the organisation, it is expected that knowledge creation at the case company centres on socialisation and externalisation, while residing primarily in the project-system layer. Whether this assumption holds true will be determined in section 5.2., in which the similarities between the case

company's knowledge creation practice and the Hypertext model will be discussed.

A last point of interest in the discussion of differences between the case company and the model is separate from the assertion that knowledge creation at the case company takes place in just two of the four modes. Two respondents have expressed their criticism towards conceptualising knowledge creation as a system in which four discrete processes take place. This criticism was declared in separate interviews and was uncontroversial among the other respondents in these interviews. Both respondents believe that there is an overlap between *internalisation* and *socialisation*, supporting this claim with a practical example of how knowledge can be created in a situation which combines elements from internalisation and socialisation. One respondent linked the assertion of overlap between these modes to the existence of a spectrum between the constructs *tacit* and *explicit* knowledge. Nonaka's (2006) acceptance of Ambrosini and Bowman's (2001) suggestion to move away from classifying these two types of knowledge as discrete constructs, in favour of seeing them take shape along a continuum, can be a reason to remodel the knowledge creation spiral to cover the "grey areas" between each mode.

## 5.2. Similarities between the case company and the Hypertext model

The similarities between the Hypertext model and the case company can be summed up as the reliance on entrepreneurial individuals, existence of creative chaos, generally high *love, trust, care and commitment*, partial support for cross fertilisation, middle-up-down management, reliance on *socialisation*, and a high resemblance with the project-system layer.

The case company exhibits high reliance on entrepreneurial individuals and the efforts these individuals put into expanding their knowledge. The overall perception is that knowledge creation primarily takes place at the personal level and these individual initiatives are held in high regard.

There is consensus about the positive effect of experiencing creative chaos on the knowledge creation outcomes. The perception of discretionary freedom in performing tasks and the occasional pressure to meet deadlines are expressed to be conducive to creating new knowledge.

*Love, trust, care and commitment* is seen as an important and prevalent prerequisite for the sharing of knowledge. Some employees are credited to exhibit low interpersonal trust, which leads to low knowledge sharing, but these employees form a minority in the organisation.

The project teams show high cross fertilisation, while the departments "Maintenance & Support" and "Hosting & IT Support" are relatively homogeneous. Knowledge creation efforts appear to be more effective in the heterogeneous project teams, which is in line with what is expected according to the Hypertext model.

The case company is managed through middle-up-down management. The upper management is responsible for the general direction of the company, which the rest of the company uses to shape the services they offer. Entrepreneurial individuals have considerable power in strategic decision making based on the influence they have exerted on upper management to change particular strategic decisions.

The position of middle managers in self-organising teams is seen as a valuable addition, because of the controlling influence they can have on knowledge creation efforts. The middle managers are also credited with moving the project teams from the project-system layer into the business-system layer by switching from a supporting role to a more strict type of leadership and being the primary communication channel through which new knowledge and ideas move up and down the organisation.

From the four modes of knowledge creation there is a preference for *socialisation*, although examples of all four modes of knowledge creation were provided. Reliance on socialisation over combination and internalisation may have been caused by the company's bias towards using self-organising teams. These teams occasionally switch from the project-system layer to the business-system layer in situations of crisis, but the respondents think that the organisation exhibits the highest resemblance with the project-system layer. Some respondents estimated that their teams or departments are in the project-system layer for more than 90% of the time.

### 5.3. Value and applicability for the case company

It is useful to realise that when making predictions about the potential value of a model for a practical scenario, this expression is inherently related to the perception of applicability of this model in this specific situation. If the model is perceived to be difficult to implement, it will be attributed with lower value for the organisation than if it were perceived to be easy to implement.

There is one caveat to implementing this model at the case company: with few exceptions, changes at the case company are met with high resistance. The case company uses a democratic way of decision making, where all employees can offer their opinions. In addition, the majority of the employees at the case company have little labour experience outside of this company and are therefore unaware of how changes can affect the organisation and the way they experience their work. In general, the employees are unwilling to take risks or step outside of their comfort zone. This means that if the case company wants to implement the Hypertext model to improve their knowledge creation effectiveness, it will have to be very delicate in handling and overcoming the resistance to change.

Based on the comments received during the interviews, the applicability of the Hypertext model is relatively high. After the interviews several respondents have expressed that they will immediately take elements of the model into practice to improve the knowledge creation effectiveness in their teams. One of these respondents is involved in strategic decision making at the case company and he has asked about the possibility to present the Hypertext model to a larger audience within the company, to increase awareness about knowledge creation and knowledge management. He and others believe that the model can be put into practice with relative ease if the triggers for the four modes of knowledge creation are subtly applied to the organisation, to shape the knowledge creation efforts along the spiral and as a result have the organisation switch through the layers of the Hypertext organisation.

As has been described over the course of this chapter and highlighted in section 5.1., there are some discrepancies between the practical situation and the way knowledge creation is modelled by Nonaka. The applicability of the Hypertext model will benefit from using the interview outcomes to bring the model closer to practice, while retaining much of its universality. Subsection 6.2.1. will elaborate on how to achieve this.

The model is considered by one respondent to be valuable for knowledge creation at the case company because it goes beyond the age-old solution of implementing a Knowledge Management System as a panacea for knowledge management related issues. Other respondents have attributed value to the model based on the awareness it creates about the knowledge creation process. The value of the model for the case company is manifested in the incentive it provides to increase knowledge sharing and documentation. Using the model can help the case company to increase the effectiveness of knowledge creation through *combination* and *internalisation*, which allows the company to create knowledge in all four modes of the knowledge creation spiral. Many aspects of the Hypertext model are already in place, but the real benefits are gained by focusing on these last elements.

A final comment on the value and applicability of the model for knowledge creation at the case company is that one respondent raised the argument that if the model was supported by a business case with an assessment of the projected costs of implementation and expected returns, an implementation decision will become easier to make and thusly further enhance the value for practical situations.



## 6. Conclusion and discussion

This thesis has started with the notion that knowledge creation models frequently suffer from a narrow scope or a too broad approach, leading to limitations in generalisation, methodological shortcomings, lack of concise explanation of constructs, difficult translation of the models to practice and overall uncertainty about value and applicability. Nonaka's Hypertext model was chosen to be brought closer to practice and to draw conclusions about its value and applicability. The model, as Nonaka has presented it in his 1994 article, was presented in section 2.1. and figure 1. After an extensive literature review a more complete interpretation of Nonaka's intentions has led to the reconstructed Hypertext model in figure 7. The reconstructed model was used in a case study which has led to interesting expressions of how the model formed an accurate representation of knowledge creation in a knowledge intensive company and perceptions of value and applicability.

There are two areas where conclusions can be drawn. Firstly, a conclusion can be drawn about the applicability and value of the model for knowledge creation in practice. This assessment is presented in section 6.1. by answering the four research questions.

Secondly, the case study has provided sufficient data to propose changing the Hypertext model to bring it closer to practice and to suggest changes to the way the case company has structured its knowledge creation activities. These items are discussed in section 6.2. and a visualisation of an improved Hypertext model in figure 11.

This chapter ends with an analysis of this study's contributions and limitations in sections 6.3. and 6.4. respectively.

### 6.1. Research question outcomes

#### 6.1.1. The main elements of the model and its contribution to knowledge creation

As has been presented earlier, the main elements of Nonaka's Hypertext organisation model are (1) the three-layered organisation design with which the context in which knowledge is created is adapted to support the type of knowledge creation activities that take place, (2) the combination of top-down and bottom-up management's knowledge creation characteristics in middle-up-down management, and (3) the knowledge creation spiral that is conceptualised as a sequence of phases in which knowledge shifts from tacit to explicit and back, while gaining in magnitude and momentum with every phase.

The model contributes to knowledge creation theory by conceptualising knowledge creation to take place in the four modes *socialisation*, *externalisation*, *combination* and *internalisation*. In

socialisation tacit knowledge is created in a process of observation, imitation and practice. In externalisation explicit knowledge is created by articulating tacit knowledge using metaphors and analogies. Combination is the creation of explicit knowledge by combining various knowledge assets into a new asset. Internalisation is the creation of tacit knowledge by absorbing explicit knowledge to the extent that it becomes taken for granted by the individual and it is used to broaden, extend, and reframe the individual's own tacit knowledge.

The second contribution to knowledge management theory is achieved by combining the effects top-down and bottom-up management have on knowledge creation in the hybrid middle-up-down management. In middle-up-down management the top management is responsible for setting out a broad direction for the organisation and formulating ambitious, but ambiguous goals. Middle management is tasked with communicating these visions and directives downwards where they are executed by entrepreneurial individuals. The middle managers are then responsible for communicating the findings of the lower end of the organisation upwards and as such form an essential communication hub in the organisation. Middle-up-down management proposes the use of self-organising teams which operate in a situation of creative chaos to become less path dependent and increase the innovative capacity of the organisation.

The third contribution to knowledge management theory is the way knowledge creation enhancing conditions are included in the model. These conditions include *creative chaos*, *redundancy of information*, *requisite variety*, and *love, trust, care and commitment*. Together these conditions create a context which is conducive to knowledge creation effectiveness.

The fourth contribution to knowledge management theory is the solution Nonaka (1991) provides to the problem of converting tacit knowledge into explicit knowledge. By using delicate metaphors and analogies, seemingly unarticulable knowledge can be transferred. As has been discussed in subsection 2.2.2., this method has received some criticism. Ambrosini and Bowman (2001) propose that the use of storytelling and cognitive mapping are more suitable ways of converting tacit knowledge into explicit knowledge.

### 6.1.2. Operationalizing and implementing the model in practice

The model can be brought into practice by emphasising knowledge scaling through gaining experience with newly created knowledge and rationally reflecting on improving processes and designs. The company should also create an environment with *requisite variety*, *redundancy of information*, *creative chaos* and high *love, trust, care and commitment* to improve knowledge creation effectiveness.

By being aware of the knowledge requirements the company faces, they can manage their

knowledge creation activities to match these requirements. The company should promote the sharing of tacit knowledge through the creation of *fields of interaction* or self-organising teams. The conversion of tacit to explicit knowledge can be stimulated by facilitating dialogue, the sharing of explicit knowledge by endorsing the documentation of existing knowledge and coordination between team members, and the conversion of explicit to tacit knowledge by allowing experimentation with newly created knowledge. These triggers also move the organisation through the three layers of the Hypertext organisation. The creation of a field of interaction can be seen as a move from the business-system layer to the project-system layer, documentation of knowledge forms the move from the project-system layer to the knowledge-base layer and coordination between team members returns the organisation from the knowledge-base layer to the business-system layer.

### 6.1.3. Value and applicability for knowledge intensive companies

The Hypertext model is attributed to be valuable for knowledge intensive companies because it goes beyond the common solution of implementing a Knowledge Management System, it creates awareness about the knowledge creation process and emphasises the sharing and documentation of knowledge. If the case company's method of knowledge creation is an accurate representation of knowledge creation in knowledge intensive companies, the model is valuable because it helps to increase the effectiveness of knowledge creation through *combination* and *internalisation*. This allows the company to create knowledge in all four modes of the knowledge creation spiral.

The applicability is perceived to be high by the respondents because they have expressed that they will immediately take elements of the model into practice to improve the knowledge creation effectiveness in their teams. Following the interviews one respondent has requested that a workshop is set up to present the Hypertext model to a larger audience within the company, to increase awareness about knowledge creation and knowledge management. The interviews have resulted in the conclusion that the model can be used by subtly applying the triggers for the four modes of knowledge creation. This shapes the knowledge creation efforts along the spiral and has the company shift through the layers of the Hypertext organisation.

The value and applicability of the model for knowledge intensive companies is perceived to increase if it was supported by a business case with an assessment of the projected costs of implementation and expected returns, to make it easier for strategic management to decide on whether to adopt this method or not. Furthermore, the model's value and applicability will benefit from addressing the discrepancies which have been found between the model and the way knowledge creation is expressed to take place in practice (see 6.2.1.).

#### 6.1.4. Conclusions regarding the applicability of the model

Whereas the value and applicability of the model for knowledge intensive companies is perceived to be high, there are comments to be made about several theoretical aspects of the model. Nonaka's (1991, 1994) knowledge typology suffers from insufficient explanation of how tacit knowledge differs from explicit knowledge. This shortcoming becomes apparent when comparing Nonaka's typology with those of other authors, such as Kogut and Zander (1992), Ambrosini and Bowman (2001), Coff, Coff and Eastvold (2006), and Turner and Makhija (2006). The adoption of the concept of a tacit-explicit continuum (Nonaka, von Krogh and Voelpel, 2006; Nonaka & von Krogh, 2009) has improved Nonaka's knowledge typology, but the constructs remain insufficiently explained.

The way Nonaka has presented the four modes of knowledge creation is plagued by the same shortcoming of insufficient explanation. The *socialisation* construct for example, is supported by poor examples. Nonaka never clearly explains how tacit knowledge is converted into explicit knowledge in *externalisation* and questions have been raised about the message integrity if tacit knowledge is packaged in a metaphor which is subsequently converted into an analogy. While Nonaka (1991, p. 99) admits to providing a poor example when explaining the *combination* construct, he does not provide a suitable alternative. Finally, the *internalisation* construct is explained using a convoluted example which shrouded the explaining elements in unnecessary details. Without regard to the way Nonaka (1991, 1994) has presented the four modes of knowledge creation, the validity of these constructs has been proven in several instances of empirical testing, with one notable remark: no conclusive evidence has been found for the use of dialogue and metaphor in *externalisation*.

The knowledge creation spiral builds on the four modes of knowledge creation and is by extension affected by the above theoretical shortcomings. Apart from this, there are several comments to be made about how Nonaka (1994) has presented the knowledge creation spiral. The first comment is that Nonaka mentions that a focus on pure combination or socialisation can prove problematic, but doesn't explain the effects of focusing on pure internalisation or externalisation. The causal relations between the proposed triggering mechanisms and the resulting modes of knowledge creation are also not elaborated on, or proven through empirical testing. It can even be said that the proposed triggering mechanisms are an operationalization of the constructs they are conceptualised to actuate. A final shortcoming in the knowledge creation spiral is that the order in which the modes are to take place is taken for granted as a sequence with a set order. Choi and Lee's findings (2002) hint at a potentially different order of the modes in the knowledge creation spiral. It may therefore prove beneficial to explore alternative orders, or abandoning the sequential nature of the spiral in favour of a parallel interpretation.

Similarly to how the relation between the triggers and the modes of knowledge creation remains to be empirically proven, the proposed enhancing conditions to the effectiveness of self-organising

teams are not supported by empirical data. The suggested relations may even be subject to a moderating effect of Japanese culture, based on how Nonaka, Toyama and Konno (2000) have conceptually developed the knowledge creation field construct into a more detailed understanding of the social aspects of knowledge development and relabelled the construct as *Ba*.

In the way Nonaka (1988b) has presented *middle-up-down management* as a hybrid management form he claims that this type of management promotes parallel knowledge creation. When using this concept in the Hypertext model (1994), he shies away from using this aspect. It is unclear why this choice is made or how the parallel processes from middle-up-down is envisioned to take place in the Hypertext organisation. Middle-up-down management also suffers from a lack of empirical grounding. The original publication (Nonaka, 1988b) presents it in a purely conceptual fashion, lacking empirical support or references to practice.

Nonaka's conceptualisation (1994) of knowledge creation enhancing conditions mentions *redundancy of information* as being helpful in speeding up concept creation by promoting the sharing of tacit knowledge and helping organisational members understand their role in the organisation. Redundancy of information can be created by the conscious overlapping of company information, business activities, and management responsibilities, which is suggested six years after publication to possibly lead to information overload (Nonaka, Toyama & Konno, 2000). It is unclear to which extent redundancy of information should be created for it to remain beneficial for knowledge creation, before it becomes detrimental.

The final item in the Hypertext model to receive criticism in this paper is Nonaka's conceptualisation of knowledge scaling. An argument is made against the scaling of tacit knowledge because it can lead to the deterioration of competitive advantages. Furthermore, the way Nonaka (1994) has presented knowledge scaling is to a great extent grounded in traditional Japanese philosophy and it is unclear to which extent it remains applicable to western management.

It can be concluded that the theoretical shortcomings to the Hypertext model are quite extensive. During the interviews a comment was made that the model is highly abstract and appears to be applicable to any organisation. The universality of the model reduces the immediate practical applicability, but enhances the model's general appeal because it can be modified to fit any organisation. The theoretical shortcomings and the model's distance from practice negatively affect the applicability of the Hypertext model. By addressing the theoretical issues from and bringing the model closer to practice, the scientific and practical value of the model will be enhanced. The following section will explain how the model can be amended to more closely resemble knowledge creation in knowledge intensive companies.

## 6.2. Increasing the model's fit with the practical setting

This section will attempt to increase the model's fit with the practical setting. Increasing the fit will be done by firstly bringing the model closer to practice, based on the feedback provided during the group-interviews. Secondly, suggestions will be provided for improving the practice of knowledge creation at the case company, based on the Hypertext model and the accompanying theoretical elaboration provided in the second chapter of this paper.

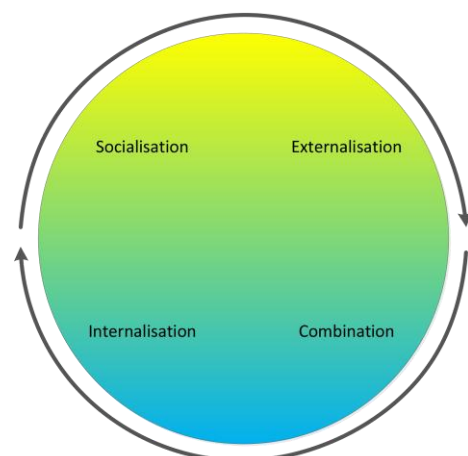
### 6.2.1. Amending the model to bring it closer to practice

Improving the Hypertext model to bring it closer to practice requires that room is created to make the model more adjustable for specific organisational settings. Nine out of sixteen respondents have argued that the model is highly abstract and conceptual, which makes it difficult to compare to the case company. The model is intended as a simplified representation of how an ideal type of knowledge creating organisation can be shaped. In its current form the model can be applied to any organisation, which has the advantage of increasing the model's value in the light of knowledge management theory development. A downside of the universality of the model is that it does not cater to the specific demands of organisations looking to improve their knowledge creation activities. With respect to both of these arguments, the suggested amendments in this subsection are aimed at improving the model's practical value for knowledge intensive companies.

As has been discussed in section 5.1., accepting the existence of a continuum between tacit and explicit knowledge leads to the problem that the four modes of knowledge creation are still based on the discrete constructs of tacit and explicit knowledge. This means that the current modelling of the knowledge creation spiral does not account for the “grey-areas” in between the modes. To overcome this issue, the first amendment to the Hypertext model is to change the knowledge creation concept from the matrix of four discrete modes (figure 4) into a circle (figure 9) which allows overlap between the modes. This type of visualisation makes it possible to place combined types of knowledge creation in the model.

The second proposed change to the Hypertext model has been hinted at in subsection 2.2.3. and in figure 5 and involves the acceptance of knowledge creation to take place simultaneously in several modes. Moving away from

**Figure 9: Knowledge creation spiral with overlapping modes**



describing knowledge creation to follow a specified order was suggested by four respondents as a more accurate representation of how knowledge creation takes place in practice. But this change to the knowledge creation spiral undermines the idea of adapting the organisational structure to stimulate the effectiveness of the knowledge creation modes. The triggers for each of the modes in the knowledge creation spiral are also responsible for moving the organisation through the three layers of the Hypertext model. By conceptualising the knowledge creation process as a more chaotic process in which modes can take place simultaneously, the organisation switches through the Hypertext layers erratically. This behaviour has the potential to negatively affect the knowledge creation efficiency. The conceptualisation of the knowledge creation spiral should therefore be in terms of a circle with implied grey-areas, but also be nuanced to explain that several modes can take place simultaneously and that the order with which knowledge moves through these modes should be seen as a guideline, rather than an instruction.

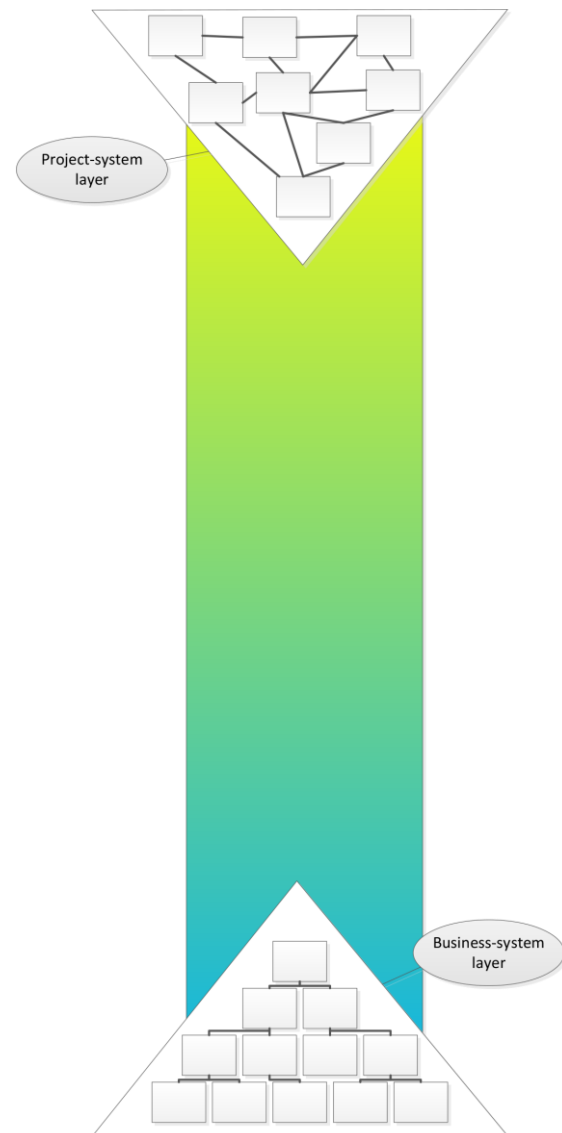
Another point which was raised during the interviews was that the current representation of the Hypertext model makes a clear distinction between the business-system layer and the project-system layer, which is perceived to be unrepresentative of how these architectures exist in practice. The choice to make this distinction is based on the vastly different composition of these layers. This was commented on because several respondents believed that the model would be closer to practice if there would be some form of overlap between these layers, because neither pure self-organising teams, nor bureaucratic hierarchies exist in practice without exhibiting some characteristics of the opposing structure. The perceived positive influence of middle managers on the functioning of self-organising teams through seeing the middle manager in the role of a controller illustrates how these teams still need someone in a leader role to increase the team's efficiency. The third proposed change is therefore to place the constructs *business-system layer* and *project-system layer* on the opposing ends of a continuum to accommodate for the various gradations in between these constructs. Depending on the dominant mode of knowledge creation at the time, the organisation's structural characteristics will sway on this continuum (figure 10) from favouring an organisational hierarchy to exhibiting features of self-organising teams. In figure 10 this continuum is purposefully coloured similarly to the gradient in figure 9 to represent the relation between these items of the amended model. If a type of knowledge creation is situated towards the blue end of figure 9, by possessing characteristics of combination and internalisation, the effectiveness of this type of knowledge creation will be improved if the organisation exhibits structural properties which lie at the same hue in the spectrum between the project-system layer and the business-system layer of figure 10.

The proposed reconceptualisation of the Hypertext organisation in figure 10 does not contain a

representation of the knowledge-base layer, because of its functional dissimilarity with the project-system layer and the business-system layer. The latter two layers are intended to describe a type of organisational structure, while the knowledge-base layer represents a knowledge repository. It is plausible that in Nonaka's (1994) visualisation of the Hypertext organisation (figure 1) the knowledge-base layer is drawn to emphasise the necessity of documenting and storing newly created knowledge and to symbolise the foundation it provides for the other layers to be constructed on top of. However, by following the triggering mechanisms for the modes of knowledge creation, it becomes inevitable that knowledge is documented, stored and recovered. It therefore does not add anything substantial to the conceptualisation and is left out of the reconceptualisation in figure 10.

The fourth and fifth proposed changes to the Hypertext model come from the cultural differences that set Japanese management apart from western management. The respondents felt a strong connection with the terms *trust*, *care* and *commitment*, but expressed to be uncomfortable with *love*. Nonaka, Toyama and Konno (2000) have intended this construct to facilitate knowledge sharing and for the self-transcending process of knowledge creation to occur. High levels of interpersonal *love*, *trust*, *care* and *commitment* mean that there is an atmosphere in which people feel safe in sharing their knowledge, where personal knowledge asset monopolies are non-existent and employees show altruistic behaviour in progressing the organisation's knowledge endowment. The intended meaning of this construct is sufficiently explained when the term *love* is removed from the label. Because increasing interpersonal *love* to improve knowledge sharing raises some eyebrows in western management, the fourth proposed amendment of the Hypertext model involves relabeling the *love*, *trust*, *care* and *commitment* construct to "trust, care and commitment".

**Figure 10: Project-system layer and business-system layer on opposing ends of a continuum**





Knowledge scaling is described by Nonaka (1994) as the crystallisation of knowledge into unique, personal perspectives, through an interaction between experience and rationality. As has been declared in section 2.4., Nonaka's explanation is distant from the distinction westerners make between body and mind. The expectation that this conceptualisation of knowledge scaling will alienate western managers was confirmed during the interviews when the majority of the respondents felt no connection with this explanation, nor could they imagine what was meant. Knowledge scaling is seen as an important mechanism in leveraging knowledge assets to become more abundant in the organisation and by extension easier accessible. Other authors (e.g. Kogut & Zander, 1992; Coff, Coff & Eastvold, 2006; Arikan, 2009) have explained knowledge scaling as increasing knowledge asset volume by sharing knowledge. Because the sharing of knowledge is such an integral part of the knowledge creation spiral, it is unclear what the value is of Nonaka's conceptualisation of knowledge scaling in the Hypertext model. Because of this element's foundation in traditional Japanese philosophy and its redundant position in the model, the fifth proposed change to the Hypertext model is to remove the knowledge scaling element.

The remaining three proposed changes to the Hypertext model were suggested during the interviews and haven't yet been discussed in this paper. Firstly, there should be greater emphasis on a collective sense of responsibility for the knowledge creation outcomes in self-organising teams. Examples were provided of teams in which each member felt highly committed and dedicated to their personal contribution, but experienced a low connection to the overall team performance. Feeling responsible for one's own performance and actions and being dedicated to the organisation's knowledge creation goals is already covered in the *commitment* part of *trust, care and commitment*. This construct was found by respondents to be too general to apply to members of self-organising teams to feel a sense of responsibility and urgency in the efforts of the collective they belong to. The sixth proposed amendment to the Hypertext model is therefore to add *collective responsibility* to *effectiveness of self-organising teams*.

The idea of adding the construct "synergy" to *effectiveness of self-organising teams* was also raised during the interviews. In various instances, respondents have claimed that the effectiveness of knowledge creation in self-organising teams is dependent on the way the team members work together. This goes further than *trust, care and commitment* and is related to *self-transcendence*, but whereas *self-transcendence* is about the individual performing above his potential, *synergy* is about a team performing better than the sum of performances if the team members were to work separately. The seventh proposed change to the Hypertext model is to improve the effectiveness of self-organising teams by emphasising the importance of assembling a team with people who like working together and complement each other's competences to create a synergetic effect in

collaboration. Adding the construct *synergy to effectiveness of self-organising teams* will reflect this change.

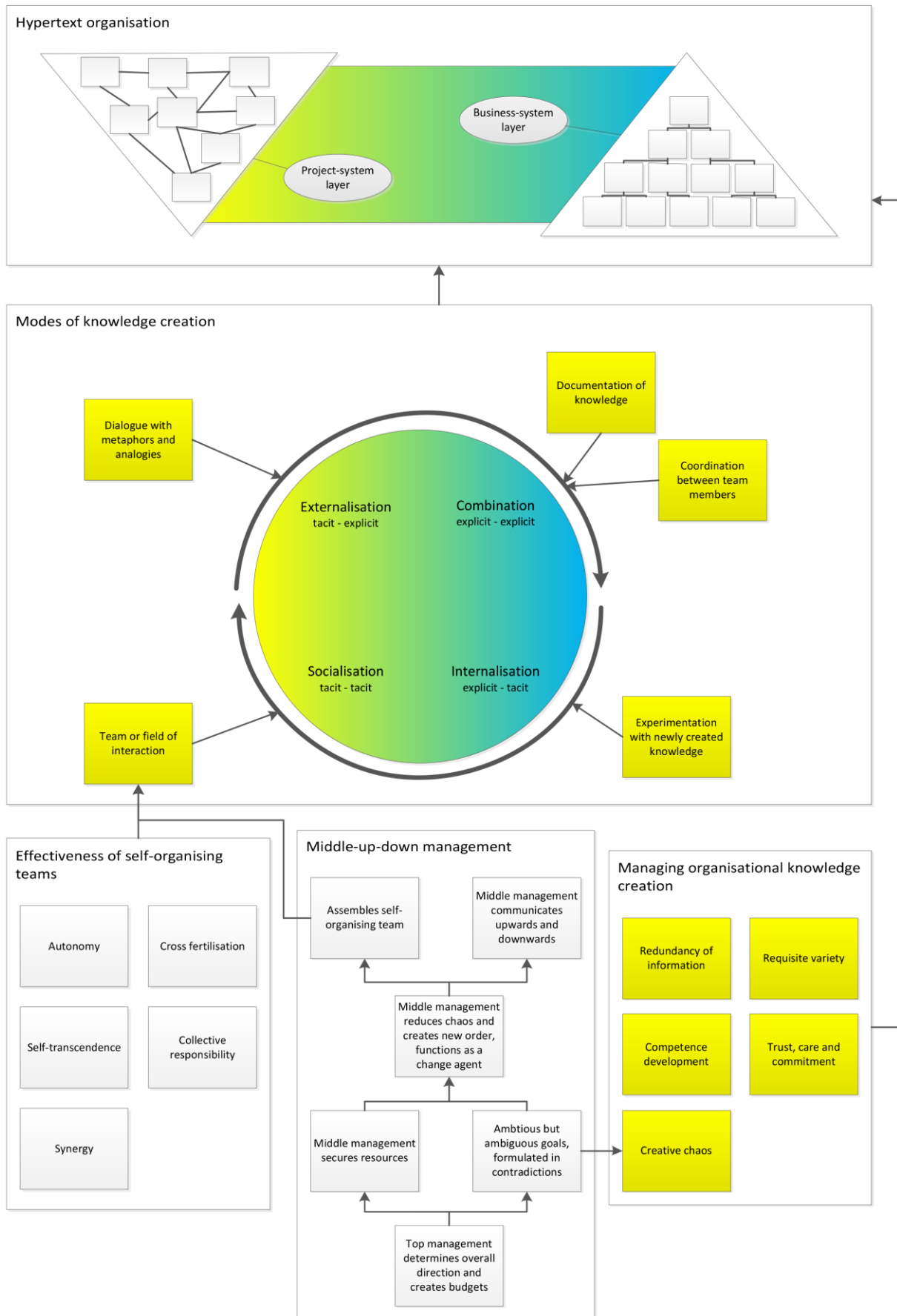
The last improvement to bring the Hypertext model closer to practice is to have more attention for the personal competences of employees. The Hypertext model is currently built on the perception that any employee who is willing to share his knowledge is also capable of sharing his knowledge. The same is implied for collaborative efforts in self-organising teams; individuals are assumed to all be capable of working together with others. The respondents have pointed out that in practice not all employees possess the necessary qualities to share knowledge or work together as is assumed in the Hypertext model. If they don't have these competences, the model will not work as intended. The eighth amendment to the Hypertext model is therefore to add *competence development to managing knowledge creation*, so that efforts to improve communicative skills and teamwork are seen as factors which stimulate the process of knowledge creation.

To bring the Hypertext model closer to practice, the eight proposed changes are:

1. Changing the knowledge creation concept from the matrix of four discrete modes into a circle which allows overlap between the modes.
2. Knowledge creation can take place simultaneously in several modes.
3. Placing the *business-system layer* and the *project-system layer* on opposing ends of a continuum to accommodate for the various gradations in between these constructs.
4. Removing the term *love* from the construct label *love, trust, care and commitment*.
5. Removing *knowledge scaling* as an emphasised element in the model.
6. Adding *collective responsibility* to *effectiveness of self-organising teams*.
7. Adding *synergy* to *effectiveness of self-organising teams*.
8. Adding *competence development* to *managing knowledge creation*.

The suggested improvements to the Hypertext model are visualised in figure 11. Note that the modes of knowledge creation (figure 9) and the Hypertext organisation (figure 10) have been rotated for layout purposes.

Figure 11: Visualisation of improved Hypertext model



### 6.2.2. Suggestions to improve knowledge creation at the case company

This subsection provides suggestions to improve knowledge creation at the case company. Though these suggestions are not the primary aim of this paper, it offers insight into how the Hypertext model can be of value in a practical situation.

The first and foremost improvement to knowledge creation at the case company is to drop declarability as the primary performance indicator of project teams and departments. As several quotes in chapter 4 have pointed out, using declarability as an important performance indicator leads to a negative sentiment towards knowledge sharing and storing, because these actions don't add to the declarability rate of the individual or the team he is working in. Dropping this performance indicator, or reducing its impact through introducing other performance indicators which are conducive to knowledge creation, will help in improving the case company's knowledge creation efforts.

Documenting and storing newly created knowledge is currently an element of the Hypertext model which receives very little attention at the case company. Low documentation negatively affects knowledge redundancy and the sharing of knowledge, but also inhibits the *combination* mode. The second suggestion for improvement is that a higher priority is placed on improving the rate with which newly created knowledge is documented and stored into the organisation's knowledge repository.

In order to make it easier to recover entries from the knowledge repository and to improve knowledge dissemination across project team and department boundaries, the third suggestion for improvement is to reduce the segregation of the knowledge repository. Currently every team and department has its own database in which knowledge is stored. These databases are accessible by outsiders, but the interviewees have expressed that they don't feel inclined to look beyond their own team's database to find solutions to the problems they are facing. A centralised knowledge repository which applies to all project teams and departments will likely boost knowledge dissemination between teams and departments.

The effectiveness of using a centralised knowledge repository as a tool for embedding knowledge into the organisational memory, stimulating knowledge redundancy, and improving inter-team and inter-departmental knowledge sharing, can potentially be improved by requiring new entries to satisfy certain quality requirements. By using a template for new entries, in which there are several fields which have to be used to describe particular details about a knowledge asset, there will be more consistency in the entries. Furthermore, using this system will allow the search engine to deliver search results which are linked to particular fields only. The fourth suggestion for improvement is therefore to standardise knowledge documentation by using templates.

The business-system layer should play a larger role in the company's knowledge creation. By stimulating documentation and experimentation, and through a stricter coordination between team members to move from the project-system layer to the business-system layer, knowledge creation at the case company will benefit from the effects of top-down management on *combination* and *internalisation*. The fifth suggestion for improvement is therefore to switch to the hierarchy more prominently through stricter coordination, and stimulating documentation and experimentation.

While evaluating the interviews with a small group of respondents, there was support for the assumption that there is low awareness of how knowledge creation can be managed. One respondent expressed that he had never realised that knowledge creation is something which can be modelled and managed to increase its outcomes. He thought it was a process which occurred naturally, in an ad-hoc fashion. The interviews form a first step in creating awareness in the case company about managing knowledge creation, because it is an eye-opener for several respondents. But awareness about knowledge creation processes can also inhibit creative behaviour. Respondents have expressed that they feel that their creative processes will be obstructed by the realisation that they don't occur freely, but are caused by incentives, triggers and other environmental factors. The relation between awareness of knowledge management techniques and the outcomes of the knowledge creation efforts is not researched in this paper, but the sixth suggestion for improvement would be the selective creation of awareness of how knowledge creation occurs. This can focus on upper and middle management.

Currently the knowledge creating efforts primarily take place at the individual level. There is low cooperation in knowledge creation beyond employees pairing up in *socialisation* and *externalisation*. Turning knowledge creation into a collective effort has efficiency benefits for all four modes of the knowledge creation spiral. Collective knowledge creation will also actuate a collective sense of responsibility for the creation of new knowledge. Accordingly, the seventh suggestion for improvement is to draw knowledge creation into the greater community of the case company and potentially across its organisational boundaries to include members of the industrial network in which the case company resides.

To improve knowledge creation effectiveness at the case company, the seven proposed areas to improve on are:

1. Dropping declarability as the primary performance indicator, or reducing its impact through introduction of other performance indicators which are conducive to knowledge creation.
2. Placing a higher priority on improving the rate with which newly created knowledge is documented and stored.

3. Reducing segregation of the knowledge repository by combining the various databases into one centralised unit which is accessible by all members of the organisation.
4. Standardise knowledge documentation by using templates which allow for uniformity in the level of detail and quality of entries.
5. The case company should switch to the hierarchy more prominently through stricter coordination, and stimulating documentation and experimentation.
6. Selective creation of awareness of how knowledge creation occurs.
7. Draw knowledge creation into the greater community of the case company and potentially across its organisational boundaries to include members of the industrial network in which the case company resides.

### 6.3. Contributions

This study contributes to knowledge management theory by addressing the gap in theory that is the broad and unclear explanation of the Hypertext model (Nonaka, 1994), which leads to an incomplete comprehension of how the model works and difficulties of translating the model to practice. Critically examining Nonaka's body of work and adjacent publications from other authors has led to clearer formulations and a reconstructed Hypertext model which forms a more complete representation of what Nonaka (1994) has attempted to explain. Furthermore, the Hypertext model has been amended to be closer to practice by implementing suggestions which have been obtained in a case study at a knowledge intensive firm.

The case study forms the basis upon which conclusions about perceived value and applicability are drawn. This qualitative and exploratory research forms the first attempt at determining the actual value and applicability of the Hypertext model for knowledge creation in practice and adds to the evidence concerning the model's strength. The outcomes of the case study are to be regarded as original empirical evidence in supporting the Hypertext model's value and applicability, which is another contribution to knowledge management theory.

A final contribution of this study is that it highlights the potential shortcomings of the model which can form the basis for follow-up research. An assessment of the potential shortcomings adds to the increased understanding of the model.

#### 6.4. Limitations and suggestions for follow up research

There are several aspects which threaten the validity of the outcomes in this study. Firstly, the statistical conclusion validity of this study is threatened by the choice of using a single case study with which conclusions are drawn for the larger population of *knowledge intensive companies*. Using a single case study has the drawback of measuring the perceptions and attitudes of respondents who may form an unrepresentative sample of the larger population. A follow up research should therefore be conducted at other knowledge intensive companies. Using the same research design, it will be possible to confirm and possibly add to the outcomes of this study. Having a broader selection of case companies will likely add to the strength of the conclusions in this study. Furthermore it will be interesting to determine the value and applicability of the Hypertext model in organisations which are to a lesser degree reliant on knowledge creation. It is possible that the outcomes of such a study will deviate from the outcomes arrived at in this study.

A second threat to the validity of this study is caused by the choice to measure perceptions of applicability and value as a substitute for the constructs applicability and value. In an ideal situation a controlled experiment would have been conducted in which two nearly identical companies use the company's method of knowledge creation and the original Hypertext model. Alternatively, a research design consisting of a pre-test of knowledge creation effectiveness, implementation of the model and a post-test of knowledge creation effectiveness can be used to measure the actual constructs *applicability* and *value*.

Arguably, the first research design will be very difficult to carry out, because of the unrealistic task of finding or creating two or more nearly identical organisations. The second research design requires a company which is willing to take the risk of implementing the model. In both cases it will be difficult to control for external influences. The current design of measuring perceptions as a substitute is a viable alternative to bring the Hypertext model closer to practice, as supported by the correlation between perceptions of value and actual value (Hornik, 1984; Katz, Larson & Larson, 1991; Burton, Sheather & Roberts, 2003).

The validity of the interview outcomes is possibly harmed by the selection criteria. The respondents are selected based on an existing amicable relationship with the researcher which has been developed over the years prior to the study when the researcher was employed at the case company. The third limitation in this study is that if the relationship between the respondents and the researcher has caused bias in the interview outcomes, the conclusions drawn in this study have reduced value. To overcome this limitation a follow-up study can use alternative selection criteria of cases, for example a combination of stratified and random sampling. Using the Chamber of

Commerce's registry, a selection can be made of knowledge-intensive companies which are of relatively equal size. From this stratified sample a randomised sample can be drawn to select companies which can be invited to participate in the study. Within these companies, probability sampling can be used to arrive at potential individual respondents.

Data can also be drawn from alternative sources. Reconfiguring the research design to incorporate quantitative data can help to arrive at more broadly comparable and ultimately generalizable outcomes. While the constructs applicability and value are difficult to measure using quantitative data, a set of questions can be constructed to arrive at accurate estimates of these constructs.

Examples of such questions in the case of *documenting and storing knowledge* are:

- The number of new entries in the organisational knowledge repository over a period of time
- The growth rate of organisational knowledge repository over a period of time, in terms of number of entries
- The perceived usability of the organisational knowledge repository, using a Likert-like scale
- The perception of completeness of the knowledge available in the organisational knowledge repository, using a Likert-like scale
- The perception of exhaustiveness of individual entries in the organisational knowledge repository, using a Likert-like scale

The fourth and final threat to the validity of the outcomes is caused by the way the researcher has explained the model during the interviews. After having conducted a literature review and coming to conclusions about the model solely based on theoretical aspects, it has proven difficult to explain the model as unbiased as possible. It was important for the respondents to receive a neutral explanation of how the Hypertext model functions, if they were to provide accurate estimates of how the model would work at the case company. To overcome this limitation, follow-up research can be designed to use multiple interviewers who are unaware of the potential theoretical shortcomings of the model. Being unaware of the shortcomings allows the interviewers to remain neutral in explaining the model, because they can't influence the respondents with negative sentiment caused by the awareness of these shortcomings. Using more than one interviewer can cause a potential bias originating at the researcher's communicative skills to be devalued in the greater sample.

There are four more suggestions for follow-up research which are not directly related to the limitations due to the research design of this study, but valuable in creating a better understanding of how the model works. In section 2.3. there is mention of how it is unclear how Nonaka has envisioned the organisation moving through the three layers of the Hypertext organisation. It is doubtful that the entire organisation moves through the layers simultaneously. Shifting only portions



of the organisation can have an effect of incongruent management practices across different overlapping business units. A third interpretation of the model is that this is merely a stylised representation of the organisation which should primarily serve as a theoretical exercise or as a guideline for managers. A suggestion for follow up research is therefore to determine how an implementation of the model will affect knowledge creation effectiveness if it is (1) applied to move all of the organisation through the three layers at once, (2) applied to move parts of the organisation through the layers asynchronously, or (3) if it is applied without shifting the organisation through the three layers and focus is put on aspects such as the level of autonomy, self-transcendence and cross-fertilisation. Based on this research a new attempt can be made to bring the model closer to practice.

This study has highlighted a number of potential shortcomings of the Hypertext model in section 2.4. which can be summarised as the insufficient explanation of constructs and of the causal relations between constructs, the relative absence of empirical support for proposed relations, the potential for a moderating effect of Japanese culture on the proposed relations, and the choice for sequential knowledge creation being incongruent with Nonaka's preference for parallel development. Another suggestion for follow up research is therefore to determine the construct validity of all the elements in the model. In addition to proving the implied causal relations between these elements, such a study will significantly add to the theoretical value of the model. This type of follow up study will have the most significant impact on the way the model is perceived to be valuable for organisational knowledge creation.

A further suggestion for follow up research concerns the potential of Japanese culture having a moderating effect on the expected relationships. After the causal relations between the model's constructs have been proven in the setting of western culture, it will be interesting to compare the model's workings across different cultures. If Nonaka's conceptualisation of *knowledge scaling*, the *field of interaction (Ba)* and interpersonal *love, trust, care and commitment* are not similarly applicable across different cultures, another adjustment to the model is warranted.

The final suggestion for follow up research is to determine whether the knowledge creation spiral can take place in an alternative order as has been hinted at throughout this study. One of the conclusions of this study is that the model will be improved by departing from the set order in which the modes of knowledge creation take place. The drawback of this is that the order of the knowledge creation spiral is strongly linked with the organisation moving through the layers of the Hypertext organisation. A solution has been provided by placing these layers on a spectrum with corresponding colouring as the revised knowledge creation spiral in figures 9 and 10. It will be interesting to see how this new design will work in practice and potentially add to the value of this study's outcomes.

## References

- Alavi, M., & Leidner, D. (2001). Knowledge management and knowledge management systems: Conceptual foundations and research issues. *MIS Quarterly*, 25(1), 107-136.
- Ambrosini, V., & Bowman, C. (2001). Tacit knowledge: some suggestions for operationalization. *Journal of Management Studies*, 38(6), 811-829.
- Argote, L., & Ingram, P. (2000). Knowledge Transfer: A Basis for Competitive Advantage in Firms. *Organizational Behavior and Human Decision Processes*, 82(1), 150-169.
- Arikan, A. T. (2009). Interfirm knowledge exchanges and the knowledge creation capability of clusters. *Academy of Management Review*, 34(4), 658-676.
- Barney, J. (1991). Firm Resources and Sustained Competitive Advantage. *Journal of Management*, 17(1), 99-120.
- Bhatt, G. D. (2001). Knowledge management in organizations: examining the interaction between technologies, techniques, and people. *Journal of Knowledge Management*, 5(1), 68-75.
- Bloodgood, J. M., & Salisbury, W. D. (2001). Understanding the influence of organizational change strategies on information technology and knowledge management strategies. *Decision Support Systems*, 31, 55-69.
- Burt, R. S. (1995). *Structural holes: the social structure of competition*. Cambridge, Massachusetts: Harvard University Press.
- Burton, S., Sheather, S., & Roberts, J. (2003). Reality or Perception? The Effect of Actual and Perceived Performance on Satisfaction and Behavioral Intention. *Journal of Service Research*, 5(4), 292-302.
- Cabrera, A., & Cabrera, E. (2002). Knowledge-sharing Dilemmas. *Organization Studies*, 23(5), 687-710.
- Choi, B., & Lee, H. (2002). Knowledge management strategy and its link to knowledge creation process. *Expert Systems with Applications*, 23, 173-187.
- Coff, R. W., Coff, D. C., & Eastvold, R. (2006). The knowledge-leveraging paradox: How to achieve scale without making knowledge imitable. *Academy of Management Review*, 31(2), 452-465.

- Dyer, J. H., & Nobeoka, K. (2000). Creating and managing a high performance knowledge-sharing network: The Toyota case. *Strategic Management Journal*, 21, 345-368.
- European Foundation for the Improvement of Living and Working Conditions. (2005). *Sector Futures - The knowledge-intensive business services sector*. Loughlinstown, Dublin: European Monitoring Centre on Change.
- Gourlay, S. (2006). Conceptualizing Knowledge Creation: A Critique of Nonaka's Theory. *Journal of Management Studies*, 43(7), 1415-1436.
- Grant, R. (1996). Toward a knowledge-based theory of the firm. *Strategic Management Journal*, 17, 109-122.
- Healy, M., & Perry, C. (2000). Comprehensive criteria to judge validity and reliability of qualitative research within the realism paradigm. *Qualitative Market Research: An International Journal*, 3(3), 118-126.
- Hornik, J. (1984). Subjective vs. Objective Time Measures: A Note on the Perception of Time in Consumer Behavior. *Journal of Consumer Research*, 11(1), 615-618.
- Kang, S. C., & Snell, S. A. (2009). Intellectual Capital Architectures and Ambidextrous Learning: A Framework for Human Resource Management. *Journal of Management Studies*, 46(1), 65-92.
- Katz, K., Larson, B., & Larson, R. (1991). Prescription for Waiting-in-Line Blues: Entertain, Enlighten and Engage. *Sloan Management Review*, 32, 44-53.
- Kogut, B., & Zander, U. (1992). Knowledge of the Firm, Combinative Capabilities, and the Replication of Technology. *Organization Science*, 3(3), Focused Issue: *Management of Technology*, 383-397.
- Krueger, R. (1994). *Focus Groups: a Practical Guide for Applied Research*. Thousand Oaks, California: Sage Publications.
- Menon, T., & Pfeffer, J. (2003). Valuing Internal vs. External Knowledge: Explaining the Preference for Outsiders. *Management Science*, 49(4), Special Issue on *Managing Knowledge in Organizations: Creating, Retaining, and Transferring Knowledge*, 497-513.
- Nelson, R., & Winter, S. (1982). *An Evolutionary Theory of Economic Change*. Cambridge, Massachusetts: Harvard University Press.

- Nonaka, I. (1988a). Creating Organizational Order Out of Chaos: Self-Renewal in Japanese Firms. *California Management Review*, 30, 57-73.
- Nonaka, I. (1988b). Toward Middle-Up-Down Management: Accelerating Information Creation. *Sloan Management Review*, 29(3), 9-18.
- Nonaka, I. (1991). The knowledge creating company. *Harvard Business Review*, 69, 96-104.
- Nonaka, I. (1994). A Dynamic Theory of Organizational Knowledge Creation. *Organization Science*, 5(1), 14-37.
- Nonaka, I., & von Krogh, G. (2009). Tacit Knowledge and Knowledge Conversion: Controversy and Advancement in Organizational Knowledge Creation Theory. *Organization Science*, 20(3), 635-652.
- Nonaka, I., Byosiére, P., Borucki, C., & Konno, N. (1994). Organizational Knowledge Creation Theory: A First Comprehensive Test. *International Business Review*, 3(4), 337-351.
- Nonaka, I., Toyama, R., & Konno, N. (2000). SECI, Ba and Leadership: a Unified Model of Dynamic Knowledge Creation. *Long Range Planning*, 33, 5-34.
- Nonaka, I., von Krogh, G., & Voelpel, S. (2006). Organizational Knowledge Creation Theory: Evolutionary Paths and Future Advances. *Organization Studies*, 27(8), 1179-1208.
- Polanyi, M. (1966). *The Tacit Dimension*. Garden City, New York: Doubleday & Company, Inc.
- Reed, J., & Payton, V. (1997). Focus groups: issues of analysis and interpretation. *Journal of Advanced Nursing*, 26, 765-771.
- Ribeiro, R., & Collins, H. (2007). The Bread-Making Machine: Tacit Knowledge and Two Types of Action. *Organization Studies*, 28(9), 1417-1433.
- Riggins, F. J., & Rhee, H. S. (1999). Developing the Learning Network Using Extranets. *International Journal of Electronic Commerce*, 4(1), 65-83.
- Saunders, M., Lewis, P., & Thornhill, A. (2009). *Research methods for business students, fifth edition*. Harlow, England: Pearson Education Ltd.
- Sim, J. (1998). Collecting and analysing qualitative data: issues raised by the focus group. *Journal of Advanced Nursing*, 28(2), 345-352.

- Song, J., Almeida, P., & Wu, G. (2003). Learning-by-Hiring: When Is Mobility More Likely to Facilitate Interfirm Knowledge Transfer? *Management Science*, 49(4) , *Special Issue on Managing Knowledge in Organizations: Creating, Retaining, and Transferring Knowledge*, 351-365.
- Starbuck, W. (1992). Learning by Knowledge Intensive Firms. *Journal of Management Studies*, 29(6), 719-740.
- Swart, J., & Kinnie, N. (2003). Sharing knowledge in knowledge-intensive firms. *Human Resource Management Journal*, 13(2), 60-75.
- Takeuchi, H., & Nonaka, I. (1986). The New New Product Development Game. *Harvard Business Review*, 64(1), 137-146.
- Tallman, S., Jenkins, M., Henry, N., & Pinch, S. (2004). Knowledge, Clusters, and Competitive Advantage. *The Academy of Management Review*, 29(2), 258-271.
- Tanriverdi, H., & Iacono, C. (1998). Knowledge barriers to diffusion of telemedicine. *Proceedings of the International Conference on Information Systems*, 19, 39-50.
- Teece, D. (2000). Strategies for Managing Knowledge Assets: the Role of Firm Structure and Industrial Context. *Long Range Planning*, 33, 35-54.
- Teece, D. J., Pisano, G., & Shuen, A. (1997). Dynamic Capabilities and Strategic Management. *Strategic Management Journal*, 18(7), 509-533.
- Turner, K. L., & Makhija, M. V. (2006). The role of organizational controls in managing knowledge. *Academy of Management Review*, 31(1), 197-217.
- Ulrich, D. (1998). A new mandate for human resources. *Harvard Business Review*, 41(1), 124-134.
- von Hippel, E. (1988). *The Sources of Innovation*. Oxford, New York: Oxford University Press.
- von Krogh, G. (1998). Care in knowledge creation. *California Management Review*, 40(3), 133-154.

# Appendices

## A.1. Interview protocol

Five groups of around three respondents will be subjected to semi-structured interviews lasting around 30-45 minutes. The semi-structured nature of the interviews allows the interviewer to change the order of the interview topics, based on the flow of the interview. Particular questions may be skipped if the topic has been sufficiently discussed following a prior interview question.

The respondents' job descriptions and tenure will be registered at the start of each interview. The interviews will be recorded using a digital audio recording device and hand written notes will be taken to help in reconstructing the vital parts of the discussions after the interviews have been conducted. The interviews will not be transcribed in their entirety.

Prior to the interview the respondents will receive a list of discussion topics. At a later stage they are granted the opportunity to critique the transcriptions to make sure they are comfortable with the quotes that are published in the paper.

The interview outcomes will be used to support claims about the applicability of Nonaka's Hypertext organisational model and form a basis upon which conclusions are drawn about the value of the model. The exploratory nature of the study implies that these conclusions hold limited external validity.

The interviews are divided into four segments. The first part will focus on the current method of knowledge creation at the case company. These questions will be used to form a context with which the Hypertext model can be compared and create awareness of the current paradigm.

Between the first and second part of the interview a brief explanation of the Hypertext model will be provided to prepare the interviewees for the upcoming discussion topics. This explanation will cover the four modes of knowledge creation and the three-layered organisation design. The questions in part two will cover the Hypertext model with certain depth. The respondents are asked to provide their opinions and expectations on the model's underlying principles. The outcomes of this part will be used as exploratory assessment of the value of the model's foundations.

After establishing some familiarity with the Hypertext model and its fundamentals, the third part of the interview will cover the expectations of value and applicability of the Hypertext model at the case company. The questions in part three are formulated to resemble the questions in part one, to allow an easy comparison between the existing model for knowledge creation and the Hypertext model. The fourth and final part of the interview serves as an opportunity for the interviewees to express

their thoughts on the topic in a general sense, or elaborate on aspects which were not covered by the interview questions.

*Part I – The knowledge creation methods currently in use at the case company. (Limited to 10 minutes)*

Introductions and formalities will be limited to thanking the interviewees for participating in the research, a brief introduction of the topic and an explanation of the relevance of this research to the case company. A sense of familiarity and trust between the interviewees and interviewer is assumed to exist based on the interviewer having been employed at the case company in the years prior to the study and as a result having an informal relation with the interviewees.

1. Explain your current involvement in knowledge creation. Elaborate on motivating factors, context and how newly created knowledge is made available to the rest of the organisation.
2. Explain why the current system of knowledge creation is a suitable, or unsuitable, system for the organisation. Elaborate on how it fits the organisation's requirements for knowledge creation.
3. How do you think the current system of knowledge creation should be amended to increase its fit with the organisation's requirements?
4. How do you think the current system of knowledge creation should be amended to increase the knowledge creation output?

*Part II – Familiarising the respondents with the mechanics of the Hypertext model, and assessing the value and applicability of the model's underlying principles. (Limited to 15 minutes)*

After briefly explaining the Hypertext model, the second part of the interview focuses on expectations about an implementation of the model at the case company. The questions will be presented using schematic representations of the four modes of knowledge creation and the three-layered organisation design. These drawings are expected to assist in explaining the model and

5. What are your expectations of using triggering mechanisms (self-organising teams, dialogue, coordination and documentation, and experimentation) to facilitate the sequence of knowledge conversion modes? Elaborate on which mode(s) of knowledge creation you think to be the closest to your current role in knowledge creation. Are you optimistic or pessimistic

about particular modes of knowledge creation? (Socialisation, externalisation, combination, internalisation)

6. Why do you think knowledge creation in self-organising teams can be a success or failure? This question focuses on the processes of socialisation and externalisation. Discuss expectations surrounding the roles of top management and middle management, creative chaos, autonomy, self-transcendence, redundancy of information, cross fertilisation, and informal face-to-face communication.
7. Why do you think knowledge creation under typical top-down management can be a success or failure? This question focuses on the processes of combination and internalisation. Discuss expectations surrounding the roles of top-down directives, low uncertainty, measurable criteria, sequential (relay pattern) information flows between organisational layers, low personal interaction with information, top management's distance from shop floors and the creation of visionary concepts at the organisational level.
8. What is your position on the storage of newly created knowledge in a central organisational knowledge repository? What do you think are the shortcomings and advantages of this approach? How would you improve the usability of a central organisational knowledge repository? How would you increase the effectiveness of using a central organisational knowledge repository?

*Part III – The expected applicability and value of the Hypertext model. (Limited to 10 minutes)*

9. Discuss how you expect your involvement in knowledge creation to change, if this model is implemented. Elaborate on motivating factors, context, how newly created knowledge is made available to the rest of the organisation and if you think this a positive or negative development.
10. Explain why the Hypertext model can be a suitable, or unsuitable, system of knowledge creation for the organisation. Elaborate on how you think it will fit the organisation's requirements for knowledge creation.
11. How do you think the Hypertext model should be changed to increase its fit with the organisation's requirements?
12. How do you think the Hypertext model should be changed to increase the knowledge creation output?
13. After discussing these topics, how would you judge the Hypertext organisation model in terms of value and applicability?



*Part IV – Ending the interview. (Unlimited)*

14. I don't have any other questions; is there anything you want to add with regard to the topic of organisational knowledge creation?

## A.2. Interview briefing

This document was sent to respondents in preparation for the interviews. It serves to inform the interviewees of the reason for inviting them to participate in this research, the research goals, the relevancy to the case company, and the discussion topics. It is written in Dutch because all respondents are of the Dutch nationality.

*Voordat ik begin wil ik jullie alvast heel hartelijk danken voor jullie deelname en moeite. Ik stel het enorm op prijs dat jullie tijd hebben willen vrijmaken om mij te helpen met wat insider-ideeën!*

*Het doel van deze briefing is om de respondenten te informeren over de achtergrond van mijn afstudeeronderzoek, voor te bereiden op het onderwerp van het interview en afbakeningen te bieden. Lees dit document dus even door, zodat je voorbereid bent op het interview en ook exact weet wat je na afloop van het interview kunt verwachten.*

*Zoals jullie wellicht al wisten, hoop ik binnenkort mijn masterstudie Business Administration – HRM af te ronden. Hiervoor is het noodzakelijk dat ik een onderzoek doe, waarover een thesis wordt geschreven. Als ik mijn onderzoeksuitkomsten succesvol kan verdedigen bij een colloquium, behaal ik mijn bul.*

*Sinds ongeveer tweeëneenhalf jaar ben ik bezig met een onderzoek naar kenniscreatie in organisaties. Hierbij onderzoek ik de praktische waarde en toepasbaarheid van het “Hypertext organisation model” van Nonaka (1994). Dit is binnen mijn vakgebied een bekend model dat voorstelt om de organisatiestructuur aan te passen aan het type kenniscreatie dat binnen de organisatie plaatsvindt. Ik heb een mening over dit model en ik wil mijn mening ondersteunen met een theoretische uiteenzetting van tekortkomingen en een case-study waaruit moet blijken hoe het model verbeterd kan worden.*

*[Het bedrijf] vervult binnen mijn onderzoek de rol van praktijkorganisatie waarbinnen ik mijn ideeën wil toetsen. Jullie antwoorden kunnen dus worden gebruikt als bewijs voor de conclusies die ik op theoretische basis wil trekken. Ook kunnen ze worden ingezet om aanbevelingen voor verbetering te doen. De waarde van mijn onderzoek voor [het bedrijf] is hierdoor minimaal. De mensen die deelnemen aan mijn onderzoek worden zich beter bewust van hoe kenniscreatie bij [het bedrijf] plaatsvindt en kunnen wellicht de aanzet geven voor een optimalisering bij [het bedrijf]. Er zal echter geen plan komen waarmee [het bedrijf] meteen aan de slag kan.*

*Het is vanwege deze beperkte waarde voor [het bedrijf] en de theoretische inslag waarmee ik het onderzoek uitvoer, dat mijn onderzoek geen opdracht van [het bedrijf] is. Dit houdt in dat*

*jullie de tijdsbesteding van dit onderzoek niet kunnen boeken. Dit maakt dat ik nog meer dankbaar ben in jullie richting, omdat het dus eigenlijk vrije tijd is waarin jullie je dienstbaar opstellen!*

*De interviews worden uitgevoerd in groepsgesprekken waarvoor ik ongeveer drie respondenten per groep heb uitgenodigd. Van deze respondenten is er altijd minstens één relevante manager aanwezig. Ik zoek de respondentengroepen binnen de projectteams van [het bedrijf] omdat ik op deze manier een basisniveau van teamgevoel verwacht en omdat mijn vragen voor een deel zullen gaan over het werken in flexibele teams. Er zijn nog een hele lijst aan methodologische keuzes die ertoe leiden dat ik groepsinterviews wil ga uitvoeren, waar ik nu niet op uitweidt. Als ik jullie hier teveel over vertel, kan het namelijk de uitkomsten van de interviews beïnvloeden.*

*De interviews zullen worden opgenomen met een geluidsrecorder. Ook zal ik met de hand notities nemen van wat er gezegd is. Hierna werk ik een gedeelte uit in de vorm van nuttige of bijzondere passages die ik wil meenemen in mijn thesis. Jullie worden van te voren gevraagd of je nog steeds achter bepaalde uitspraken staat, alvorens ik jullie woorden publiceer in mijn paper. Ik wil namelijk niet dat jullie het gevoel krijgen dat ik jullie woorden verdraai. Tenslotte is het nuttig om even op te merken dat ik de naam van [het bedrijf] niet noem in mijn thesis en dat ook jullie namen gecodeerd worden, waardoor het voor outsiders lastig is om vast te stellen wie er aan het onderzoek hebben deelgenomen. De teamnamen zoals “Fronteers” of “Special Forces” kunnen in de uitwerking worden gebruikt om respondenten te kunnen identificeren.*

*De interviews zijn verdeeld in drie delen, met een slotvraag. In het eerste deel (geplande duur: 10 minuten) zal ik het onderwerp even introduceren en stel ik vier vragen over hoe kennis op dit moment wordt gecreëerd bij [het bedrijf]. Het gaat dan over ideeëngeneratie, hoe deze ideeën tot stand komen en hoe kennis wordt gedeeld zodat iedereen hier beter van kan worden. Concreet gaan de vragen over:*

- 1. Wat is jouw rol in kenniscreatie?*
- 2. In hoeverre denk je dat de methode van kenniscreatie past bij de organisatie?*
- 3. Hoe zou je deze methode willen aanpassen om het beter te laten aansluiten met de kennisbehoeften van de organisatie?*
- 4. Hoe zou je het willen aanpassen om meer ideeën te kunnen genereren met dezelfde mensen?*

*In het tweede deel van het interview (geplande duur: 15 minuten) introduceer ik jullie aan het Hypertext model en de fundamenteen waarop dit model rust. Omdat het nogal een complex model is, zal ik proberen het zo helder en aantrekkelijk mogelijk te brengen. Een tipje van de sluier kun je vinden op pagina 3 van deze briefing. Eigenlijk wil ik jullie de basics in minder dan drie minuten kunnen uitleggen. Op basis van deze uitleg ga ik onder andere de volgende vragen stellen:*

- 5. Wat vind je van het gebruik van triggers om de vier modi van de kennispiraal in gang te zetten?*
- 6. Hoe sta je tegenover kenniscreatie in zelfsturende teams? Hierbij gaat het met name over de processen socialisation en externalisation.*
- 7. Hoe sta je tegenover kenniscreatie in een top-down managementstructuur? Hierbij gaat het met name over de processen combination en internalisation.*
- 8. Wat vind je van een gecentraliseerde kennis-databank, waar nieuwe kennis in wordt opgeslagen en waarop aanspraak kan worden gedaan als je iets wilt opzoeken dat al eerder is gedaan?*

*Het derde deel van het interview (geplande duur: 10 minuten) gaat over het model in zijn geheel en hoe het te vergelijken is met hoe kennis wordt gecreëerd bij [het bedrijf]. Met de discussie die is ontstaan in vraag 5 t/m 8 zul je over voldoende basiskennis van het model beschikken om de volgende vragen te kunnen beantwoorden:*

- 9. Als het Hypertext model wordt ingevoerd bij [het bedrijf], hoe denk je dat jouw rol in kenniscreatie zal veranderen?*
- 10. In hoeverre vind je het Hypertext model een toepasselijke manier van kenniscreatie voor [het bedrijf]?*
- 11. Hoe zou je het Hypertext model willen aanpassen om het beter te laten aansluiten met de kennisbehoeften van de organisatie?*
- 12. Hoe zou je het Hypertext model willen aanpassen om meer ideeën te kunnen genereren met dezelfde mensen?*
- 13. Terugkijkend op wat we hebben besproken in de vorige twaalf punten; wat is jouw mening over de waarde en toepasbaarheid van het Hypertext model voor kenniscreatie binnen [het bedrijf]?*
- 14. Afsluiting; als je nog iets wilt toevoegen dat niet aan bod is gekomen tijdens het interview, dan kan dat hier.*

Zoals aangegeven een korte uitleg van het Hypertext model, waarover vragen 5 t/m 13 gaan:

Kennis wordt gezien als een ontastbare resource die de organisatie aanwendt om waarde te creëren. Een belangrijk verschil tussen kennis en andere resources is dat kennis zich bij overdracht vermeerderd in omvang, terwijl andere resources in een transactie niet groeien. Kennis kan hierbij twee vormen aannemen, explicit of tacit. Explicit kennis is alle kennis die je met relatief gemak onder woorden kan brengen, kan opschrijven, of kan overdragen met gebruik van taal of symbolen. Tacit kennis is kennis die niet zo gemakkelijk over te dragen is met behulp van taal of symbolen. Fingerspitzengefühl of intuïtie zijn vormen van kennis die in zakendoen vaak belangrijk zijn, maar niet gemakkelijk uit te leggen zijn aan anderen.

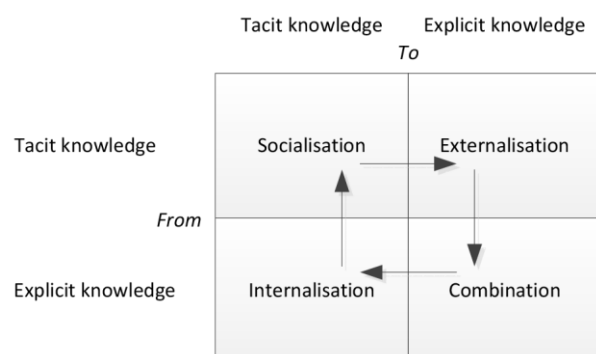
Kenniscreatie wordt gezien als een proces waarbij kennis wordt overgedragen aan anderen, waarbij het schommelt van explicit naar tacit en weer terug. Dit proces wordt de spiraal van kenniscreatie genoemd. Hierin zijn vier fasen te onderscheiden, socialisation, externalisation, combination en internalisation. In socialisation wordt tacit kennis overgedragen, waarbij nieuwe tacit kennis ontstaat. Dit gebeurt door gedurende lange tijd ervaring op te doen met het toepassen van de kennis, zoals in de setting van een leermeester-leerling relatie, welke in oude ambachten gebruikelijk is.

In externalisation wordt tacit kennis overgedragen, waarbij nieuwe explicit kennis ontstaat. Dit proces kan plaats hebben als er in een open discussie wordt gesproken over de tacit kennis van de afzender en hierbij gebruik te maken van metaforen en analogieën om de tacit kennis onder woorden te kunnen brengen. De dialoog tussen afzender en ontvanger is hierbij noodzakelijk om de inhoud van het bericht in stand te houden. De ontvanger kan daarna zelf een betekenis geven aan het bericht en is dan ook in staat om de tacit kennis te coderen in de vorm van taal of symbool. De kennis die dan ontstaat, is niet langer tacit, maar explicit.

In combination wordt explicit kennis overgedragen, waarbij door een combinatie met andere explicit kennis, nieuwe explicit kennis ontstaat. Dit is te beschrijven als het synergetische effect dat kan ontstaan wanneer

verschillende kennisbronnen worden gecombineerd tot een nieuwe kennisbron. Deze nieuwe bron heeft dan een grotere waarde dan de som van de delen waaruit de bron is opgesteld. Een concreet voorbeeld van kenniscreatie door middel van combinatie is het samenwerken van een interactie-

**Figuur 1: Spiraal van kenniscreatie**



ontwerper met een front-end en back-end developer om een site te bouwen. Afzonderlijk hadden ze ook tot innovatieve resultaten kunnen komen, maar ze tezamen is hun resultaat waarschijnlijk nog veel beter.

De vierde fase, internalisation, is te vergelijken met de meest traditionele vorm van kennisoverdracht, met behulp van schoolboeken. Als je iets leest in een boek, interpreteer je de nieuwe kennis met behulp van jouw eigen ervaringen en eerder opgedane kennis.

Onbewust leg je dan verbanden tussen wat je leest en wat je al wist. Deze factoren tezamen maken dat je tot nieuwe, gecombineerde kennis komt die specifiek is voor jouw eigen interpretatiekader. Deze nieuwe kennis is tacit van aard.

De spiraal van kenniscreatie wordt gevormd door deze vier fasen in een volgorde te plaatsen. Kennis beweegt dan langs elk van de vier fasen en groeit in omvang bij elke keer dat het wordt overgedragen aan anderen (zie de figuur 1).

Het Hypertext model neemt deze vier fasen van kennisontwikkeling als uitgangspunt en zegt dat de fasen socialisation en externalisation het beste tot uiting komen in een flexibele organisatiestructuur met zelfsturende teams. De middelmanagers (of projectleiders, in het geval van [het bedrijf]) hebben hierbij de rol van communicatieknooppunt tussen de innoverende uitvoerende medewerkers en de topmanagers die de algemene richting van de organisatie uitstippelen, maar zich inhoudelijk niet al te sterk bemoeien.

Daar tegenover staat dat combination en internalisation waarschijnlijk het beste kan plaatsvinden in een meer gelaagde organisatiestructuur waarbij sprake is van top-down bestuur. Het hoger management is dan verantwoordelijk voor het uitzetten van duidelijke richtlijnen en het wegnemen van onzekerheden, zodat de uitvoerende medewerkers exact weten waar ze aan toe zijn.

Het Hypertext model stelt daarom voor dat organisaties moeten kunnen switchen tussen deze twee structuren, naar gelang het type kenniscreatie dat plaatsvindt binnen het bedrijf. Hierbij wordt de organisatie als een drielaags systeem gezien (zie figuur 2) met in de basis een centraal opslagsysteem van kennis, een hiërarchisch systeem en een flexibel systeem.

**Figuur 2: Hypertext model voor kenniscreatie in organisaties**

