Cycling in a connected world:

Utlizing the SECI cycle of knowledge creation to construct a social media method for high-tech SMEs

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Abstract

A dynamic environment such as the technological industry often causes firms to give priority to knowledge and the managing of this knowledge. However, a first important step in the managing of knowledge is the creation of it. Since small- and medium enterprises have a lack of internal resources, managers of these firms are more often resulting to informal ways to create the knowledge they need. With the rising volume of web-based applications such as social media, it remains the question whether these applications can aid these managers in this knowledge creation process. Previous studies have reported that this is certainly possible, but much of this research has been descriptive in nature. From the practical side, managers are aware that social media has value but this remains unexplored due to a lack of knowledge and/or time. Therefore the purpose of this research is to bridge this gap in literature and practice by using the knowledge creation model developed by Nonaka and Takeuchi (1994), the SECI cycle of knowledge creation. A design science research approach is taken, to systematically combine the academic literature with the practical needs of companies. The current literature on the SECI cycle in an online environment is reviewed to form requirements, which are used to systematically search through the social media literature. The study finds that the 3M-Framework of Gallaugher and Ransbotham (2010) is most suited to meet these requirements. However, the main drawback of the framework is its metaphoric nature, so this is tackled through analogies that result in two social media phases of distribution and extraction. These two social media phases are modeled into a new method (SM-SECI) that includes the use of a log file for distribution and the use of tags for extraction. To empirically expand SM-SECI, three case studies were conducted at high-tech SMEs. The main observations made that were not supported by SM-SECI were a lack of coordination, use of tools which cause for distraction and a lack of interaction. The lack of interaction was examined further through a second design cycle which proposed that the log file can be kept in Microsoft Excel and that interaction can be monitored using NodeXL. The results of this study broaden our understanding on the social media phenomenon by providing a distinctive perspective. Moreover, the results reinforce the utility of the SECI cycle in a practical high-tech SME context.

Keywords: knowledge creation, SECI, social media, high-tech SMEs.

Dutch abstract

Een dynamische omgeving zoals de technologische industrie heeft vaak als gevolg dat bedrijven prioriteit geven aan kennis en het managen van deze kennis. Een belangrijke eerste stap in het managen van kennis is het creëren hiervan. Doordat midden- en kleinbedrijven een gebrek aan interne middelen hebben, zijn managers vaak geneigd deze kennis via wat meer informele wegen te creëren. Met het stijgend aantal web-applicaties zoals sociale media blijft het de vraag of deze applicaties enige nut bieden voor deze kenniscreatie. Eerdere studies hebben beweerd dat dit zeker mogelijk is, maar veel van dit onderzoek is beschrijvend in aard. Aan de praktische kant valt op dat managers wel bewust zijn van de waarde van sociale media, maar dat dit niet verder wordt bestudeerd door een gebrek aan kennis en/of tijd. Hierdoor is het doel van dit onderzoek om deze kloof in literatuur en praktijk te overbruggen met behulp van de kenniscreatie model ontwikkeld door Nonaka en Takeuchi (1994), de SECI cyclus van kenniscreatie. Er wordt gebruik gemaakt van een ontwerpgerichte benadering om systematisch de academische literatuur te combineren met praktische behoeften van bedrijven. De huidige literatuur over de SECI-cyclus in een online-omgeving wordt bestudeerd om eisen op te stellen, die worden gebruikt voor het systematisch zoeken in de sociale media-literatuur. Zo wordt er gevonden dat het 3M-kader van Gallaugher en Ransbotham (2010) het meest geschikt is om aan deze eisen te voldoen. Het model is echter te metaforisch in aard, waardoor analogieën worden gebruikt om de kern te bestuderen, wat resulteert in twee sociale media fasen: distributie en extractie. Deze twee fasen worden gemodelleerd in een nieuwe methode (SM-SECI) waarin het gebruik van een log voor distributie en het gebruik van een tag voor extractie centraal staan. Om deze methode empirisch uit te breiden, zijn semigestructureerde interviews gehouden bij drie technologische MKBs. De hoofdobservaties die bij deze bedrijven zijn gedaan waar SM-SECI geen toevoeging aan biedt zijn een gebrek aan coördinatie, gebruik van tools wat vaak tot afleiding leidt en een gebrek aan interactie. Het gebrek aan interactie op sociale media werd verder onderzocht, waarbij werd voorgesteld dat het logbestand in Microsoft Excel gehouden kan worden en NodeXL opties biedt om de interactie op sociale netwerken te meten. De resultaten van deze studie geven een nieuw perspectief aan op het gebruik van sociale media en zorgen ervoor dat de waarde van de SECI cyclus bevestigd wordt in een praktische technologische MKB context.

Steekwoorden: kenniscreatie, SECI, sociale media, technologische MKB.

Preface

This thesis makes up the final element in my bachelor studies Industrial Engineering and Management. If I look back on these three years, I am happy to say that I really shaped my own learning, and in doing this I experienced the real value of developing myself into a researcher and working on my own critical thinking. This of course was facilitated by the exceptional learning environment I perceived at this university.

The eagerness in me to learn translates to my interest in the research field of knowledge management and how companies can shape and master such a complex process. The writing of this thesis was not possible without the help of a few individuals. First and foremost, I want to thank my supervisor, Fons Wijnhoven, for his sharp eye for detail and valuable guidance in staying focused and on track. I was amazed at how much I could learn from him in such a short time. I also want to thank my second supervisor, Tom de Schryver for his excitement on wanting to add his expertise in evaluating this piece. Of course a thank you word is in place for the managers who cooperated with their time and the knowledge on their companies.

But most of all, I think I would be nowhere without the help of my mother who always knows what to tell me and how to motivate me to complete my goals in life. I also want to give a special thank you to my friends, whom were always there when needed and always strongly believed in my capabilities. I am convinced to go from the bachelor to the master as a developed student and am excited for what the future holds for me.

The content in this thesis is an original product of the author,

Daury Jansen

July 10nd 2014

Enschede

List of figures and tables[1]

[1] Each table and figure includes a source, with the citing of a particular article from which the table or figure was taken or the words 'own table' or 'own figure' to indicate original content produced by the author of this thesis.

Contents

1 INTRODUCTION

In order to understand the contribution that this research is aimed at providing to both the academic and the practical business field, it is necessary to understand the background on which this research resides, the problem statement from which the research is initialized, the corresponding research questions and the structure of the thesis.

1.1 Research background

As today's markets become highly dynamic and competitive, many scholars have opted to provide models for the complex process of organizational learning. The complexity of this process stems from the observation that organizational learning is a multi-level process that involves the individual, the group and the organization (Crossan, Lane & White, 1999). The interactions between these levels is what is supposed to produce knowledge for the organization (Nonaka & Takeuchi, 1994), but what do we mean exactly by the term knowledge? There are two fundamental approaches that one can adopt to knowledge, namely, subjectivism and objectivism (Wijnhoven, 2008). As Wijnhoven (2008) sums up, subjectivism assumes that knowledge is connected to an individual and is thus person-dependent, while objectivism is person-independent and assumes that knowledge can be formalized or scientifically validated. In adopting one of these views towards knowledge, terms such as data and information are often mentioned, as these two concepts form the foundation of knowledge (Nissen, 2002). Data can be seen as objective and includes for instance observations, symbols and facts. This data becomes information when it is meaningful, true and relevant for the pragmatic function of information, which is to make decisions and solve problems (Wijnhoven, 2012). However, we can only refer to knowledge when this information is contextualized, meaning when it is made specific to a certain situation (Wijnhoven, 2008). Knowledge is therefore what we could call personalized information (Alavi & Leidner, 2001) and involves the use of information to form a justified and true belief (Nonaka & Takeuchi, 1994).

In the process of personalizing information, or making sense out of it, Polanyi (1966) noted that two important distinctions exist in our knowing, the tacit and the explicit. The famous quote often used to describe this distinction is that we know more than we can tell. The part that we can tell is what Polanyi (1966) referred to as explicit knowledge, while the part that we cannot tell is what he referred to as tacit knowledge. If tacit knowledge cannot be told or easily expressed, this implies that it is personal knowledge, the kind of knowledge that is not exposed to the outside world. However, as Wijnhoven (2012) points out, the distinction between tacit and explicit is not identical to the distinction between written or unwritten as to express includes both written and oral form. As can be deducted from this one example, there is ongoing scholarly debate regarding this classification made by Polanyi (1966). Some scholars argue that the distinction is not easily distinguishable and that knowledge should rather be distinguished by using a scale (Ambrosini & Bowman, 2001) to recognize that knowledge can also be latent (Wijnhoven, 2012). Some authors therefore argue that to limit oneself to these two types of knowledge (tacit and explicit) results in a limited view of the field of knowledge management (Cook & Brown, 1999; Ambrosini & Bowman, 2001; Gourlay & Nurse, 2005).

This debate is not uncommon, as the knowledge management field is broad, open to many interpretations. Alavi and Leidner (2001) also mention this but state that the one objective most knowledge management studies have is to support 'the creation, transfer and application of knowledge in organizations' (p. 107). As can be seen from this objective, if knowledge were to be managed it first needs to be created, an observation which was highly elaborated upon by Nonaka and Takeuchi (1994). The work of Nonaka and Takeuchi (1994) highlights the way in which organizations create knowledge, which occurs along the epistemological dimension and the ontological dimension.

Towards the epistemological dimension, Nonaka and Takeuchi (1994) supported the views of Polanyi (1966) by stating that knowledge can be either tacit or explicit. The ontological dimension remains as explained before, since all organizational knowledge starts at the individual level, moving to the group and ultimately to the organization. Interplay between tacit and explicit knowledge occurs according to Nonaka and Takeuchi (1994) through four modes, which they refer to as socialization (tacit to tacit), externalization (tacit to explicit), combination (explicit to explicit) and internalization (explicit to tacit). These modes are abbreviated to form the acronym SECI, which if repeated forms a continuous cycle causing organizational knowledge to be amplified from the individual to the group to the organization. Such a cycle starts with a *socialization* stage, in which the sharing of tacit knowledge occurs. According to the theory of Nonaka and Takeuchi (1994), this tacit sharing of knowledge is facilitated by face-to-face interactions, the sharing of experiences and observations. The focus element in this mode is acquiring know-hows in order to build common mental models, such as an organizational culture. However, this amplification of tacit knowledge still remains tacit, meaning it still needs to be put into a form through which it can shared. That is why one finds the *externalization* mode, in which the mental models are rationalized by successive rounds of meaningful dialogue. This dialogue is created by using metaphors, which enable individuals to imagine and to learn intuitively. If contradictory elements are found through the use of metaphor, a commonality can be found through the use of analogy. Once individuals have created concepts that they can express, this knowledge can be captured and *combined* with other sources of existing explicit knowledge. According to Nonaka and Takeuchi (1994), combination is triggered by coordination between team members and the documentation of existing knowledge. This combination is often done through for instance filtering, sorting, adding or reconfiguring existing data in order to build a new expanded form of a knowledge system. The last stage of their model*, internalization*, is about making explicit knowledge part of one's routines and know-hows, which is mainly done by learning and reflection. Nonaka and Takeuchi (1994) argue that this stage is triggered by experimentation or learning by doing. This means that individuals should experiment with explicit knowledge, but should also reflect upon this knowledge in order to translate into their know-hows.

Central to the knowledge creation is the dynamic shared context, which Nonaka and Takeuchi (1994) refer to as 'ba', meaning place in Japanese. In the socialization stage this refers to a place of origin, in the externalization phase it is a place of interaction and dialogue, in the combination phase we find a cyber ba, while the internalization phase features an exercising ba or a place to practice what has been learned. This thesis uses the theory of Nonaka and Takeuchi (1994) since it is widely known in the knowledge management literature and is starting to gain a solid base of empirical

support based on its effectiveness and implementation. As can be seen in the following section, it provides a suitable solution to the problem statement expressed in this thesis.

1.2 Research initialization

1.2.1 Problem statement

While knowledge is important to many firms, this is particularly true of the technological industry, where it is often the main source of competitive advantage. The industry is often characterized by low product life cycles and thus large investments in research & development. Therefore a firm in this industry must be continuously focusing on innovation. Zooming in on the word innovation, one might ask whether this is not the same as knowledge creation. Popadiuk and Wei Choo (2006) provide the answer by defining innovation as the generation of ideas and the implementation of these ideas to produce value, while knowledge creation involves the sharing of mental, emotional and active knowledge. The key distinction thus comes from the observation that knowledge creation precedes innovation, or as Nonaka and Von Krogh (2009) argue that ensuring knowledge creation allows a firm to generate product and process innovation.

The management of both internal and external knowledge is therefore a crucial task for a business in the technological industry. While larger firms often have formal practices for managing this knowledge, this is not always the case in small- and medium enterprises (SMEs) as these firms have significantly different characteristics and cannot be seen as scaled-down versions of larger enterprises (Sparrow, 2001). The main characteristic of SMEs often mentioned in literature is their lack of resources (Hutchinson & Quintas, 2008; Sparrow, 2001; Löwik, 2013). While larger firms may also lack resources, this is distinctive for small- and medium enterprises as they have to prioritize their investments and efforts (Sparrow, 2001). Nevertheless, in their approach towards knowledge we find few management layers available in such firm meaning the formation of close relationships is facilitated and internal knowledge is often created through socialization (Desouza & Awazu, 2006). Externalization, combination and internalization efforts usually occur through the manager (Desouza & Awazu, 2006), who is often also found to play a key role in the knowledge processes occurring in such firms (Hutchinson & Quintas, 2008).

In order to execute the knowledge creation process, these managers often find themselves resorting to more informal sources. With formal one can for instance think of traditional market research or formal knowledge management activities such as a course or a seminar. Nevertheless, these informal sources often present themselves as informal communities or networking relationships (Delgado-Verde, Martín-de Castro & Navas-López, 2011). Interestingly enough, in the face of our contemporary connected world, one can observe how informal ways of connecting are growing as the web becomes an important part of our daily lives. This is particularly so with the rise of social media, a series of web-based applications that feature content created by the users themselves (Kaplan & Haenlein, 2010) and are low-cost solutions that are easily accessible (Hanna et al., 2011). Such applications appear to be promising tools for the creation of knowledge, since they allow for value creation both inside as outside the company (Haefliger, Monteiro, Foray & Von Krogh, 2011). Nevertheless, this

relationship is still poorly understood in the academic literature and is even less understood in practice. Some studies have attempted to link knowledge creation and social media (Wagner, Vollmar & Wagner, 2014; Chatti et al., 2007) or to model how personal knowledge or tacit knowledge is shared in such spaces (Panahi, Watson & Partridge, 2013), but these articles are limited as to how exactly information technologies should be used in accordance with the SECI cycle. One reason for this could be that we have still not grasped the full concept of organizational learning as many knowledge management models are in need of more empirical testing (De Schryver & Rosendaal, 2013). Moreover, social media presents many barriers towards its use, including a lack of time or knowledge of the tools available, in addition to the common cautions that are raised about information security (Frenken, 2013). This causes the social media literature to often be ineffective, mostly focused on promotion (Mangold & Faulds, 2009), while few studies see it as a source of information and knowledge (Crawford, 2009).

The theory of Nonaka and Takeuchi (1994) as a knowledge creation model seems valuable in bridging this gap in both research and practice as the model has been empirically tested in a variety of industries (Delgado-Verde, Martín-de Castro & Navas-López, 2011; Constandse, 2013) and has also been found to be significantly present in smaller firms (Desouza & Awazu, 2006). From this analysis one can proceed to draw up variables which have been identified as important to this study as shown in figure 1.

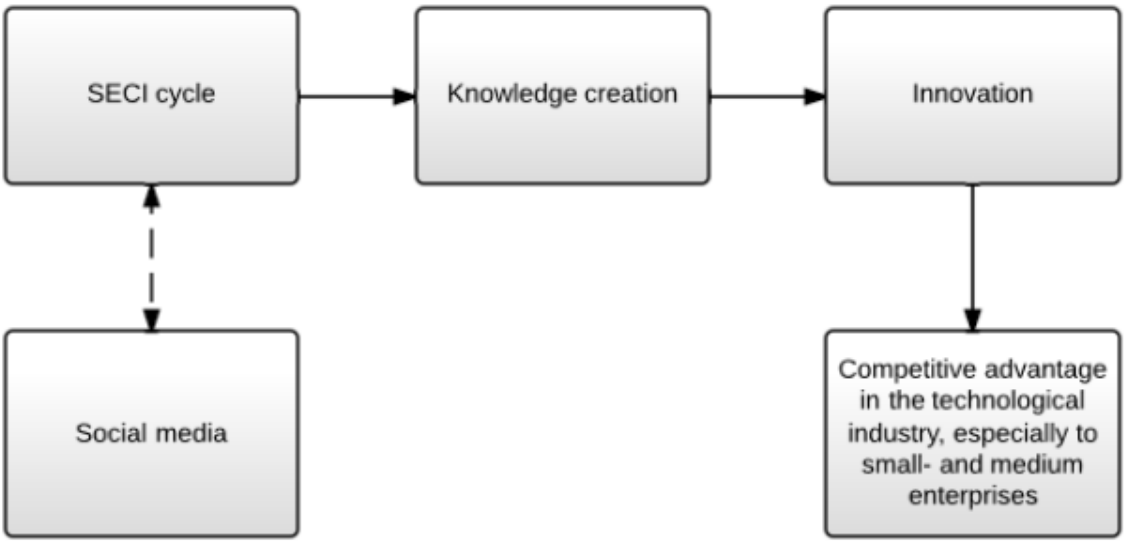

Figure 1 Causal relationships between variables (own figure)

The solid lines represent relationships established in literature, while the dotted line represents the relationship under investigation in this study. Figure 1 indicates that this thesis assumes that the SECI cycle leads to knowledge creation; therefore no other knowledge creation models are discussed. The dotted line represents the contribution that the theory of Nonaka and Takeuchi (1994) has to social media. This results in the adoption of the following problem statement in this study:

"The SECI cycle of Nonaka and Takeuchi (1994) can make a contribution to social media use, but this has not yet been studied in a high-tech SME context."

1.2.2 Research questions

The purpose of this thesis is to contribute to solving the problem statement, and it therefore maps out the contribution that the SECI cycle makes to social media use in a high-tech SME context. This is done by developing a social media method for such firms, which is designed by integrating both theoretical and practical findings into a workable solution. In order to guide the research process, the following research question is formulated:

"How can the SECI cycle of knowledge creation be used to design a social media method for high-tech SMEs?"

Since this is a broad research question, a set of four sub-questions is used. These are sequential in nature, meaning that the output of each sub-question serves as the input for the other:

a) What are the requirements set out by the SECI cycle for the creation of knowledge on social media?
b) What model for social media use best suits these requirements?
c) How can this model be integrated with the SECI cycle to form social media SECI (SM-SECI)?
d) How can SM-SECI be made useful to high-tech SMEs?

1.3 Structure of the thesis

As can be seen in the research question, a central concept in this research is that of design. This means that design will be the key activity guiding the research. Design science research (Hevner, March, Park & Ram, 2004) is therefore used and a detailed explanation of this is given in the next chapter. The structure of the thesis follows this research process, meaning that it passes through the design cycles in order to establish the final social media SECI cycle, referred to as SM-SCI.

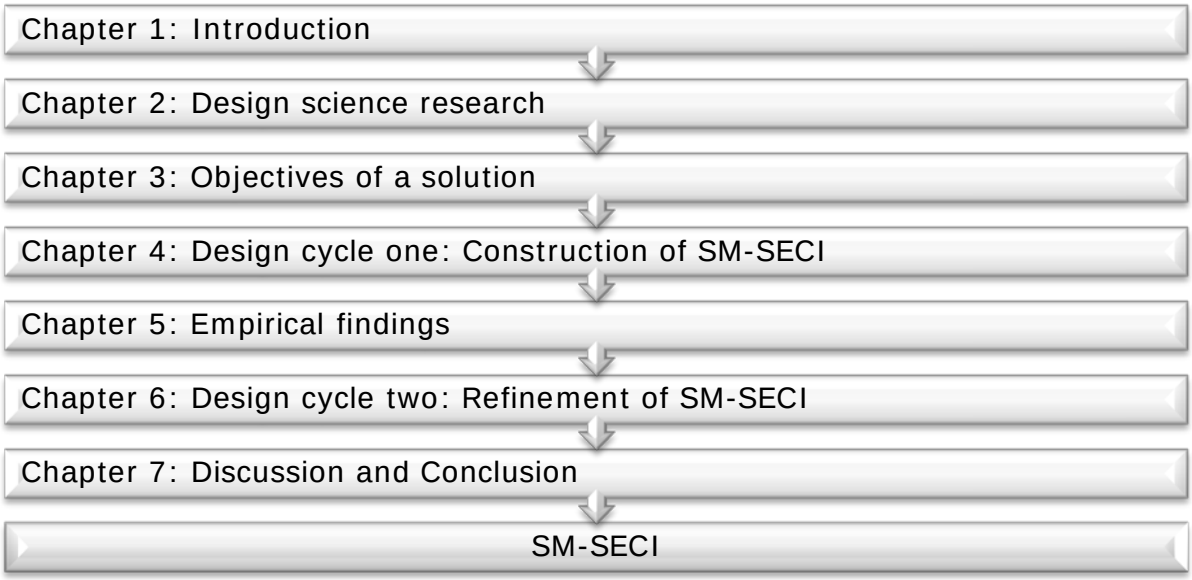

Figure 2 Thesis structure (own figure)

2 DESIGN SCIENCE RESEARCH

This chapter describes the methodology adhered to in this research. While this has been partly explained in Chapter One, this chapter further elaborates on the concept of design science research and describes how empirical data is collected and analyzed from high-tech SMEs to include in the design.

2.1 Kernel theory and cycles

This thesis is aimed at investigating an unexplored area of study by combining observations from literature and practice in order to construct a method that serves managerial use. Design science research is suitable for this type of practical research due to its relevant and rigorous nature (Hevner et al., 2004). As published in a later Chapter in the book *Design Research in Information Systems: Theory and Practice* Hevner and Chatterjee (2010) point out how their 2004 *MISQ* paper did not include an actual way for a researcher to perform design research. Therefore Hevner and Chatterjee highlight the existence of three design cycles, which are displayed in figure 3. The environment domain is mainly based on the business field and ensures a clear understanding of the people and systems involved. The knowledge base includes scientific theories which are used for the design of products and services. Both the environment and the knowledge base produce a relevance cycle and a rigor cycle respectively, which serve to inform the construction of a design cycle in which the artefact is build.

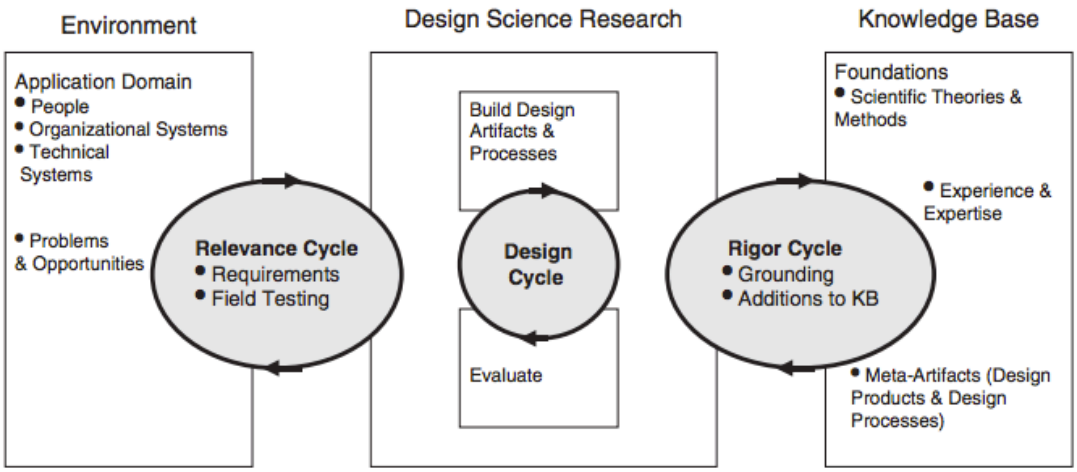

Figure 3 Design science research cycles (Source: Hevner and Chatterjee, 2010)

To ensure that the building of this artefact is done effectively, Hevner et al. (2004) propose to work with guidelines. The following is an explanation of these seven guidelines and how they have been applied in this thesis. *Guideline (1) Designing an artefact*, is achieved through the creation of the SM-SECI cycle with its corresponding design propositions, which relate to how the artefact should function (Van Aken, 2004). *Guideline (2) Stating the problem relevance,* is achieved by noting the importance of knowledge creation in the high-tech industry and the problems that arise when managing social media. Therefore, viewing social media from a knowledge creation approach is a valid study with both social and scientific relevance. *Guideline (3) Evaluating the design*, is done through three cases in which a semi-structured

interview is conducted and a social network analysis of the companies is done. *Guideline (4) Research contributions*, this is research that provides a new view on the use of social media, contributes to an under-researched area in literature and provides managers with a toolkit that can be used and implemented in daily practices. *Guideline (5) research rigor,* a clear operationalization of the SECI cycle on social media is done, a systematic literature review to find social media methods and a systematic approach to data collection and analysis. *Guideline (6) Design as a search process,* available knowledge is used while maintaining a focus on the needs of high-tech SMEs and the requirements the SECI cycle presents. *Guideline (7) Communication of the research*, the report is written for both audiences to understand, with an introductory text for each chapter that explains the structure of the chapter.

In this research the knowledge base plays a particular important role, as the research question is focused on using a scientific theory to solve a practical problem. Wijnhoven (2012) cites the work of Walls et al. (1992), which specifically goes into the how design science research should be rooted in theories. Such theories are referred to as kernel theories, which serve as input for the formation of meta-requirements (Wijnhoven, 2012). Through these meta-requirements, a researcher can remain close to a scientific base and, as Hevner et al. (2004) describe it, can adhere to the problem domain. Therefore the theory of Nonaka and Takeuchi (1994) can be seen as the kernel theory of this study, which in the next chapter is studied in the light of social media.

2.2 Case studies

On top of the knowledge base, the environment is also important to include in the design. This is done through qualitative observations, as qualitative research is focused on studying things as they are or, in other words, in their natural setting (Gibbs, 2007). The empirical analysis consists of three case studies at three high-tech SMEs. The selection of companies for the case studies was done through non-probabilistic sampling, in which companies are selected according to the criteria of a high-tech SME. This meant that they should have no more than 250 employees and use technology in their products or services. An initial total of 30 firms were contacted through email, which were mostly located in the eastern part of the Netherlands. The company was told that the study involved the development of a social media method that was constructed using knowledge creation theory; therefore this study provided a new view on the use of social media. They were told that their expertise would serve as a valuable addition to the method and that they as no other knew the obstacles which they face. The response rate to the initial mailing yielded a total of three companies, giving a response rate of 10%. To ensure the anonymity of these companies, their names are not included in this thesis, and they will henceforth be referred to as Company A, Company B and Company C. In the range of small- and medium enterprises we find medium firms having less than 250 employees, small having less than 50 employees and micro having less than 10 employees (CSES, 2012). Each one of the companies included represents a category. Company A focuses on the development of integrated mechatronics applications and has 200 employees. Company B focuses on embedded systems and has 50 employees and Company C focuses on product development and has a total of 7 employees.

Data was collected in two steps in these case studies. The first step involved an on-site visitation in which a manager was interviewed using a semi-structured interview. All interviews started with a general introduction, in which the goal of the study was explained and permission was asked to record the interview using a mobile phone. After the introduction, questions were asked to gain more knowledge about the respondent's function and the firm in general. Through a series of follow up questions, they were asked how knowledge is currently created and how social media can aid this process. The manager was also invited to provide feedback on the method or to make suggestions as to how the method could be relevant to his or her organization. An overview of the interview protocol can be found in Appendix A.1. The second step involved studying the company's social network in order to search for examples of online behavior that supported particular claims mentioned in the interviews. While using social media to directly observe a sample may be a new phenomenon in social science, this study finds it a suitable data collection technique, as the content that is published by high-tech SMEs will give us insight into their goals and the ways in which they use social media. The social network chosen for observation in this sample was Twitter, because this tool was most often mentioned in literature as a valuable source of information (Kaplan & Haenlein, 2011).

The guidelines of Gibbs (2007) were followed for data analysis of the interviews. He proposes that there are two steps in qualitative data analysis, namely, data preparation and coding. The data in these case studies was prepared by recording each interview and transcribing them using the qualitative data analysis software, Atlas.ti. After the interviews were transcribed, the coding procedure began. According to Gibbs (2007), this can be done in two ways, either through concept coding or open coding. Concept refers to the researchers drawing insights from literature in developing a coding scheme, while open coding is where the researcher is led by the interview transcript. Often researchers combine these two methods in order to analyze the data in the best possible way. This research also combined both coding procedures to produce the following steps that were taken in coding the interview transcripts:

1. A first round of coding was constructed in order to pay close attention to what the respondents were actually saying (Gibbs, 2007). In Atlas.ti, the option in-vivo coding was used, meaning that the most essential word in a line was used as a label for that particular code.
2. All the codes generated in step one was sorted according to each mode of knowledge creation, i.e. socialization, externalization, combination and internalization.
3. The codes were analyzed for patterns in order to develop normalized codes representing each mode of knowledge creation that was relevant to the respondents.

By adopting such a process of data analysis, we can ensure rigor in the coding procedure. As Gibbs (2007) points out, this ensures that the data analysis is not biased or affected by the personal opinions of the researcher, but the coding is done by staying as true as possible to what the respondents have said. The final classification of the codes according to each mode of SECI can be found in Appendix A.3.

3 OBJECTIVES OF A SOLUTION

Before constructing the SM-SECI method, it is necessary to understand the requirements of the theory on which it is based. Nevertheless, this theory has been significantly influenced by information technology. Therefore, in this chapter an understanding is formed of how information technology such as social media has influenced the SECI cycle and what this means for how our method should look like.

3.1 Challenge in operationalizing SECI

The claims as examined in Chapter One regarding the SECI cycle are all very theoretical in nature, and possibly even highly conceptual. The SECI cycle is therefore often criticized as lacking practical value (Gourlay, 2006) or as not being sufficiently operationalized to guide managerial decisions (Gourlay & Nurse, 2005). In their study, Nonaka and Takeuchi (1994) suggest that the SECI cycle should aid an organization in becoming hypertext. This means to strive for integration between the knowledge-base of the organization, the business-system layer carrying out routine operations and the project-system layer consisting of assignments or projects the company has. However, the extent to which a company can achieve such integration between these layers is questionable. Constandse (2013) agrees with this and studied to what extend a knowledge-intensive company can reach the hypertext organization as referred to by Nonaka and Takeuchi (1994). Her results indicated that a firm can indeed reach such a state, but that the four SECI modes overlap each other and can occur simultaneously. They are, moreover, not as cyclical as Nonaka and colleagues suggest.

This is where the main challenge occurs with operationalizing the SECI cycle. In a perfect world, shifts between tacit and explicit knowledge would be very easy to identify. The individual, group and organizational level would also be rather simplistic to separate. However, from a practical point of view, individuals find themselves in a dynamic context in which they interact with multiple ontological dimensions at the same time, whilst using tacit and explicit knowledge interchangeably. Von Krogh, Ichijo and Nonaka (2000) admitted that the SECI cycle lacked such practical rigor, and published a book titled *Enabling Knowledge Creation.* In this book, they dug deeper into the process involved in the creation of knowledge and identified five steps that should be taken to ensure knowledge creation. These are the sharing of tacit knowledge, the creation of concepts, the justification of concepts, the building of a prototype and the cross levelling of knowledge. The sharing of tacit knowledge is closely related to socialization, in which individual knowledge is enlarged through social interactions. The justification of concepts shares properties with externalization in which concepts are created to serve for a conversion of tacit knowledge to explicit knowledge. The justification of concepts however has more properties with internalization, as an organization has to determine whether the concept that it has created is worth pursuing. After such an internalization stage, the firm can proceed to build an archetype, which is for instance a system or a prototype. The last phase involves the cross-levelling of knowledge in which knowledge is mobilized to either a group, the whole organization or to parties outside the organization.

One can clearly see that many SECI modes are present in such a process. But it is certain that the centre of knowledge creation lies in the interplay between the creation of concepts (externalization) and the crystallization of those concepts (internalization)

(Nonaka and Takeuchi, 1994). An organization thus learns as it is constantly externalizing and internalizing, which is also shown in figure 4.

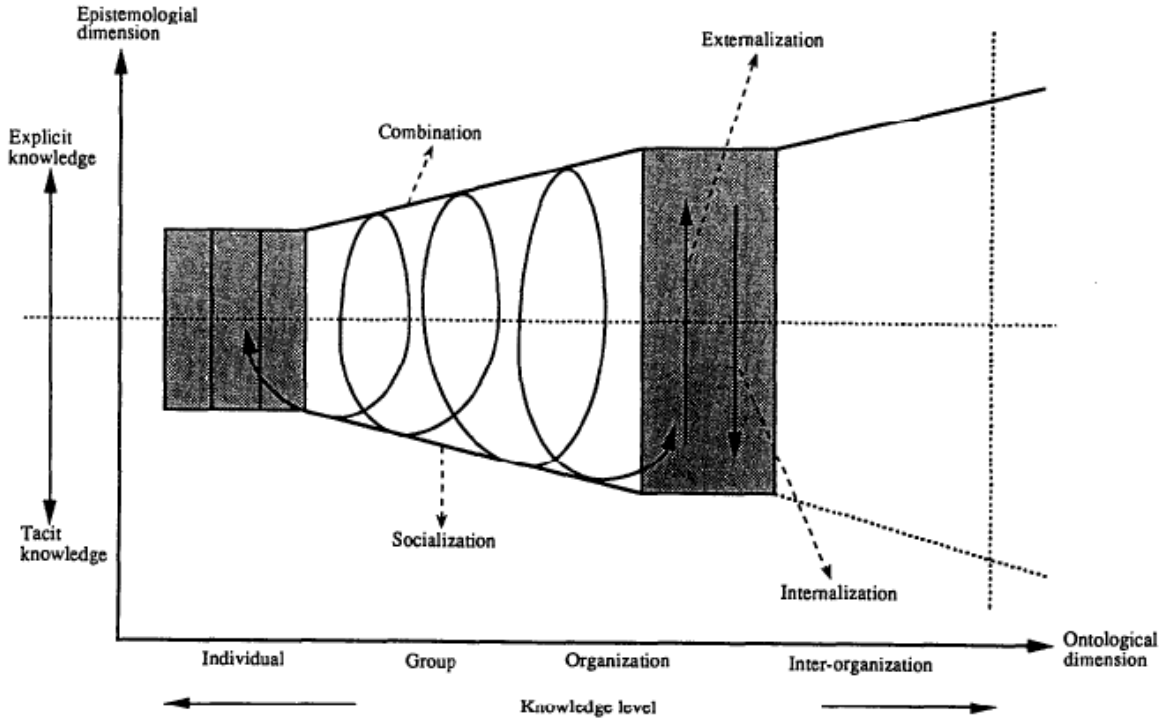

Figure 4 Spiral of knowledge creation (Source: Nonaka and Takeuchi, 1994)

3.2 SECI meets social media

Tremendous changes have occurred over the past few years in the World Wide Web, as the internet has grown from one stream way of information (Web 1.0) to a high level of social interactions (Web 2.0) (O'Reilly, 2005). Platforms that have been developed based on the Web 2.0 concept are given many names, such as social software and social media. Seen collectively, these names refer to a group of applications aimed at supporting, extending or deriving value from human behavior (Back & Koch, 2011). The high volume of interaction found on social media platforms, means that it does not require much thought to realize that these interactions will significantly influence the SECI cycle. How this happens, however, is only marginally touched upon in the literature. This section describes the articles that have discussed this relationship in order to develop our own understanding of this phenomenon. A listing of the articles and their corresponding journals can be found in Appendix B.1.

Kimmerle, Cress and Held (2010) summarized the impact of social media on the SECI cycle by stating that, in essence, there is interplay between individual and collective knowledge. This occurs because social technologies allow individuals to collectively build the knowledge they need (Kimmerle et al., 2010). Such collective knowledge building occurs when an individual finds relevant information by navigating through online spaces. As users navigate an online space they associate information with existing knowledge in order to assimilate it. If multiple users engage in this process, a form of a shared digital artefact (Kimmerle et al., 2010) is created from which the organization can subsequently benefit. The creation of such shared digital artefacts is

precisely what social media facilitates. Note that, Kimmerle et al. (2010) summarize the knowledge creation process only by using externalization and internalization. They state the following regarding these two:

- Externalization involves both *externalization and combination* as people need to articulate their knowledge. However, to be able to do this, they need to be able to combine existing pieces of information, or to edit this information.
- Internalization involves both *internalization and socialization* as people use a shared digital artefact to browse for relevant information. However, to transfer this relevant information to their cognitive system requires a specific situation, meaning an originating context.

According to Chatti, Klamma, Jarke and Naeve (2007) all four modes of the SECI cycle can be supported separately by certain tools. Socialization is for instance supported by communities of practice, including for instance online social networks. Blogs are particularly useful for articulating knowledge as they allow for storytelling. This makes such tools useful in supporting externalization. The findings of Chatti et al. (2007) are presented in Figure 5. As a side note, however, one should be aware of the methodological limitations of this study, as there is no clear explanation how tools were chosen, nor does the study indicate how the tools should be used to support each mode.

Figure 5 Usage of social media tools for SECI modes (Source: Chatti et al., 2007)

A different and more systematic approach is taken by Wagner et al. (2014) who studied the affordances social media can provide to each mode of knowledge creation. A review of the affordances discussed by scholars such as Leonardi and Treem (2003) and McAfee (2006) suggested that the socialization mode is supported by the formation of relationships, the externalization mode through the editing of content, the combination mode through reviewing content over time and the internalization mode through experimentation. The points put forward by Wagner et al. (2014) are interesting because they have many overlapping elements with what Chatti et al. (2007) presented. For example, one can experiment more freely in a virtual world, causing an enhanced form of internalization, while observation and communities allow for the formation of relationships in which tacit knowledge can be shared.

Focusing on this tacit knowledge sharing, Panahi, Watson and Partridge (2013) have argued that tacit knowledge sharing occurs over social media through social interactions, the sharing of experiences, informal relationships, networking, observation and listening, and the development of mutual swift trust. The swift aspect in the trust refers to a temporary form of trust, which is created in an online environment and supports the sharing of knowledge.

Lastly, we find the study of Huang and Güney (2012), who base their arguments on social capital theory to develop a conceptual framework for Web 2.0 driven organizational learning. According to these authors, social capital theory is often used to investigate knowledge creation studies and is especially useful for explaining how social interactions occur (Huang & Güney, 2012). The authors do this by drawing on the three dimensions of social capital (structural, relational and cognitive). In essence, the findings imply that understanding the dimensions of social capital allow an organization to understand how the ba of each SECI mode can be combined with corresponding Web 2.0 applications (Huang & Güney, 2012).

3.3 Formation of requirements

Turning aside from the theory, we can proceed to form requirements for our solution by investigating the previous studies in which the SECI cycle has been analyzed from a social media perspective. While it can in no way be presumed that these studies cover all the academic literature available on this subject, it is possible to argue that they are centrally important and that their authors have an impressive track record in the study of both knowledge creation and information technology. To develop these requirements, we adhere to the context in which knowledge must be created, as we have seen that information that is not contextualized cannot be called knowledge. The context or the ba from Nonaka and Takeuchi (1994) is expanded with the studies found in the previous section to form the requirements for our solution. For the socialization mode, the context is originating and as was found most studies refer to such an originating ba as an online community, in which relationships are formed (Huang and Güney, 2012; Wagner et al., 2014). Therefore an online community can be seen as a key requirement for the socialization mode. For externalization, the ba is dialoging, a space in which dialog is used to rationalize common mental models. As was seen the authoring of content on social media allows for such a dialog (Chatti et al., 2007; Kimmerle et al., 2010; Wagner et al., 2014). However, the theory of Nonaka and Takeuchi (1994) specifically states that discussions are important in the externalization mode. Therefore it can be argued that the discussions are an important

factor, which the studies do not mention. Therefore dialogue and discussions are seen as a requirement for the externalization mode. The combination mode occurs as users can create combined digital artifacts (Kimmerle et al., 2010). Since the combination mode was developed with an online environment in mind the requirement can be left untouched as the original theory of Nonaka and Takeuchi (1994) stated that combination is supported by the coordination, combination and dissemination of information. To sum this up in one word the idea of Charsombut (2010) is found useful, who mentions the integration as a key concept of combination, as ultimately the existing knowledge needs to be integrated into a new form causing an enhancement of explicit knowledge, something which is also mentioned in the studies discussed. Lastly, the internalization mode is triggered by experimentation, a process of trial and error which translated to actions and know-hows. As we have seen this is supported by virtual worlds (Wagner et al., 2014) but mainly as organizations determine what is relevant to them (Kimmerle et al., 2010). Therefore the requirement for the internalization mode is determining the value of information. Table 1 gives an overview of the final requirement for the artefact.

	Socialization	Externalization	Combination	Internalization
Original Nonaka and Takeuchi (1994)	Building a field of interaction	Meaningful rounds of dialogue	Coordination and documentation of existing knowledge	Experimentation and reflection for translating knowledge to actions
Context needed	*Originating*	*Dialoging*	*Systemizing*	*Exercising*
Social media impacts context	The need for a shared context through online communities of practice	Authoring and editing leads to dialogue and discussions	Reviewing, grouping, sorting, and filtering	Translation to action in specific situation or event
Context translated to requirement for artifact	Artifact that facilitates the building of an online community	Artifact that facilitates dialogue and discussions	Artifact that facilitates the integration of knowledge	Artifact that facilitates the assessment of the value of information

Table 1 SECI meets social media translated to requirements (own table)

4 DESIGN CYCLE ONE: CONSTRUCTION OF SM-SECI

This chapter is aimed at constructing a new method which is especially designed for the creation of knowledge on social media. This is done through a systematic literature search, in which a social media model is chosen, strengthened and integrated with the SECI cycle.

4.1 Literature search

For ensuring quality literature reviews, Webster and Watson (2002) suggest starting with the most prestigious journals as these are most likely to include the most relevant contributions in the field. One should then conduct a backward search through the references and a forward search through the citations. Since the literature search is aimed at finding models of social media use, one single ranking of the jounrals was not found, as the social media literature is spread across many management fields. While the journals used in the previous chapter include knowledge management and learning journals, the journals needed for this chapter should be more focused on the practical use of social media by managers. This led to the selection of two prestigious journals, namely, *MIS Quarterly* and *Computers in Human Behavior*. To find additional journals, the term 'social media OR software' was used in Scopus without restrictions to provide an overview of which articles feature this term. This yielded a total of 86,654 entries. Arts, economics, psychology and medicine were filtered out, resulting in 36,553 entries for English literature. The results were sorted according to citations and the leading journals were taking in for consideration. The next step was to check the selected journals for their impact factor and this led to a selection of of the nine journals displayed in Table 2.

Journal	Impact factor	Reason for inclusion
MIS Quarterly	4.66	Initial inclusion as important journal.
Organization Science	4.34	Featured the original article central to this research.
Commu. of the ACM	2.51	Leading journal in the computing field.
Harvard Business Review	2.18	Next to business horizons, valuable practical managerial journal.
Computers in Human Behavior	2.07	Initial inclusion as important journal.
Cyberpsychology, Behavior and Social Networking	1.84	Most important journal found to cover the impact of social networking on individuals.
MIS Quarterly Executive	1.74	Practice-based research for managerial probems covering information systems.
Business Horizons	1.42	Practical journal related to managerial problems, especially intended for the business audience.
Journal of Small Business and Enterprise	1.12	Leading journal in the field of small business research.

Table 2 Journals selected (Source: SCIMagoRanking)

The list of journals shown in Table 2 was used to form a Scopus syntax, which is displayed in Appendix B.2. The Scopus database was consulted on May 16th 2014 using this syntax. Scopus was selected for this task due to its many filtering capabilitites, its connections to many other databses and its inclusion of a large number of peer-reviewed articles. Using this syntax, search strings were used that matched the requirements identified in the previous chapter. Table 3 shows the results, with * being the initial output and ** the articles selected. This resulted in a total of 21 articles. The references in these articles — a so-called forward search — yielded seven additional sources. The citations did not yield any additional sources.

SECI mode	Search string	*	**
Socialization	'social media OR software' AND 'community'	44	9
Externalization	'social media OR software' AND 'discussions OR dialogue'	28	7
Combination	'social media OR software' AND 'integration''	32	2
Internalization	'social media OR software' AND 'value of information'	23	3
		Total initial search	21
		Total added through forward search	7
		Total added through backward search	0
		Total included	28

Table 3 Literature search (own table)

4.2 Theoretical models for social media use

By now, managers are not completely new to the social media field. However, as Back and Koch (2011) argue the problem lies mainly in the fact that social media is often seen as a means and not a means to an end. This end implies a goal or an objective, which has to be set and followed for social media to lead the desired results. Therefore the literature on social media use is focused on how to plan activities and how to engage with the target audience and through which platforms to do this. Most of these theories are represented in so-called models, which are created and validated through best-practices case studies. These studies help researchers and practitioners to define and position social media in literature. This thesis includes four of these models, which are well cited in the literature and provide a sufficient picture of how social media should be used by companies.

4.2.1 The groundswell

The groundswell theory as coined by Bernoff and Li (2010) indicates a social phenomenon in which the power shifts away from the companies towards the customers. As Bernoff and Li (2010) put forward this shift occurs since customers are now defining their own perspective on companies and social technologies are aiding this process. As such, executives should consider how to navigate through the groundswell which according to Bernoff and Li (2010) can be done by using objectives and metrics. Working with objectives and metrics allows a company to work within a strategic framework for 'developing and implementing the right applications' (p. 38). The objectives and the metrics which needs to be established are according to Bernoff and Li (2010) dependent on the department for which they are used. Research and

development is for instance interested in new product ideas, which it can gain by working with a listening objective, while Sales is for instance more interested in energizing customers in order to create new sales or new orders. Table 4 represents the complete overview of how Bernoff and Li (2010) argue each department should hold its own objectives and metrics.

Department	Objective	Applications	Metrics
Research and development	Listening: Gaining insights from customers	Brand monitoring, Research communities, Innovation communities	Insights gained, usable product ideas, increase speed of development
Marketing	Talking: Using conversations with customers to promote products or services	Blogs, communities, Video on user-generated sites	Better market awareness, online buzz, times spent on web-sites, increased sales
Sales	Energizing: Identifying potential customers	Social networking sites, Communities, widgets	Community membership, online buzz, increased sales
Customer support	Supporting: Enabling customers to help one another to solve problems	Support forums, Wikis	Number of members participating, volume of questions, decreased volume of support calls
Operations	Managing: Providing employees with tools so that they can assist one another in finding more effective ways of doing business	Internal social networks, Wikis	Number of members participating, increased operational efficiency, decreased volume of email

Table 4 Using social applications across departments (Source: Bernoff & Li, 2010)

4.2.2 The 3M-Framework

Gallaugher and Ransbotham (2010) observed the Starbucks case for a period of over three years. Through this observation the researchers developed a conceptual model that enabled them to explain how social media can be used to engage in a dialog with customers. While Starbucks is a large company, which has created a certain social media presence mainly due to the strength of its brand, the ideas of Gallaugher and Ransbotham (2010) do provide a suitable social media guide. The authors propose that the communication flows between firms and their customers can be viewed as information flows or as channels through which information flows that is relevant to the company. Information technologies such as social media act to enhance such communication patterns between firms and their customers. Figure 6 represent the 3M-Framework, depicting the four parties (focal firm and customer, other firms and customers) and the several communication patterns that emerge.

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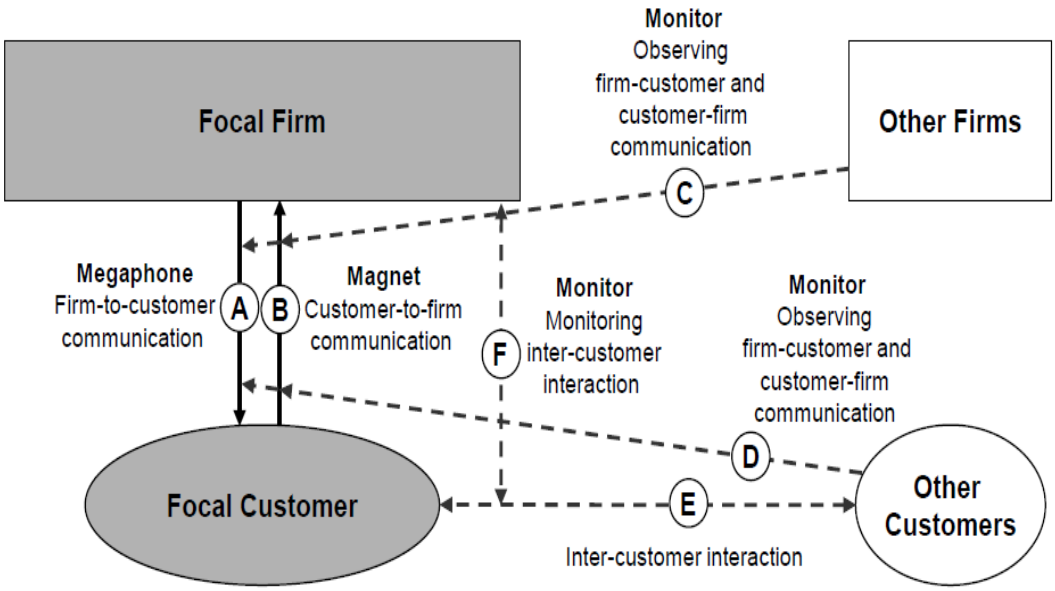


Figure 6 3M-framework (Source: Gallaugher and Ransbotham, 2010)

As can be seen in Figure 6, there are six possible communication paths that social media opens, which are denoted by the letters A to F. Paths A and B are solid lines and represent traditional communication patterns that have always been present. Paths C to F are dotted lines and represent the communication patterns that are enabled by social media use. As can be seen in the figure, the megaphone can be used to communicate with the focal customer, while the magnet can be used if the customer seeks to communicate with the firm. The remaining communication patterns occur as the firm taps into inter-customer interactions as well as the interactions between other customers and other firms.

4.2.3 The honeycomb of social media

Kietzmann, Hermkens, McCarthy and Silvestre (2011) developed what they called the 'honeycomb' of social media, in which seven building blocks together form a honeycomb on which the functionality of these platforms resides. These seven building blocks are identity, conversations, sharing, presence, relationships, reputation and groups. These building blocks are supported by many authors, such as Piskorski (2011) who emphasizes that social networks are more about relationships than anything else. These seven functionalities are based on the user and provide an understanding on how organizations should behave on such platforms in order to reach their full potential. The authors note that many platforms do not focus on only one of the blocks, but make use of several blocks. For example, LinkedIn is highly focused on identity, but also focuses on relationships and reputation. Using these patterns of thought, the following four Cs can be identified as a guide to developing a strategy around social media.

- Cognize: Understanding the social media landscape will allow the organizations to know where their position is in this landscape. Moreover, it is also important for them to know where the conversations of the firms are occurring and how this can be explained by the functional building blocks.
- Congruity: This step is about ensuring alignment between the functionalities of the platforms used and the business goals of the firm. A firm should focus on

the building block that best fits its business goals. This stage also involves planning and can include making use of metrics in order to measure success.

- Curate: A firm needs to determine how often it should participate in online conversations, and employees who can effectively find and participate in these conversations need to be identified. In addition, the use of content aggregators or a mashup can assist in finding and combining information from a variety of sources.
- Chase: The environment needs to be continuously scanned so that one can understand the velocity of conversations. Using the honeycomb as an ongoing lens through which to engage with customers and other relevant stakeholders is recommended.

The advantage of this method is that it provides an understanding of the functionalities of each platform. For example, social networking sites such as Facebook are focused on the building of relationships, while microblogs such as Twitter are focused on conversations. Understanding the functional block of each one of these platforms allows usage that is purposeful and effective (Kietzmann et al., 2011).

4.2.4 Ecosystems

Hanna, Rohm and Crittenden (2011) developed guidelines around what they called the social media ecosystem, and which were based on a best-practice case study of the music industry. The authors discuss how too many companies treat social media platforms as silos, whereas their strategy should be to integrate them. In its purest essence, social media can be seen as equivalent to a network, with elements represented as nodes that are connected to each other. Ecosystems can take on many forms, such as product and consumer ecosystems (Dass and Kumar, 2013), but there are also ecosystems that consist of the platforms themselves (Hanna et al., 2011). In considering the formation of a media ecosystem, Hanna et al. (2011) highlight the existence of three media types, namely, owned, paid and earned media. Owned media refers to controlled content such as the firm website, paid media includes publicity such as advertising and earned media is the content that a firm gains through monitoring or online activities. Hanna et al. (2011) argue that by working within the ecosystem, a manager or user is able to ask strategic questions. These could include asking who the target is in such an ecosystem, or which platforms should be used, or how such platforms relate to the company website. In the building of a consumer ecosystem, users can also be segmented. The users of social media can be creators (who publish often), critics (who comment and rate often), collectors (who save and share), joiners (who connect, refer and unite) or spectators (who do not post but mainly read).

4.3 Choice of social media model

Remaining faithful to the scope of this research requires assessing which social media model has the most potential in helping us to build the artifact, for which requirements have been set out in Chapter Three.

For the socialization mode the artifact needs to facilitate the building of an online community. The model of Bernoff and Li (2010) focuses on such an online community, which means that it provides a method for navigating through such a community to obtain the value a company needs from social applications. However, it is unclear

whether this model has the potential for the other modes of the SECI cycle since it only discusses which applications should be used and not how they should be used. The metrics do provide support for internalization as through metrics a company can assess if the information it has is with value, but again the relationship here is not clear. Looking at the 3M-Framework, one can see a promising model that supports socialization due to the information flows that it highlights and externalization due to the magnet that is used and combination and internalization through the monitor, which involves is a continuous process of information extraction and expansion. The honeycomb of social media is especially focused on applications and their functionalities, which means that the model might only provide good value for combination of these applications. Nevertheless, internalization is also supported by this model as the authors propose to use the honeycomb as an ongoing lens, allowing for a certain trial and error process. Lastly, we find the ecosystems approach which is a model focused on visualization. Visualization is closely related to rationalization, providing direct support for the externalization mode. This discussion leaves us with the 3M-Framework in which the most potential is seen, but as explained next this match needs further explanation.

4.4 Strengthening the 3M-Framework

It needs to be admitted that the 3M-Framework of Gallaugher and Ransbotham (2010) is rather metaphoric in nature. The only way the metaphor of the megaphone, the magnet and the monitor are explained, is through their interactions, which was discussed in section 4.2.2. However, caution is necessary with the use of metaphors since they allow for free association (Hey, Linsey, Agogino & Wood, 2008). Hey et al. (2008) point out that together with the metaphors, one finds analogies that are less inclined to free association and are more structural in nature. This observation is also found in the theory of Nonaka and Takeuchi (1994) who argue that a combination of metaphors and analogies supports the externalization mode. The use of metaphors without proper analogies can be seen as a limitation of the 3M-Framework. To bridge this gap, it is possible to identify analogies that correspond to each component of the framework. These analogies allow the identification of a shared feature (Hey et al., 2008), which strengthens the phases identified by Gallaugher and Ransbotham (2010).

Looking at the megaphone, for example, one can see that it consists of an information flow that is initiated by the firm. A corresponding analogy that can be developed is that speech through a megaphone is distributed to a large audience, just as a firm wishes to use social media to distribute a message to a large audience. The shared feature in this analogy is therefore *distribution.* Looking at the magnet, one can see that it consists of an information flow that is initiated by the customer. A corresponding analogy that could be developed is that a magnet extracts, just as a firm wishes to extract some form of value from social media use. The shared feature in this analogy is *extraction.* Lastly, we find the monitor, which is the information flow that comes from other firms, other customers and inter-customer interaction. A corresponding analogy here is that a monitor allows an individual to keep continuous track of something, just as a firm wishes to keep track of what is happening on the social media landscape. However, this particular analogy can be viewed as equivalent to extraction, because this is ultimately the goal of such monitoring, and therefore the choice is made to also view the monitor as part of the extraction. As can be seen from

this metaphor-analogy comparison, the 3M-Framework of Gallaugher and Ransbotham (2010) can be strengthened by converting the three metaphors used to two main stages in social media usage, namely, *distribution* and *extraction.*

4.5 Distribution and extraction through SECI cycle

With regards to *distribution,* we find the same properties of knowledge creation discussed by Wagner et al. (2014) and Kimmerle et al. (2010), which is that social media can aid the learning process if users have the ability to author or manipulate digital artefacts. It is important to mention that the distribution referred to here is not equivalent to the dissemination concept pointed out by Nonaka and Takeuchi (1994). The dissemination of knowledge is a specific step involved in the combination of explicit knowledge in which the knowledge that has been combined is spread across the whole organization, while the distribution referred to here is focused on the use of social media to spread content across a certain target group. Social media is known for its content properties, as most of the content on these platforms is user-generated (Mangold & Faulds, 2009; Kaplan & Haenlein, 2010) with a varying degree of quality in that content. This gives importance to concepts such as content management and content management systems that are found in the literature, with studies focusing on how to publish or modify content to reach a certain goal.

However, to remain true to the scope of this research requires holding ourselves to the SECI framework. While there is no magical bullet by which to determine which content leads to which results, an individual in an organization can use the SECI cycle to develop an understanding of how to publish such content. In this we see the socialization mode occurring, in which tacit knowledge is obtained on how others, including other firms, are publishing content. However, this only provides the know-how and it is important to document this knowledge. Such documentation could be done through the use of a log file, which is known in computer science as a way of recording events that occurred in the running of particular software. However, a log file can also assist in recording observations made on social media and can help one to obtain patterns that enable one to see which content leads to which result. If the log file that has been created is extended to compare with how the organization has been publishing content, then the combination mode can be used. This comparison will lead to a new type of configuration, resulting in an enhanced form of explicit knowledge. Finally, a firm can learn how it needs to publish content by discovering the patterns between the two log files. This should lead to actual action, which is the publication of effective content that leads to desired results.

Before we discuss *extraction* an important side note needs to be made. The way a company can extracts knowledge from a certain source an integrate it into their knowledge base is a complex process. Kraaijenbrink, Wijnhoven and Groen (2007) refer to this process as external knowledge integration, and it is defined as the identification, acquisition and utilization of external knowledge in a company. Knowledge identification involves a continuous interplay between the knowledge seeker and the source in which knowledge can be found, whether accidentally, intentionally or in an unsolicited way (Kraaijenbrink et al., 2007). Knowledge acquisition involves a transfer from a source to the organization and this transfer can occur in many forms which may involve written texts, physical objects, people, courses, cooperation and outsourcing (Kraaijenbrink et al., 2007). The last step is knowledge utilization and involves making knowledge accessible in the organization

through application, exploitation, storage, diffusion, direction and routinization (Kraaijenbrink et al., 2007). However, in their sample of 317 high-tech SMEs, the authors found that this process was not predominant, but rather that a more tentative fit occurred between the data and the organizational effectiveness functions (OEFs) of Stein and Zwass (1995) (Kraaijenbrink et al., 2007). Analyzing these functions would extend beyond the scope of this research, but I am of opinion that is important for the reader to realize that although it is simplistically put in the next paragraph, there are many factors to keep in mind with such knowledge extraction, which is elaborated upon in the future research section of this thesis.

Nevertheless, returning to the sole use of social media, we find that not only can firms create content with the SECI cycle but also extract information from this. This means that if knowledge is to be created, it needs to be directed by a certain objective or goal, which can be represented as the knowledge need. A knowledge need is not necessarily complicated, but it does need to be specific, measurable, attainable, realistic and timely (SMART), as these kind of goals form an important part of social media use (De Vera & Murray, 2013 as cited in Wijnhoven, 2013). In order to represent the knowledge need, the use of tags is recommended. These are promising tools through which individuals can assign meaning to certain events or persons by using a single word. This tag can be used throughout a variety of content aggregators (Dellarocas, Katona & Rand, 2010), which are technologies and tools available on the web that combine various resources into a single user interface. Popular content aggregators include SocialMention (Kietzmann et al., 2011) or InfoExtractor. The tag that has been created by the organization comes to be seen as a single search query that is used for extracting information from social media. The knowledge is then reviewed for its relevance by returning to the knowledge need and assessing whether this need has been met.

The description provided above for both the distribution of content and the extraction of information from social media can be modelled into the single method mentioned in the introduction and referred to as SM-SECI. The distribution of the right content allows a company to build a growing online community. Knowledge from this growing community can be extracted if a knowledge need guides the process and gives direction to the information retrieval process. Figure 7 presents SM-SECI and the steps described above.

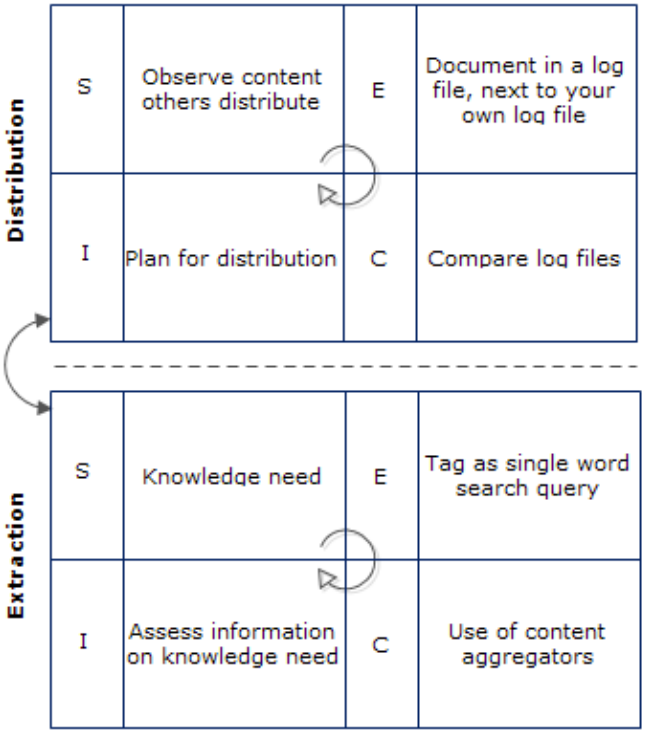


Figure 7 SM-SECI (own figure)

Two central central tools that are used in each phase of social media use are a log file and tags. Since these two tools are central in our method, they can be used to develop the so-called technical rules or design propositions (Van Aken, 2004). Design propositions are commonly used in design science research in order to represent a design. They are defined as a 'chunk of general knowledge, linking an intervention or artefact with an expected outcome or performance in a certain field of application' (p. 228). These design propositions are shown below. The design propositions are left to be broad as their purpose is to summarize the essence of the design.

Main proposition 1: The use of a log file facilitates the distribution of content on social media according to a SECI cycle, through observation, documentation, comparison and actual distribution.

Main proposition 2: The use of tags facilitates the extraction of knowledge from social media according to a SECI cycle, through a knowledge need, a tag as a search query, content aggregators and assessing the value of information based on the knowledge need.

5 EMPIRICAL FINDINGS

This chapter aims to extend our design and propositions by augmenting them with knowledge from the business environment. As explained in Chapter Two, this is done through case studies in which observations are made on how knowledge is currently created by high-tech SMEs and on the value of social media in this process.

5.1 Network analysis and codes

Chapter Two gives a complete overview of how the companies were recruited and how the interview was set up and analyzed. Before visiting the company, the social media networks were analyzed to determine the online community that these firms had. Company A currently uses Twitter primarily for recruitment and has a network of 541 Twitter followers. Company B uses Twitter largely for the promotion of network events and the publishing of scientific articles that relate technical issues; it has a network consisting of 25 Twitter followers. Company C uses Twitter for identity building and often uses tags such as #productdevelopment to indicate what is currently being done; its network consists of 203 Twitter followers. One particular observation made in the network is that the responses the company get on their content is low, meaning it is noted that there is a lack of interaction in the online social network.

Following the coding procedure explained in Chapter Two resulted in the main codes as shown in the three boxes below. This was done by building a code network through the code manager option of Atlas.ti. The codes displayed in Table 5 were subsequently related to each mode of SECI and this is shown in Appendix A.3

Company A main codes
Interaction, engineers do not interact, need interaction, reacting, ties individuals to you, need for problem statement and addressing reaction, posting technical questions, receiving answers, static updating leads to no results, obstacles coordinating, difficulty getting knowledge at the right place, distraction and difficulty obtaining knowledge on social media.

Company B main codes
Recruitment, broadcasting network event, no creation of knowledge, content is everything, growing process, interaction, low usage of social media, introvert, ad-hoc, unexplored area, information out more relevant than information in.

Company C main codes
Observation, community, Facebook for image, LinkedIn for recruitment, culture building, increase in Twitter usage, Twitter news, knowledge in the network or Google, expectation to gain new clients but does not happen, social media use is market dependent, assessing customer needs is difficult, Hootsuite leads to distractions.

Table 5 Main codes found from coding procedure (own table)

5.2 Company A

Company A was established as a spin-off of the University of Twente. The company has seen tremendous growth since its establishment, which can be ascribed to its multidisciplinary approach to problems and its ability to provide a complete solution to the customer. This company now features over 200 employees, all of whom are highly

educated and are accustomed to working in changing teams. The technology that Company A uses is mechatronics, which involves the integration of technical disciplines. The interview was conducted with the public relations officer. Company A is characterized by a transparent organizational culture, which means that employees are invited to collaborate with each other. This is supported by the firm's open door policy. The projects that the firm operates on are multidisciplinary and therefore require such collaboration for the formation of knowledge. The company organizes information meetings in order to keep everyone informed about its progress and its strategies.

Company A's use of social media is focused on using these platforms primarily for the recruitment of future engineers. While this may not be knowledge creation per se, its goal is to expand the knowledge base of the organization in terms of its employees, which the manager sees as one of the strengths of social media. However, this currently provides challenges as interaction with engineers, the group the company desires to reach, has its own difficulties as can be seen in the following quote: *"I am looking for something which gives me more interaction (...) That is hard. To get the interaction with engineers that they react on something"* (22, R1). The observation that Company A uses social media primarily for recruitment is confirmed by an analysis of their presence on social media. Most of the content the firm publishes on social networking sites includes visits to network events, meetings with students or job openings. But it is also clear that there is not much interaction occurring through this presence. However, quotes such as these nevertheless point to the relevance of the firm's social media presence for the formation of content: *"The high-tech branch is less approachable in this. If you look at, for instance, recruitment, that is very good. But to go more towards your customers, there is so much that you get from your existing network. Yet I think by showing what you are doing, what you have done, in this way, you are present"* (18, R1). Moreover, *"If you only statically post updates, we are doing this, we are doing that. Yes then people see that and think oh... (...) But if you send out something stimulating then you get interaction, and that is where the real value is"* (28, R1).

The quotations cited above are interesting because the respondent implies that although much knowledge has already been obtained from the direct network, there is also knowledge that can be obtained by being present on social media. This does not occur currently since the socialization mode, or a shared context in which engineers interact, has not yet been created. Moreover, the manager sees the coordination and actual extraction of knowledge from social media sources as still presenting a substantial challenge. These challenges present themselves in two forms:

- The actual extraction of knowledge
- Getting at the knowledge in the right place inside the company.

However, when presented with the SM-SECI cycle, the manager did see possibilities for taking future steps towards the actual extraction of knowledge. But, as was often mentioned, the most immediate need seen was to take steps to refine and polish the firm's current social media presence. Based on this case analysis, one can conclude that Company A wishes to establish socialization with its future employees and to form content related to this. Company A therefore needs a method that is highly focused on gaining more interaction with its relevant parties.

5.3 Company B

Company B focuses on electronics and embedded systems. It has 50 employees who are specialists in the field of analogic and digital electronics and software. Company B has a high focus on co-development with the customer and works on projects from establishments in Enschede and Eindhoven. As with most high-tech SMEs, the company is very focused on knowledge, which includes both technological and market knowledge. As the company website states, it sees it as a priority to know how the technology is being applied in the market of the customers. Company B is an organization that is willing to invest in co-development and sees the value this can bring to both its business development and its overall strategy. The interview was conducted with the manager of the Marketing department. The main codes found at Company B relate mostly to the externalization mode, which means that the company is highly focused on articulating their know-hows on social media. Nevertheless, the service provisions of Company B are very customer orientated. Relationships with customers are seen as one-on-one relationships in which according to the manager no additional value will be gained through the use of social media to enhance knowledge creation. This could explain the low usage of social media within the company, which is limited to approximately 10% of the employees. This means that most of the social media activities occur through the respondent, limiting the company's efforts in this area to that of information output, as can be seen from the following quote: *"At my previous job a few people used to have access to the blog of the company, but the return I saw on that was very low. I think it is more to show your knowledge and abilities instead of a source of information"* (20, R2). This clearly indicates the attitude of the respondent who sees social media merely as a distribution channel, and work in this sphere to only include the publication of content. Moreover, by announcing network events, knowledge is obtained on the buzz of that event. Therefore, an important aspect of Company B's use of social media are the metrics, which the manager uses to obtain information from the target group. As was stated: *"You can build nice metrics on that both on Facebook and LinkedIn, analytics on website. I post something and see how many times it viewed, so you can get a nice view of your target group"* (33, R2). Despite this, the respondent sees the value of social media mainly lying in recruitment and energizing, and as a means of identifying potential customers. According to the manager, this type of activity best fits the current tasks and projects of the company and a method geared towards this would therefore fit their needs.

5.4 Company C

Company C is an industrial design company located in Enschede. The company focuses on new product development. The approach taken to product development is that of integral design, where the engineers strive to find the balance between what the technologies can offer and what the customer desires. In this same manner the company characterizes itself due to its minimal time to market and the ability to take over the whole product development process from its respective customers. The company consists of seven employees. The interview was conducted with the CEO and founder of the company. While small, Company C has characterized itself by its distinctive, young and fresh culture, which also accounts for it being known by its customers and competitors. The small size of the company implies a high use of socialization in the creation of knowledge. Social media is seen by the manager as a

valuable tool in aiding the knowledge creation process in terms of observation and culture building, as can be seen in the following quotes: *"I use social media (Twitter and LinkedIn) to stay updated on what others are doing, so it can be that I see what they are doing and then I know that they have knowledge that I need to get"* (24, R3). And *"By posting on Twitter you can open up the doors of your company to the outside world, take a look at what you are doing and what your culture is"* (21, R3). However, the manager also emphasizes that much of the knowledge he needs is obtained in his direct network or through the use of a search engine. This results in no codification of knowledge. In one case, the manager tried using Hootsuite for the combination mode, but this resulted in distraction and an overload of information: *"I worked with Hootsuite once and I installed it and I searched for product development, because we do that, but I became crazy from the number of messages, so it distracted me from my tasks. It is too much"* (48, R3).

According to the manager, the actual creation of knowledge that should occur is very market dependent, meaning that there is no point searching for knowledge on social media if the target group does not use this medium. This company therefore finds an understanding of the target group in the shared context or socialization to be significant. Twitter is used mainly for news dissemination. An examination of the company's social network on Twitter does indeed show a high post rate and a large number of followers. The company acknowledges the value of social media for knowledge creation as traditional methods are costly and do not always provide results: *"We often need to determine if technical functions comply. And that is hard to determine, and with market research or conversations with users this is sometimes hard. So I think your piece is fun and I never thought about doing this through social media, I think this is very good"* (54, R3). Based on this case study it could be found that the firm does indeed create knowledge through socialization, but that more work needs to be done on the other instances of the SM-SECI cycle (Figure 7), such as obtaining knowledge on social media through a log file or trying out other forms of content aggregators. In conclusion, we can state that Company C's greatest need is a market-driven method suitable for discovering the needs of end users.

5.5 Summarizing empirical findings

The results shown in this chapter indicate that the high-tech SMEs in the sample are still mainly focusing on the socialization stage and have not yet made steps toward the other modes of the SM-SECI cycle. To indicate why this is so, a distillation has been made from the previous sections that presented interview data of the current practices of the companies and their needs regarding social media. To do this, a 3x4 matrix is constructed and table 6 in which the rows represent the companies and the columns represent the modes of SECI. To fill in this matrix, the classification of codes was used as shown in Appendix A.3. Three colors are used to distinguish observation and their meanings are displayed below the table 6.

The lack of interaction mentioned at Company A is not found in SM-SECI, as the method does not provide a way to determine or monitor the interaction that occurs from the content that is distributed. Additionally, getting the knowledge at the right place inside the company is also not included in the SM-SECI method as the method only includes how to obtain this knowledge. Lastly, the cause for distraction observation was mentioned at company A and C. Therefore three important observations can be derived from Table 6 as to why companies are not successfully

creating knowledge through social media and for which the SM-SECI cycle does not provide support, which are: a lack of interaction, lack of coordination and cause for distraction.

The other observations made were chosen as a match with the SM-SECI mainly because the method does provide a way to set up observation and does provide a way to distribute content. Moreover, the method shows a manager how to derive action from social media use and how to start using social media for knowledge creation purposes. The next chapter discusses how SM-SECI can be improved to take into account three identified observations.

	Socialization	Externalization	Combination	Internalization
Company A	Engineers do not interact (lacking interaction)	Posting updates that are interesting leads to discussions	Getting the knowledge at the right place is difficult (lacking coordination)	Employees would like to do their jobs, addition of use needs to be clear (causing distraction)
Company B	Recruitment, metrics to gain knowledge on target group	Broadcasting network event, content is everything		Growing process, low usage, unexplored area
Company C	Observation, community and culture building	Increase in Twitter usage for news but main knowledge in direct network	Use of tools (e.g. Hootsuite) leads to distractions (causing distraction)	

Table 6 Matrix of observations

Observations that SM-SECI design offers a contribution to
Observations that SM-SECI does not offer a contribution to
Non-significantly present

6 DESIGN CYCLE TWO: REFINEMENT OF SM-SECI

This chapter discusses the study's findings by assessing how the SM-SECI cycle that has been constructed can be expanded to include the observations made from the sample. This is done by choosing a dominant observation and arguing how this observation can be taken into account to form a refined SM-SECI cycle.

6.1 Dominant observation

As discussed in Chapter Five, the three observations not covered by the SM-SECI cycle were lack of interaction, lack of coordination and cause for distraction. These observations are mostly associated with socialization, combination and internalization. Note that this does not mean that the SM-SECI is flawless in supporting externalization, but this is all that could be extracted from the empirical analysis of the firms. From these three observations, it can argued that the cause for distraction is an observation or problem which is lessened if the value of a particular activity is clear, as a manager mentioned: *"I often notice people just want to do their job, and I don't mean they are not open to it but it needs to be clear what something is contributing to"* (37, R1). In the same way it can also be argued that the coordination of the knowledge retrieval is something which can best be facilitated by the manager, for which now the SM-SECI does provide a solution through the knowledge need that is developed. This knowledge need should originate from a certain place in the company, meaning the knowledge that is found should fulfill this knowledge need. Therefore when digging deeper into the SM-SECI than just the empirical findings it can be said that both lack of coordination and cause for distraction are indeed supported by the current SM-SECI cycle, but in a more indirect manner. However, this is not so for the lack of interaction observation, as the SM-SECI cycle does not provide ways to monitor the interaction that is resulting from content. This is particularly important to guide managers in the process of changing the mindset from sole distribution to also extraction. This mindset is perfectly displayed through the following quote: "*Now social media is more a display of your knowledge than a source of information"* (20, R2). If managers are thus more aware of the interaction they are causing with their content, it can cause a certain state of increased awareness in the importance of not just distributing but also extracting the information they need from social media. Moreover, when the social networks of the companies were analyzed it was indeed found that the content they produce does yield little to no interaction from their desired target group. Therefore this lack of interaction observation is seen as a dominant observation in the sample which needs to be addressed.

6.2 Incorporating observation into SM-SECI

The word interaction may cause confusion to the reader as it is overused and lacks meaning. According to the Oxford Dictionary, interaction refers to the way in which human beings affect each other. A paper published by Manual E. Sosa can advance our understanding of this interaction through social networks and how this can lead to beneficial results for a company. Sosa (2011) reviewed the literature and asked where creative interactions come from and why some organizational interactions are more likely to generate useful ideas than others. To study such a complex question, he decided to view knowledge creation on the dyadic level, meaning the interactions

between organizational dyads, that is, the 'transfer of technical information between the source and the recipient' (p. 8). The findings of Sosa (2011) indicate that a lack of network cohesion favors for creative interactions, as individuals do not feel the social pressure to respond and also do not have to deal with information redundancy. However, interestingly enough tie strength was found to be a significant predictor of a recipient receiving novel and useful ideas through interactions.

Tie strength and network cohesion are concepts that are rooted in the theoretical discipline of Social Network Analysis (SNA). Social Network Analysis uses concepts from network theory in order to visualize, map and assess a network's properties. For the purposes of SM-SECI design, the book by Hansen, Shneiderman and Smith (2010) is found particularly useful for SNA. This book was initially found through the backward search mentioned in section 4.1, as it was cited by Hanna et al. (2011). The tool that Hansen et al. (2010) highlight in their book is referred to as NodeXL. Due to the abilities that NodeXL can give a company in monitoring both tie strength and network cohesion, it is argued that NodeXL is a valuable tool for the execution of SM-SECI. For example, if a firm decides to share content that it has been created by running the distribution phase of SM-SECI, it can decide to monitor the effect that this content has had on the tie strength of the firm, whether its network has grown and whether it has become more interactive with its current community. In order to do this, it is advisable to work with two main worksheets in Microsoft Excel, shown in figure 8. The Reason why Microsoft Excel is advised is because NodeXL itself works as an add-on to this software, facilitating the creation of one document. The two worksheets will serve as a sort of knowledge portal in which the user gets a complete overview of how they are executing SM-SECI.

Figure 8 Worksheets in Microsoft Excel (own figure)

In the distribution worksheet, a log file can be created, for which an example is shown in Figure 9. As can be seen below, Microsoft Excel enables a proper comparison between the log files on social media, and the internal log file, referring to the way the firm publishes content.

Log file other parties

Date	Instance observed	Content that was published	Result (interactions)
20-6-2014	Company A	Trivia	23
30-6-2014	Company B	Use of Mondaytip	28
1-7-2014	Company C	Fun question of the day	13
6-7-2014	Company D	Asked customers to come up with name	10
15-7-2014	Company E	We want your voice!	29
21-7-2014	Company F	Asked for customer opinion on product X	11
25-7-2014	Company G	Made content personal for users	22
5-8-2014	Company H	Added news article	14

Internal log file

Date	Purpose	Content that was published	Result (interactions)
20-6-2014	Recruitment	We want you to work for us!	10
30-6-2014	Branding	Development of product X	14
1-7-2014	Market research	Asking customer voice	2
"	"	"	"
"	"	"	"
"	"	"	"
"	"	"	"
"	"	"	"

Figure 9 Log file exemplar (own figure)

In the extraction worksheet, the NodeXL tool can be used to import social media data that can be edited and reconfigured in a variety of ways. Additionally, NodeXL allows the insertion of search queries. For a complete guide on how to use NodeXL, one should consult the book by Hansen, Shneiderman and Smith (2010). For the purposes of this thesis, it is sufficient to state the proposal that Microsoft Excel and NodeXL can be used to create a knowledge portal, providing a solid foundation for the execution of SM-SECI. Figure 10 represents the revised SM-SECI framework. The design propositions are also displayed below the figure, in which the changes are bold faced.

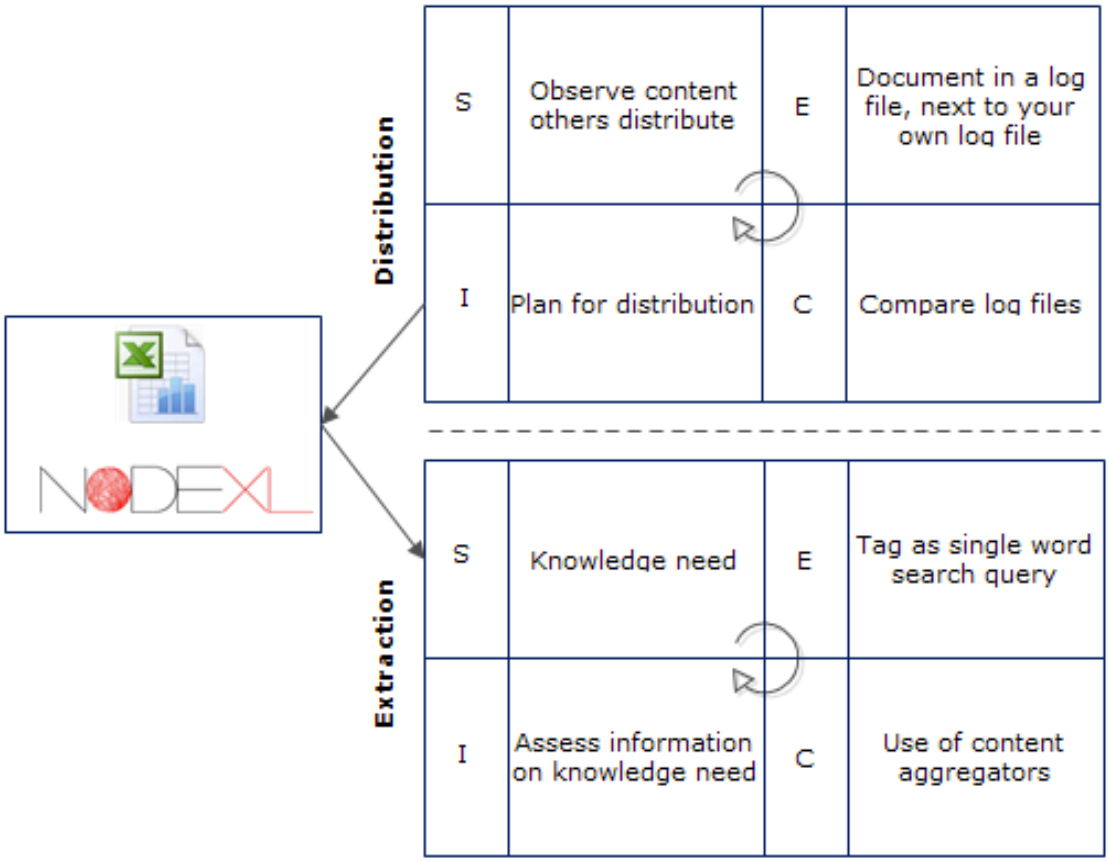


Figure 10 Revised SM-SECI (own figure)

Main proposition 1: The use of a log file **in Microsoft Excel** facilitates the distribution of content on social media according to a SECI cycle, through observation, documentation, comparison and actual distribution.

Main proposition 2: After monitoring interaction **with NodeXL,** tags can be used to facilitate the extraction of knowledge from social media according to a SECI cycle, through a knowledge need, a tag as a search query, content aggregators and assessing the value of information based on the knowledge need.

7 DISCUSSION AND CONCLUSION

This chapter concludes this research by reviewing how the research questions posed in Chapter One have been answered, stating how this research contributes to both the academic field and the practical field, stating the limitations of the study and pointing out new avenues for future research.

7.1 Key findings

The research described in this thesis set out to investigate how the SECI cycle can be used to design a social media method for high-tech SMES. This purpose is also found in the research question, as described in chapter One. To answer such a broad research question, four sub-questions were used, which are answered next.

The first sub-question asked what the requirements are that are set out by the SECI cycle for the creation of knowledge on social media. As explained in Chapter Three, this study found that Nonaka and Takeuchi (1994) did not operationalize the SECI cycle sufficiently and that the cycle therefore lacked practical value. This practical value was sought from a few studies who investigated the relationships between the SECI cycle of knowledge creation and the emerging phenomenon of social media. These studies were used to establish requirements for the artifact to be developed. Socialization is possible through a certain field of interaction, which comes from an originating ba. As many studies summarizes this is facilitated by an online community in which users can build relationships and thus share tacit knowledge with each other. The artifact should thus support the building of an online community. Externalization occurs through meaningful round of dialogue, in which individuals can author and edit content on social media allowing for discussions. An artifact should thus support dialogue and discussions. Combination deals with the coordination of existing knowledge, for which an artifact should support the integration of this knowledge into a new form. Lastly, internalization is supported through a trial and error process of experimentation and reflection, meaning for a company this mainly relates to the value of information found on social media.

The second sub-question asked what model for social media use best suits these requirements. The 3M-Framework of Gallaugher and Ransbotham (2010) was found a strong model to comply with the requirements, but the model was found to be rather metaphoric in nature. Therefore analogies were constructed that resulted in two phases of social media usage, namely, distribution (creation of content) and extraction (obtaining of relevant information).

The third sub-question asked how this model can be integrated with the SECI cycle to form a new cycle, which is referred to as SM-SECI. Distribution and extraction were modelled into SECI with two tools: a log file and tags. A log file is found useful for distribution as through them users can observe others, document it, compare it with their own actions and derive action from this. A tag is found useful as it conveys meaning to a certain situation, allowing the knowledge need of a company to be developed, the tag to be used as a search query and expanded with content aggregators. Lastly, the value of information is assessed by returning to the knowledge need.

The fourth and final sub-question asked how this newly developed cycle can be made useful to high-tech SMEs. As was seen from the sample of three firms analyzed in this study the dominant factor found was a lack of interaction. For an interaction to occur that is beneficial to the firm, it is important to think in terms of social networks. The NodeXL tool combined with Microsoft Excel has shown much promise in providing companies for a way to document the log file properly and monitor the interaction their content is producing.

To return to the main research question, it is perfectly reasonable to conclude that the SECI cycle of Nonaka and Takeuchi (1994) has not only helped in mapping out how social media steps can be advanced, but also indicates how actual knowledge can be created from these activities through such strategies as the use of NodeXL. Lastly, as was brought to me by S.A De Vries, Nonaka and colleagues developed the SECI cycle in highly connected Japanese companies — and is that not an accurate reflection of our world today?

7.2 Academic and social contributions

This research has explored an academic area in it's early stages. Previous studies that have attempted to link the SECI cycle to an online environment usually lack practical guidance and have remained at the level of general claims about how social media assists knowledge creation (Wagnet et al., 2014), how social capital is developed (Huang and Güney, 2012) or which applications allow for the sharing of a specific form of knowledge (Panahi et al., 2009; Chatti et al., 2007). The present study, however, makes noteworthy contributions to the theory of Nonaka and Takeuchi (1994) and the social media literature. The study which was recently published by Wagner et al. (2014) is the first study to systematically assess how each SECI mode can be supported by social media. As the authors conclude in their paper, much more research is needed on how social media can be used to inform management about the creation of knowledge assets. This reseach has attempted to do precisely that and our SM-SECI method can be viewed as an extension of the current studies avaiable on this issue. Figure 11 represents how the learning spiral was extended in this thesis. As can be seen, the distribution of content is mainly focused on the online community, which resides on the ontological level outside the organization. The execution of such a SM-SECI cycle should lead to the knowledge reaching other online communities, so that a continious process of externalization and internalization occurs in which both are enhanced by combination and socialization, all resulting in knowledge being created from a larger online community. In its essence the knowledge that is being created by the company internally remains unchanged, and the distribution and extraction should serve as a complentary toolset managers can use to enhance the knowledge creation spiral within their companies.

As for the social contributions, managers of high-tech SMEs and other firms can benefit from implementing the method into their firms. While the practical value of the method stills needs to emperically determined, the strengths are clear as managers are not provided with a sole model or framework but are also provided the tools that can aid the process. While social media in itself is often poorly understood or disregarded for knowledge creation, by thinking in terms of the SM-SECI cycle new posssiblites emerge for the way this medium is seen as a source of competitive advantage.

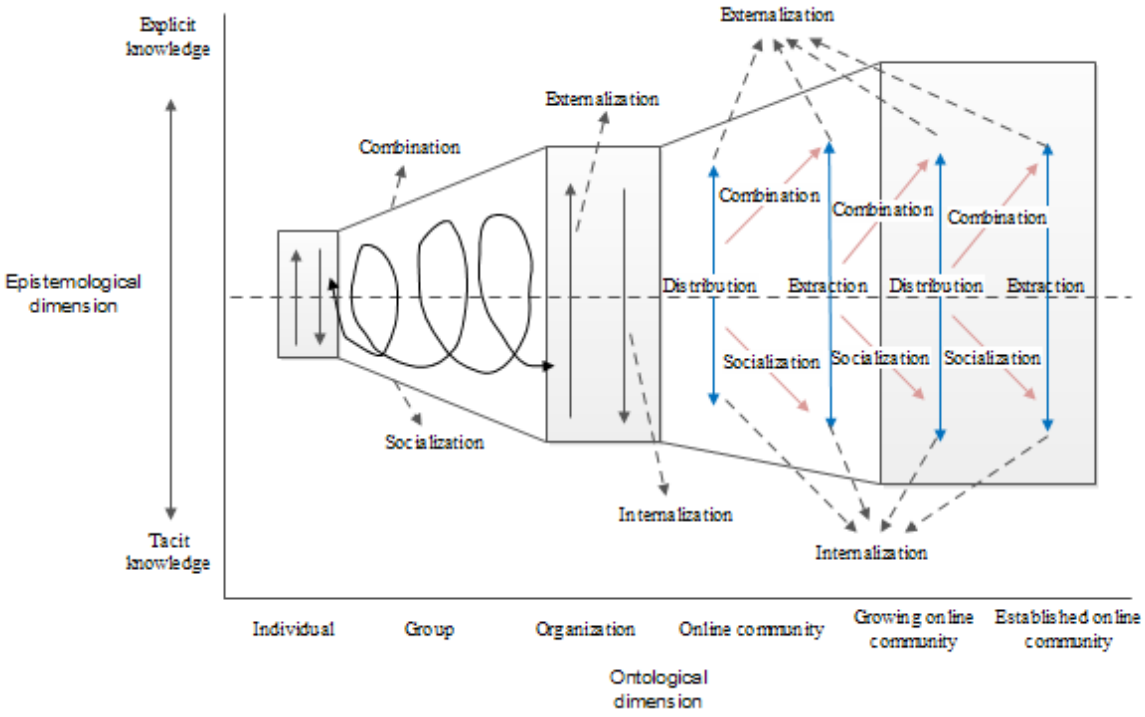


Figure 11 Addition to the knowledge creation spiral (own figure)

7.3 Limitations

The findings of this thesis are subject to a set of limitations. First, the sample that was used consisted of firms that are located mainly in the eastern part of the Netherlands. This is so due to the usage of a convenience sample. Additionally, the study suffered from a low response rate. This causes us to state that future case studies are needed in order to generalize the findings. The second limitation of this research lies in the data collection method, which could be biased as individuals were asked about their opinion in combination with experiences they have had. The assumption that the manager interviewed contained the needed expertise was not checked. Nevertheless, by trading in dialogue with the manager this was overcome and sufficient views could be provided and combined with actual facts from the social network of the companies. A third and final limitation that needs to be mentioned is the wide scope of the research area, which limited us to study additional concepts which could also be very valuable in this line of research. As was mentioned in Chapter Three much more work is needed on how firms integrate external knowledge into their knowledge base, for which the study of Kraaijenbrink et al. (2007) has provided a solid start towards a kernel theory. A final limitation of this study is the exclusion of information security and data reliability, as not everything that is included on social media platforms can be considered as reliable and true, for which the concept of information triangulation can serve as a valuable solution.

7.4 Suggestions for further research

Limitations present themselves as opportunities for future researchers to tackle up the interesting and challenging landscape of social media and knowledge creation and sharing. New research following this research should primarily focus on conducting more design cycles, in which the method proposed here is empirically tested through for instance a longitudinal case study. Managers can be observed as they use a log file or actively use tags, in which their activities are matched with each mode of the SECI cycle. As a result of the findings, future research could also focus on certain interaction patterns on social media and which ones lead to a certain mode of knowledge creation.

Reviewing other knowledge creation models or shying away from the tacit and explicit classification may also prove to be useful in examining social media. With the high amount of social media monitoring and analysis tools increases each day future research could also focus on assessing the quality of these tools by for instance ranking the output on relevant content or providing an integrative dashboard solution that is designed by using a knowledge management model. Lastly, future design science research is needed to for instance create a recruitment method that is facilitated by social media and is based on best practices, opening up research avenues in both HRM as the IS field. All in all, this research has shown that the creation of knowledge on social media is a process of give and take, and that if used properly it can help us navigate and cycle through this connected world.

References

Alavi, M., & E Leidner, D. (2001). Review: 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.

Back, A., & Koch , M. (2011). Broadening participation in Knowledge Management in Enterprise 2.0. *Information technology*, *53*(3), 135-141.

Bernoff, J., & Li, C. (2010). Harnessing the power of the oh-so-social web. *IEEE Engineering Management Review*, *38*(3), 8-15.

Charsombut, N. (2010). *Collaborative Knowledge Management in Organization from SECI model Framework*. Paper presented at TIIM conference, Pattaya , Thailand. doi:10.1504/IJMOM.2011.039529

Chatti, M. A., Klamma, R., Jarke, N., & Naeve, A. (2007). *The Web 2.0 Driven SECI Model based Learning Process*. Paper presented at Seventh IEEE International Conference on Advanced Learning Technologies, Niigata, Japan . doi:ICALT.2007.256

Constandse , J. M. (2013). *Exploring organizational knowledge creation: What is the practical value of Nonaka's Hypertext model and how can it be applied?* University of Twente Faculty Management and Governance, Enschede. Retrieved from http://purl.utwente.nl/essays/62752

Cook, S. D. N., & Brown , J. S. (1999). Bridging epistemologies: the generative dance between organizational knowledge and organizational knowing. *Organization Science*, *10*(4), 381-400.

Crawford , K. (2009). Following you: Disciplines of listening on social media. *Continuum: Journal of Media & Cultural Studies*, *23*(4), 525-535.

Crossan, M. M., Lane , H. W., & White , R. E. (1999). An Organizational Learning Framework: From Intuition to Institution. *The Academy of Management Review*, *21*(3), 522-537.

CSES . (2012). *Evaluation of the SME Definition*. Retrieved from http://ec.europa.eu/enterprise/policies/sme/files/studies/executive-summary-evaluation-sme-definition_en.pdf

Dass, M., & Kumar , S. (2013). Bringing product and consumer ecosystems to the strategic forefront.. *Business Horizons*, *57*(2), 225-234.

De Schryver, T., & Rosendaal , B. (2013). *Moderated mediation to identify the knowledge stocks, learning flows and barriers at a Dutch telecom operator*. Paper presented at IOLKC2012: International Conference on Organizational

Learning, Knowledge and Capabilities, Valencia , Spain . Retrieved from http://purl.utwente.nl/publications/87364

De Vera, J. C., & Murray, B. (2013). *The art of listening: Social media toolkit for non-profits* (The Greenlining Institute). Retrieved from http://greenlining.org/wp-content/uploads/2013/09/The-Art-of-Listening-Social-Media-Toolkit-for-Nonprofits.pdf

Delgado-Verde, M., Martín-de Castro, G., & Navas-López, J. (2011). Organizational knowledge assets and innovation capability: Evidence from Spanish manufacturing firms. *Journal of Intellectual Capital*, *12*(1), 5-19.

Dellarocas , C., Katona , Z., & Rand , W. (2010). *Media, Aggregators and the Link Economy: Strategic Hyperlink Formation in Content Networks* (Boston University School of Management). Retrieved from http://ssrn.com/abstract=1694370

Dermham, R., Cragg, P., & Morrish, S. (2011). Creating Value: An SME and Social Media. *PACIS 2011 Proceedings*, *53*(1), 1-9. Retrieved from http://aisel.aisnet.org/pacis2011/53

Desouza, K. C., & Awazu, Y. (2006). Knowledge management at SMEs: five peculiarities. *Journal of Knowledge Management.*, *10*(1), 32-43.

Frenken, R. R. M. (2013). *Enabling entrepreneurs to perform more efficient market research using social media* (University of Twente, Faculty Management and Governance, Enschede). Retrieved from http://purl.utwente.nl/essays/63468

Gallaugher, J., & Ransbotham, S. (2010). Social media and customer dialogue management at Starbucks. *MIS Quarterly Executive* , *9*(4), 197-212.

Gibbs, G. R. (2007). *Analyzing Qualitative data*. California , United States: SAGE Publications.

Gourlay, S. (2006). Conceptualizing knowledge creation: a critique of Nonaka's theory. *Journal of Management Studies*, *43*(7), 1415-1436.

Gourlay, S., & Nurse , A. (2005). Flaws in the "engine" of knowledge creation: A critique of Nonaka's theory. *Issues in Knowledge Management*, *5*, 293-316.

Haefliger, S., Monteiro, E., Foray, D., & Von Krogh, G. (2011). Social Software and Strategy. *Long Range Planning*, *44*(5-6), 297-316.

Hanna, R., Rohm, A., & Crittenden, V. L. (2011). We're all connected: The power of the social media ecosystem. *Business horizons*, *54*(1), 265-273.

Hansen, D. L., Shneiderman, B., & Smith, M. A. (2010). *Analyzing social media networks with NodeXL insights from a connected world*. Amsterdam, The Netherlands : Morgan Kaufmann.

Hevner, A. R., & Chatterjee, S. (2010). Design science research in information systems. *Design Research in Information Systems: Theory and Practice*, *1*, 9-22.

Hevner, A. R., March, S. T., Park, J., & Ram, S. (2004). Design Science in Information Systems Research. *MIS Quarterly*, *28*(1), 75-105.

Hey, J., Linsey, J., Agogino, A., & Wood, K. (2008). Analogies and Metaphors in Creative Design. *International Journal of Engineering Education*, *24*(2), 283-294.

Huang, K., & Güney, S. (2012). Toward a Framework of Web 2.0-Driven Organizational Learning. *Communications of the Association for Information Systems*, *31*(6), 130-53.

Hutchinson, V., & Quintas, P. (2008). Do SMEs do Knowledge Management?: Or Simply Manage what they Know? *International Small Business Journal*, *26*(2), 131-154.

Kaplan, A. M., & Haenlein, M. (2010). Users of the world, unite! The challenges and opportunities of Social Media. *Business Horizons*, *53*(1), 59-68.

Kaplan, A. M., & Haenlein, M. (2011). The early bird catches the news: Nine things you should know about micro-blogging. *Business Horizons*, *54*(2), 105-113.

Kietzmann, J. H., Hermkens, K., McCarthy, I. P., & Silvestre, B. S. (2011).). Social media? Get Serious! Understanding the functional building blocks of social media. *Business horizons*, *54*(3), 241-251.

Kimmerle, J., & Cress, U. (2010). The interplay between individual and collective knowledge: Technologies for organizational learning and knowledge building. *Knowledge Management Research and Practice*, *8*(1), 33-44.

Kraaijenbrink, J., Wijnhoven, F., & Groen, A. (2007). Towards a kernel theory of external knowledge integration for high-tech firms; Exploring a failed theory test. *Technological forecasting & social change*, *74*, 1215-1233.

Löwik, S. J. A. (2013). *Micro-foundations of absorptive capacity : a study on knowledge processes for innovation in SMEs*. Retrieved from http://purl.utwente.nl/publications/85545

Mangold, W. G., & Faulds, D. J. (2009). Social media: The new hybrid element of the promotion mix. *Business Horizons* , *52*(4), 357-365.

Nissen, M. E. (2002). An Extended model of knowledge-flow dynamics. *Communications of the Association for Information Systems* , *8*(1), 1-18.

Nonaka, I., & Konno, N. (1998). The Concept of „Ba“: Building a Foundation for Knowledge Creation. *California Management Review*, *40*(3), 40-54.

Nonaka, I., & Takeuchi , H. (1994). A dynamic Theory of Organizational Knowledge Creation. *Organization Science*, *5*(1), 14-37.

Nonaka, I., & Von Krogh, G. (2009). Perspective--Tacit Knowledge and Knowledge Conversion: Controversy and Advancement in Organizational Knowledge Creation Theory. *Organization Science*, *20*(3), 635-652.

O'Reilly, T. (2005, September 30). What is Web 2.0: Design patterns and business models for the next generation of software. Retrieved from http://www.oreillynet.com/pub/a/oreilly/tim/news/2005/09/30/what-is-web-20.html

Panahi, S., Watson, J., & Partridge, H. (2013). Towards tacit knowledge sharing over social web tools. *Journal of Knowledge Management*, *17*(3), 379-397.

Piskorski, M. J. (2011). Social strategies that work . *Harvard Business Review* , *89*(11), 166-122.

Polanyi, M. (1966). *The Tacit Dimension*. New York, United States: Doubleday.

Popadiuk, S., & Choo, C. W. (2006). Innovation and knowledge creation: How are these concepts related? *International Journal of Information Management*, *26*(4), 302-312.

Sosa, M. E. (2011). Where do Creative Interactions Come From? The role of Tie content and Social Networks*. Organization Science, 22*(1), 1-21.

Sparrow, J. (2001). Knowledge Management in small firms. *Knowledge and process Management*, *8*(1), 3-16.

Van Aken, J. E. (2004). Management Research Based on the Paradigm of the Design Sciences: The Quest for Field-Tested and Grounded Technological Rules. *Journal of Management Studies*, *41*(2), 219-246.

Wagner, D., Vollmar, G., & Wagner, H. (2014). The impact of information technology on knowledge creation: An affordance approach to social media. *Journal of Enterprise Information Management*, *27*(1), 31-44.

Webster, J., & Watson, R. T. (2002). Analyzing the past to prepare for the future: Writing a literature review. *MIS Quarterly*, *26*(2), 13-23.

Wijnhoven, F. (2008). Manufacturing Knowledge Work: The European Perspective. In *Methods and Tools for Effective Knowledge Life-Cycle-Management* (pp. 23-44). New York, United States: Springer Berlin Heidelberg.

Wijnhoven, F. (2012). *Information services design: A Design Science Approach for Sustainable Knowledge*. Routledge, New York, United States.

Wijnhoven, F. (2013). *Enabling the collective brain for organizations: a QuickStart in management software skills* (University of Twente, Faculty Management and Governance, Enschede). Retrieved from http://purl.utwente.nl/publications/87959

Appendix

A Interview

A.1 Protocol

The interviews conducted were all semi-structured in nature meaning the protocol mentioned here serves a guideline but was not always followed as the focus of the interview was to trade into a discussion with the manager of the value of social media in the way knowledge is currently being created. To faciliate this discussions a general introduction was given, followed by knowledge creation questions, social media questions and a short feedback session on the SM-SECI cycle.

Introduction

First and foremost introductory note. For note-taking purposes this interview will be recorded using a mobile phone, so I would like to ask for permission to do this. The transcripts will only be used for research purposes, viewed by the researchers and not made publicly available. The purpose of this study is to develop a method that facilitates knowledge creation through social media for high-tech SMEs, thus using social platforms or social media to obtain the knowledge that is relevant for your organization. So I will be asking you a few questions on how you are currently dealing with the concept of knowledge and I will also be asking you questions about your experiences with social media and the way you view this as valid knowlede creation tool. I will also provide you with an examplar of the SM-SECI method, a prelimar form in the design process, for which I would like your opinion.

Profile of executive and organization

1. What is your function within this organization or what are your tasks?
2. How would you describe the structure and culture of this organization?
3. What distinguishes this firm from other high-tech SMEs?

[Explain the difference between tacit and explicit knowledge and knowledge creation]

Knowledge creation

4. How was does your firm create knowledge?
    a. *Socialization: keywords interaction and community*
    b. *Externalization: keywords dialogue and discussions*
    c. *Combination: keywords intergration*
    d. *Internalization: keywords value of information*
5. How does your firm find external knowledge?

a. *Socialization: keywords interaction and community*
b. *Externalization: keywords dialogue and discussions*
c. *Combination: keywords intergration*
d. *Internalization: keywords value of information*

Social media

6. What is your opinion on social media for corporate use?
7. What are your experiences with social media inside [insert company name]?
8. Do you use any platforms and how or why (not)?
9. Do you think it is difficult to create knowledge using social media and why?

Method feedback

[Show SM-SECI method, explain how it was developed from the methods in theory, allow for reading and digesting]

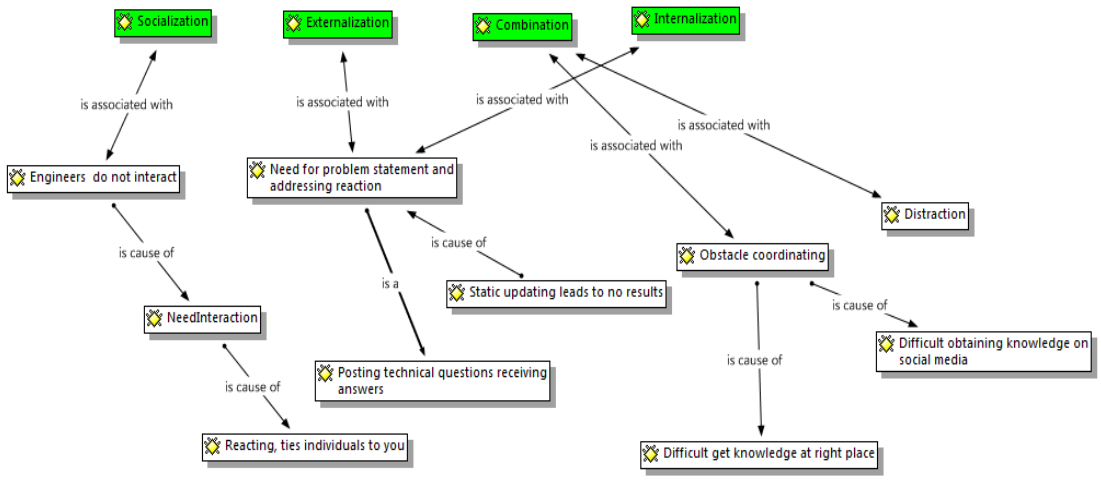
10. Do you recognize parts from the method? Are you applying some parts now?
11. What is your opinion on the method?
12. What elements of this method are you missing relevant to your firm?

[Thank interviewee. The company name and the transcripts will not be included in the thesis. A full copy of the report will be available to the respondent after the research is concluded.]

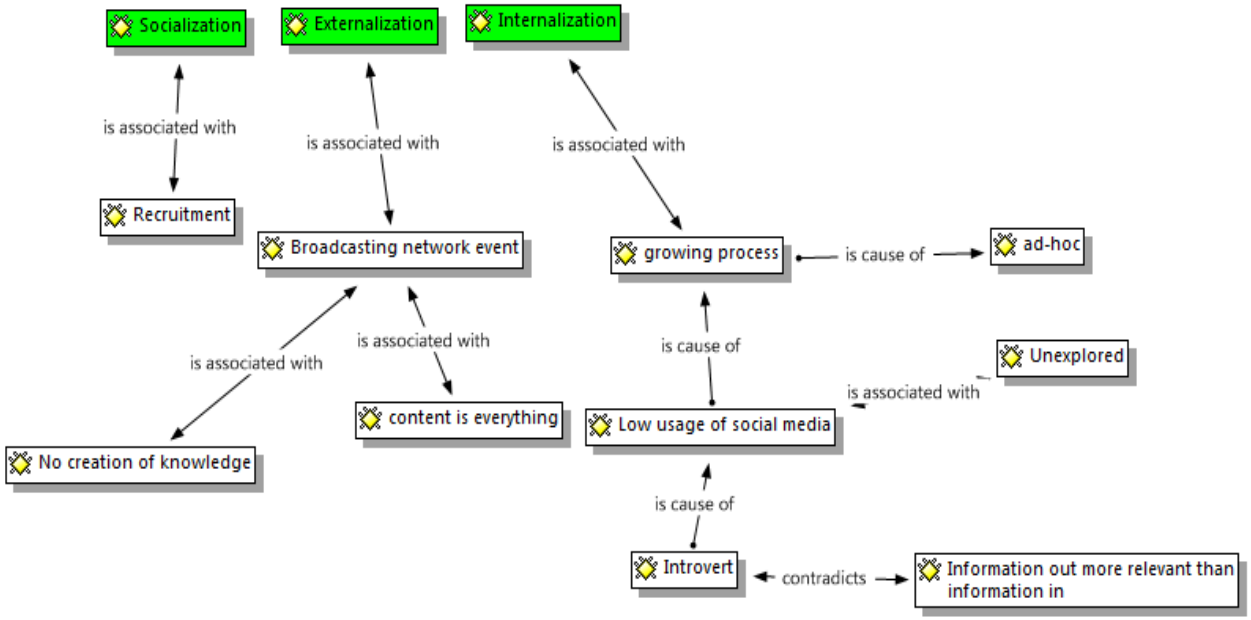
A.2 Transcripts

{not available in public version}

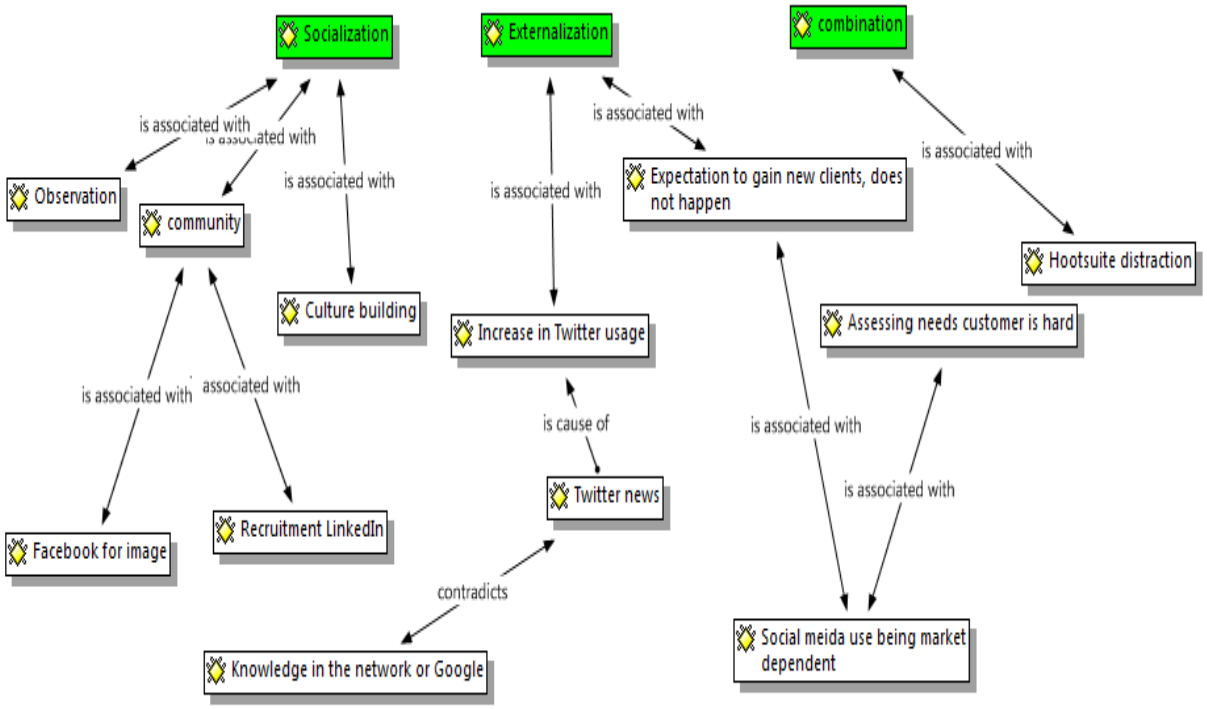
A.3 Classification of codes



Company A



Company B



Company C

B Journal selection and use

B.1 Articles used for objectives of a solution and corresponding journals

Article	Corresponding journal or conference
Nonaka and Takeuchi (1994)	Organization Science
Huang and Güney (2012)	Communications of the Association for the information systems
Kimmerle, Cress and Held (2010)	Knowledge Management Research and Practice
Chatti, Klamma, Jarke and Naeve (2007)	IEEE International Conference on Advanced Learning Technologies
Panahi, Watson and Partridge (2013)	Journal of Knowledge Management
Wagner, Vollmar and Wagner (2014)	Journal of Enterprise Information Management

B.2 Scopus search syntax

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TITLE-ABS-KEY(keyword)AND (LIMIT-TO(EXACTSRCTITLE,"Computers in human behavior" )
OR LIMIT-TO(EXACTSRCTITLE,"MIS Quarterly: Management Information systems" )
OR LIMIT-TO(EXACTSRCTITLE,"Organization Science" )
OR LIMIT-TO(EXACTSRCTITLE,"Business horizons" )
OR LIMIT-TO(EXACTSRCTITLE,"Cyberpsychology, behavior and social networking" )
OR LIMIT-TO(EXACTSRCTITLE,"Communications of the ACM "
OR LIMIT-TO(EXACTSRCTITLE,"MIS Quarterly Executive")
OR LIMIT-TO(EXACTSRCTITLE,"Harvard business review" )
OR LIMIT-TO(EXACTSRCTITLE,"Journal of small business and enterprise development " ))
AND (EXCLUDE(SUBJAREA,"ARTS" ) )
AND (EXCLUDE(SUBJAREA,"MEDICINE" ))
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