Master's Thesis

Sustainable Innovation

and Knowledge Management



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Number of characters/pages 171.460 / 75.5

Date of Submission 15th of May 2020

Abstract

I draw on the emerging literature on organizational capabilities associated with learning and sustainability innovation to investigate the effects of knowledge management, dynamic capabilities and normative values on sustainable innovation. The aim of this paper is to gain an understanding of how sustainability is managed from a knowledge management perspective, and how sustainable innovation and knowledge management foster integrative- and dynamic capabilities.

To measure how and to which degree sustainable innovation has been implemented in manufacturing companies, I have conducted a literature review of four articles that empirically deal with organizational capabilities associated with learning and sustainability innovation. Two of these focus on organizational capabilities and two of these focus on the company's absorptive capacities. The empirical studies deal with manufacturing companies in Denmark, Italy, and two in Germany one of which deals with a multinational company with local branches worldwide.

Managing sustainable innovation is relevant for firms, as sustainability is becoming increasingly complex and dynamic, due to rules and regulations, health- and climate catastrophes, increasing consumer demand for sustainable products and services, and due to resources that are being used up faster than they can be regenerated.

My findings suggest that sustainable innovation is an inevitable prerequisite for the long-term survival of today's companies. The main findings of the study are that firms should focus on the development of environmental-oriented absorptive capacities of knowledge acquisition and knowledge exploitation; both a unit-specific absorptive capacity and a common absorptive capacity. Furthermore, A second finding is that a firm's organizational capabilities seem to develop through focus on corporate sustainability. A third finding reveals that dynamic capabilities were found to be of high relevance for firms in VUCA conditions (volatility, uncertainty, complexity and ambiguity), and that firms should use the sensing capability to adapt their knowledge to environmental VUCA conditions and possibly be the drivers of new knowledge themselves. Finally, I found that corporate sustainability should be a part of the cognitive frame of the firm to encourage normative values and in turn increase the managers' open-mindedness and motivation towards sustainable innovation, and their willingness to risk-taking concerning sustainability.

Acknowledgement

I would like to thank the people who have been a part of the process in writing this paper. My supervisor, Karin Tollin, has been a great help. She has supported me with sparring and her proficiency in the subject. I would also like to thank her for her support and motivation during the entire process.

My family, boyfriend, and friends have also supported me through the entire process. I would like to give a special thanks to my father, who has been my sparring partner whenever I needed to say my thoughts out loud or discuss any given subject or problem.

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Chapter 1: Introduction

This chapter presents the motivation, background, problem identification, problem formulation and delimitation of this study.

Motivation

Throughout my study in Strategic Market Creation, I have learned about knowledge management, which was the motivation for my choice of research in this paper. The program has a focus on creating an innovative mindset and creating new business opportunities. The UN's Sustainable Development Goals have created an even higher focus on sustainability in companies, which made me curious about how organizations manage the implementation of these goals and led me to combine the knowledge management theory with sustainable innovation. My supervisor introduced me to Day and Schoemaker's work on adapting to fast-changing markets and technologies through the dynamic capabilities; sensing, seizing and transforming. I found this perspective very interesting, as the sustainable environment is complex and increasingly changing. Firms face many changes concerning sustainability, and I wanted to find out, how they can create a fundament in the firm which fits the dynamic environment. Through my studies I have worked with values-based normative innovation, which I found would be an interesting and relevant perspective on sustainable innovation. Consequently, my motivation for conducting this study is a combination of my interest and curiosity about sustainability and my insights about knowledge management, dynamic capabilities and values-based normative innovation.

Background

Sustainability is a megatrend and an important driver for many firms. The manufacturing market is a very competitive market and therefore it is important for companies to stay innovative and come forward with new ideas and techniques to create new and better products. Already established and large companies in the manufacturing industry have increased their focus on sustainable products during the past decades. The degree to which the organizations prioritize and focus on sustainability varies a lot. The transparency about their commitment to sustainability also varies from one organization to another. Furthermore, we have also seen new players in the market, where their main purpose and foundation for starting the organization have been to create more sustainable products.

Problem Identification

Climate changes have been accelerating through the past decades and the consequences of one generation's actions have already started to appear. Our future depends on our willingness to change the world we are living in. We cannot take back or completely eliminate the damage that we have already done, but we can do better in the future. David Wallace-Wells speaks in a 'Ted Talks Daily' podcast about, how we can change the planet's climate future. He states that "...even if we take dramatic action and avoid some of these truly terrifying worst-case scenarios, it would mean living on an entirely different planet. With a new politics, a new economics, a new relationship to technology and a new relationship to nature. A whole new world". If we want a new future, we need to completely change our way of living. We have the tools we need to prevent climate change, global poverty, epidemic disease, and abuse of women. What we need is "new politics – a way of overcoming all those obstacles – our culture, our economics, our status quo bias, our disinterest in taking seriously anything that really scares us" (Ted Talks Daily: David Wallace-Wells).

"This better future won't be easy, but the only obstacles are human ones... Science isn't stopping us from taking action, and neither is technology" (Ted Talks Daily: David Wallace-Wells).

Problem Formulation

The aim of this thesis is to assess manufacturing companies' knowledge management systems with regard to how they have been affected by sustainability. By examining how integrative- and dynamic capabilities and agile project management, with a normative value-based perspective, are applied in firms, I hope to gain an understanding of how they are affected by corporate sustainability and knowledge management systems.

Sub Questions

- 1. What characterizes sustainability in the manufacturing industry?
- 2. How is sustainability managed from a knowledge management perspective?
- 3. How do sustainable innovation and knowledge management contribute to the development of capabilities?
- 4. Do manufacturing companies face potential organizational *development* through the *development* of organizational capabilities in corporate sustainability innovation processes?

Delimitation

In order to narrow the scope and focus of my study, certain limitations have been made. I have chosen to focus on manufacturing companies and how innovation can be improved by adapting dynamic capabilities in their knowledge management systems. Furthermore, I have chosen to focus on the European market, more specifically the German, Italian and Danish market, due to the relevance of the empirical studies for my investigation. One of the empirical studies, however, is a German multinational company, and some of its subsidiaries are located outside of Europe. The study on the German multinational company investigates the headquarters and three subsidiaries in the US: the corporate headquarters worldwide (Germany), the US headquarters, the BASF future business (US) and the US catalyst business.

Thesis Structure

My thesis is structured in 6 chapters; introduction, methodology, theoretical framework, literature review, discussion and conclusion. An overview of the structure of the thesis is represented in figure 1 below. The first chapter presents the motivation, problem identification, problem formulation and delimitations of the thesis. The second chapter is a review of the methodology, which presents the research philosophy, research approach, and research strategy. Chapter three outlines the theories: sustainability, innovation, normative values-based innovation, knowledge management, and dynamic capabilities. The sustainability section outlines a definition of sustainability by Baumgartner et el. (2017), a review of the triple bottom line and its applicability, FN's Sustainable Development Goals, and a review of what it means to be a sustainability leader. Herefter, I define innovation, the innovation Space by Tidd, Bessant and Pavitt (2005), and lastly sustainable innovation in terms of how it provides potential solutions to some of the most challenging issues that currently face the world. The next section, values-based innovation, introduces the concept with an introduction of the concept by Breuer and Lüdeke-Freund (2017) and how it should be used in regards to sustainability. The following section outlines knowledge management by defining what knowledge is, identifying knowledge management strategies, challenges in regard to managing knowledge and finally the model of the revised knowledge pyramid by Jennex (2019). The last section about dynamic capabilities, provides a definition of the agile manifesto, a definition of dynamic capabilities by Teece (1993), and dynamic capabilities in VUCA conditions by Day & Shoemaker (2016). Chapter four is the literature review, where the four articles are reviewed and in the end I represent the future researc in the four articles. The four articles are about organizational capabilities and absorptive capacity: Developing Sustainable New Products in the Textile and Upholstered Furniture Industries: Role of External Integrative Capabilities (Dangelico and Pujari, 2013); How organizational cognitive frames affect organizational capabilities: The context of corporate sustainability (Grewatsch and Kleindienst, 2017); Under the Tip of the Iceberg: Absorptive Capacity, Environmental Strategy, and Competitive Advantage (Delmas, Hoffmann, and Kuss, 2011); On the implementation of a 'global' environmental strategy: the role of absorptive capacity (By Pinkse, Kuss and Hoffmann, 2010). The fifth chapter presents the discussion, where I discuss the theoretical framework and the literature review in regards to the four subquestions, and afterwards I discuss managerial implications of my study and future research. The final chapter, chapter six, is a conclusion, where I outline the findings of this study.

Chapter 2: Methodology

In this chapter, I will present the research philosophy, the research approach and research strategy applied in this study.

Research Philosophy

Research philosophy reflects assumptions about the way we view the world. "Anyone who examines a problem will not start from scratch but with some kind of pattern, some assumptions and ideas in mind." (Jonker & Pennink, 2010, p. 27). Research philosophy deals with the way we develop knowledge and thereby it affects the way we conduct a research study. Epistemology and ontology are the two major ways of thinking about research philosophy (Saunders, et al., 2011).

Ontology Considerations

"Ontology is a branch of philosophy which is concerned with the nature of social phenomena as entities" (Saunders et al., 2011, p. 128), and it reflects "the researcher's view of the nature of reality or being" (p.119). A researcher with an objectivist position argues that "social phenomena and their meanings have an existence that is independent of social actors" (Bryman, 2016, p.693). Whereas, a researcher with a constructionist orientation argues that "social phenomena and their meanings are continually being accomplished by social actors" (Bryman, 2016, p.689).

This study is using a constructivist approach, as I perceive the world through a socially constructed point of view, where reality depends on social actors. My interpretation of the social reality is not definitive, but it reflects the specific versions of social reality that is presented in the four empirical studies that constitute my literature review. Bryman (2016) states that social phenomena are in a constant state of revision, which is represented through the dynamic environments that are investigated in the four articles. Additionally, he states that "this position challenges the suggestion that categories such as organization and culture are pre-given" (p. 33). Thus, I perceive the manufacturing industry as socially constructed and in a constant state of revision. My ontology determines how I see the world of business and management, and thereby my choice of what to research (Saunders, 2019)

CEOs, managers, experts and other participants of the empirical studies in my literature review, constitute their own world through their subjective views, which means that they perceive the constructs of my investigation in different ways. The purpose of my study is to understand, how these constructs are socially constructed in the manufacturing industry through subjective interpretations and to understand the motives, actions and intentions in a meaningful way (Saunders et al., 2011).

Epistemology Considerations

"Epistemology concerns what constitutes acceptable knowledge in a field of study." (Saunders et al., 2011, p. 129). Thus, it reflects the researcher's understanding of what is considered acceptable knowledge. The two paradigms in epistemology are positivism and interpretivism, which are opposites.

A positivistic stance "advocates the application of the methods of the natural sciences to the study of social reality and beyond" (Bryman, 2016, p. 714). Positivistic epistemology is characterized as observable and measurable facts, law-like generalizations, numbers, causal explanation and prediction as contribution (Saunders et. al, 2019).

In contrast, an interpretivist stance "requires the social scientist to grasp the subjective meaning of social action" (Bryman, 2016, p. 712) and requires the researcher "to grasp the subjective meaning of social action." (p.692). Interpretivism is characterized as perceiving theories and concepts to be simplistic, focus on narratives, stories, perceptions and interpretations, and new understandings and worldviews as contribution (Saunders et. al, 2011). Accordingly, positivist researchers interpret the subjective meanings of social actors as acceptable knowledge, and it is my own epistemological assumptions, with support from my supervisor which determine what is considered legitimate for my research (Saunders et. al, 2011).

This study takes an interpretivist stance as I interpret the social role of others in accordance with my own set of meanings (Saunders et. al, 2011). As my investigations concerns dynamic and complex constructs, which are affected by context, settings, humans and organizations, it makes sense to apply an interpretivist stance. It does not make sense to measure facts or make law-like generalizations, as knowledge management processes are complex and dynamic. Each of the four empirical studies in my literature review, contributes with insights depending on their participants' subjective views. Based on understanding and interpretation, I accept the research conducted in my empirical studies as acceptable knowledge.

Research Approach

Research approach is about choosing the way you combine theory and empirical data. Three different research approaches exist; deductive, inductive, and abductive. The deductive approach conduct research with reference to hypotheses and ideas created from theory (Bryman, 2016). Thus, when you choose to apply a deductive approach, "you develop a theory and hypothesis (or hypotheses) and design a research strategy to test the hypothesis" (Saunders et al., 2011, p. 124). Oppositely, in the inductive approach, "you collect data and develop theory as a result of your data analysis" (p. 124).

Peirce (1867/1960) introduced an alternative approach, which was abduction. When you apply an abductive approach, "the researcher grounds a theoretical understanding of the contexts and people he or

she is studying in the language, meanings, and perspectives that form their worldview" (Bryman, 2016, p. 394). Saunders, (2011); Yu, (1994) states that it might be advantageous to apply the abductive approach, as it combines the inductive approach and the deductive approach, which both have different merits and shortcomings. In the abductive approach it is possible to go back and forth between theory and data and in a way use critical reasoning (Yu, 1994). Bryman (2016) states that "the crucial step in abduction is that, having described and understood the world from his or her participants' perspectives, the researcher must develop a social scientific account of the social world as seen from those perspectives." Consequently, the abductive approach is appropriate for my study, as I aim to understand the manufacturing industry from the empirical studies' perspectives and finally, I suggest a social scientific account of the social world as seen from those perspectives. My research questions aim to understand the manufacturing industry, however, I do not develop theories or hypotheses, as you do in the deductive approach. The abductive approach is to some extent similar to the inductive approach, as you collect data and develop theory as a result of the data analysis. However, the abductive approach distinguishes itself from the inductive approach, as it relies on explanations and understanding on participants worldview, rather than data. Furthermore, I do not develop a theory, but rather suggest a social scientific account of the social world as seen from the participants' perspectives.

Research Strategy

This study is theoretical and the material that is being treated mainly consists of research papers and articles. Additional materials included in this research study consist of journal articles, book chapters and market data. The main research approach that I have used is that of a literature analysis. I have carried out two theoretical analyses.

The first theoretical analysis had the purpose of clarifying the concepts of sustainability, innovation, knowledge management, and dynamic capabilities and to create coherences between these theoretical perspectives. "Tranfield et al. (2003) argue that it is necessary to carry out studies to evaluate the relevance of the subject to be researched, as well as to delimit the area of study" (Bezerra et al, 2019, p. 3). I searched for literature through SCOPUS, libsearch, google scholar and academia. I searched for papers which relate to sustainable innovation and knowledge management. I chose the literature, which I found relevant for the purpose of my study. The literature that I found constitutes the base of my theoretical framework.

The second part had the purpose of identifying coherences between the concepts in empirical investigations, and which essential constructs that affect the way sustainability is implemented. In cooperation with my supervisor, I conducted a literature research at SCOPUS and decided to apply Bezerra, Gohr, and Morioka (2019) to identify my empirical research. Bezerra et al. (2019) is a systematic literature review, which presents a general overview of the literature on organizational capabilities for sustainability.

The aim of the study was to propose an integrative framework that relates strategic organizational capabilities for sustainability and expected corporate sustainability benefits. In the study Bezerra et al. identify, evaluate and interpret 88 relevant and available articles regarding capabilities and sustainability, social performance and social responsibility. They presented different organizational capabilities for sustainability in an overview with definitions, related terms and references (table 1). I used the reference related to the category; capabilities related to the absorption of knowledge/learning about sustainability. Bezerra et al. defines this category as the ability to acquire knowledge (from internal and external sources) related to processes and practices that may improve sustainable results.

Data collection is a process, where information is collected and analyzed, and subsequently put together to make sense in relation to relevant questions, and finally, evaluation of the results.

My data collection method is a literature review (LR), which is a secondary study that identifies primary studies which provide relevant available evidence to the specific research question. A literature review enables us to understand, what existing research tells us about the field of investigation. It can be defined as a tool to identify, evaluate and interpret available and relevant studies regarding a particular research question. The LR collects and reviews relevant literature in order to provide an overview of the studies' exposure of the problem that is being investigated, research gaps in the literature and a research agenda. The findings from the LR will be presented and Literature gaps and opportunities for future research will be reported in the end.

The LR is a labor-intensive task, as it is an intentional selection of a huge amount of data. In my search for literature, I have filtered the results of a number of articles to choose the most relevant articles for my research. The articles I have chosen needed to fit certain criteria that I had selected beforehand and certain criteria were made during the process, due to the availability of studies. I chose certain criteria for inclusion and exclusion of articles.

25 articles are represented in Bezerra's overview concerning capabilities related to the absorption of knowledge/learning about sustainability (see Table 1). I excluded 12 articles, which were either not empirical studies, not available, or not relevant in regard to the purpose of my study. I structured an overview of the remaining 13 articles in terms of area of research, industry and country, research approach, context, author(s), article name, theory, keywords, purpose of article, findings and further research (Appendices I). It is important to have a comprehensive coverage of the literature in a study to generate generalizable results. However, due to time constrains, this was not possible (Bryman, 2016).

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General overview of OCSs categories.

OCS categories	Definition	Related terms	References
Capabilities related to collaborative relationships for sustainability (OCS 1)	Ability to cooperate with other companies and other stakeholders to jointly address sustainability challenges.	Ability to collaborate; Inter-firm relations; Relational capability; relationship building; capability for collective action; Integration with stakeholders (Customers, suppliers); Ability to integrate with external resources; cultural context; supply chain integration	Choi and Hwang (2015); Hofmann et al. (2012); Hoof and Thiell (2014); Luzzini et al. (2015); Renouard (2011); Sharma et al. (2007); Spekkink (2015); (Annunziata et al., 2018; Behnam et al., 2018; Bowen et al., 2001; Chen and Kitsis, 2017; Choi et al., 2019; Dangelico et al., 2013, 2017; Gelhard and von Delft, 2016; Grewatsch and Kleindienst, 2017; Hong et al., 2018; Kumar et al., 2018; Lee and Klassen, 2008; Leonidou et al., 2013; Liu et al., 2018; Melander, 2018; Peters et al., 2011; Scarpellini et al., 2017; Sharma and Vredenburg, 1998; Torugsa et al., 2012; Watson et al., 2017; Woo et al., 2016; Werlev et al., 2010
Capabilities related to the absorption of knowledge flearning about sustainability (OCS2)	Ability to acquire knowledge (from internal and external sources) related to processes and practices that may improve sustainable results	Absorption capability; external knowledge links; acquisition of knowledge and skills; acquisition of technical know-how; learning capability; knowledge assessment	(Beske, 2012; Beske et al., 2014; Chang. 2017; Chen, 2008; Dangelico et al., 2013; Delmas et al., 2011; Fraj Andrés et al., 2013; Grewatsch and Kleindienst, 2017; Johnson, 2017; Ketata et al., 2014; Kim et al., 2015; Pinkse et al., 2010; Sharma and Vredenburg, 1998; Upstill-Goddard et al., 2016; Xie et al., 2016 Charan and Murty, 2018; Grewatsch and Kleindienst, 2017; Jiang et al., 2018; Pacheco et al., 2018; Rodriguez and Cunha, 2018; Zhou et al., 2018; Hong et al., 2018; Melander, 2018; Choi et al., 2019; Chen and Kitsis, 2017)
Capabilities related to innovation/technology for sustainability (OCS 3)	Ability to develop technologies, products and processes aiming sustainability goals.	Capability of Innovation; sustainable innovations; continuous innovations; Predisposition to innovate; R&D capability; technological adoption capability; Technological detection/response capability	(Amores-Salvadó et al., 2015; Annunziata et al., 2018; Bhattarai et al., 2019; Cezarino et al., 2019; Chakrabarty and Wang, 2012; Chen, 2008; Dangelico et al., 2017; Fernando et al., 2019; Fraj Andrés et al., 2017; Fernando et al., 2019; Fraj Andrés et al., 2013; Gabler et al., 2015; Hofmann et al., 2012; Hong et al., 2018; Jiang et al., 2018; Kang and He, 2018; Ketata et al., 2014; Ko and Liu, 2017; Lai et al., 2015; Leonidou et al., 2013; Ramanathan et al., 2017; Rodriguez and Wiengarten, 2016; Sharma et al., 2007; Sharma and Vredenburg, 1998; van Kleef and Roome, 2007; Wong, 2013)
Capabilities related to alignment/motivation for sustainability (OCS4)	In-house capabilities that create an internal enabling environment to meet the challenges of sustainability within the organization.	Shared vision capability; understanding of environmental issues; employee support; multifunctional integration; support from senior management; capability for training, qualification and motivation; environmental management capability of the organization; space, commitment and an open-mind to learn about environmental issues; internal communication capability; entrepre neurship; ability to acquire e nough capital to invest in environmental management; environmental orientation	(Bowen et al., 2001; Cezarino et al., 2019; Chang, 2017; Chen and Kitsis, 2017; Fraj Andrés et al., 2013; Gabler et al., 2015; Jiang et al., 2018; Johnson, 2017; Kang and He, 2018; Ketata et al., 2014; Kim et al., 2015; Lee and Klassen, 2008; Leenidou et al., 2013; Melander, 2018; Paulkaj, 2011; Peters et al., 2011; Torugsa et al., 2012)
Capabilities related to marketing/external communication for sustainability (OCS5)	Ability to explore and meet market needs on sustainable issues.	Marketing capability; Ability to communicate and share sustainability information with stakeholders	(Grewatsch and Kleindienst, 2017; Hirunyawipada, 2018; Jiang et al., 2018; Kim et al., 2015; Ko and Liu, 2017; Mariadoss et al., 2011; Wong, 2013; Woo et al., 2016; Yu and Ramanathan, 2016) (Bhattarari et al., 2019; Hong et al., 2018; Kamboj and Rahman, 2017; Yu et al., 2017; Zhou et al., 2018)
Capabilities related to flexibility/adaptation on sustainable issues (OCS6)	Ability to respond adequately and quickly to sustainability challenges	Environmental Adaptability Capability; flexibility capability; resilience capability; organizational capability for change; construction and reconfiguration of resources	(Dangelico et al., 2017; Eltantawy, 2016; Folke et al., 2002; Johnson, 2017; Judge and Elenkov, 2005; Ramachandran, 2011; Reuter et al., 2010; Wong, 2013; Zhou et al., 2018; Hong et al., 2018; Oni et al., 2019)
Capabilities related to the management of sustainable operations (OCS7)	Ability to tailor the efficiency of operations processes to sustainable issues	Environmental product and process management capability; Echo design capabilities; capability of oper ations; Process improvement; Ability to integrate with internal resources; Execution capability (integration of resources); sustainable pur chasing capability	(Betts et al., 2018; Bowen et al., 2001; Dangelico et al., 2017; Hirunyawipada, 2018; Lee and Klassen, 2008; Liu et al., 2018; Peters et al., 2011; Ramachandran, 2011; Yook et al., 2017; Yu and Ramanathan, 2016)

Table 1: General overview of OCSs categories Bezerra et al. (2019)

As I had collected all the information, I concluded that all 12 articles were relevant for my studies. I chose to further collect information about type of study and context, to select the articles most relevant for my investigation. I colour coded the articles in the area of research, industry and country coloumn based on type of industry, and I noted in which country the investigations were carried out (appendices II).

Furthermore, I marked the research approach and context columns with red, green and yellow; green representing the articles that I found most relevant based on research approach and context, yellow representing the articles that I considered relevant, and red representing the articles I found least relevant compared to the other articles.

On the basis of this overview, I chose seven articles, which were all in the manufacturing industry and marked with green. Of the seven articles, I chose four which I found most relevant for my study and which were all investigations in Europe; Germany, Italy and Denmark. These articles are marked in blue in the article name column (appendices I. One of the four articles is about a multinational company headquartered in Germany. Of the seven articles about the manufacturing industry, I excluded three about investigations in China.

The main subject of two of the four articles, which I chose, concerns organizational capabilities, and the main subject of the other two concerns absorptive capacity, where one of them has a focus on the organizational cognitive frame, and the other one has a focus on knowledge sharing in a multinational company (MNC). I found it relevant to apply an empirical study concerning an MNC, as Bezerrra et al. (2019) state that only few studies concern MNCs. The methods used in the articles are both quantitative, qualitative and mixed method. These four articles constitute my empirical data for this study.

Besides the preparation and selection of data, which is time consuming and labor-intensive, another task that is time consuming and labor intensive awaited. Each individual article that I selected, needed to be analyzed one by one, and finally, the results should be presented in a way that makes it clear, how the sense that I made of the findings relates to the research question that I am investigating. It required a high-level summary of the literature and a specific description of the coherences in the studies.

I began by reading the articles carefully, and hereafter I did my content analysis. In the analysis, I began by underscoring the relevant parts of the articles. Relevant parts in articles when doing an LR would be those which provide an overview of the studies that address sustainability and knowledge management, research gaps in the literature and a research agenda.

As I had collected and described the theoretical framework and the literature review, I answered the research questions based on the review of the literature dealing with sustainability, normative values, knowledge management and dynamic capabilities, and the review of the four articles that empirically deal with organizational capabilities associated with learning and sustainable innovation. The goal of my study is to contribute with different understandings of the literature review by answering my research

questions (Bryman, 2016). As I am applying literature dealing with the knowledge gaps identified, I am contributing with new insights, which have been identified as relevant for future research. To gain an understanding of, how each study contributed to my theoretical framework, I organized the findings in tables. The tables presented the theoretical framework divided into categories in the left vertical row and the findings from each article in the upper horizontal row (appendices III). By categorizing the theoretical framework and the literature, I provide a means of describing the contributions and increased understandings.

Chapter 3: Theoretical Framework

In this chapter, I will describe the theories and frameworks. First, I will define sustainability and the core concepts. Secondly, I will define innovation, sustainable innovation and the effect of normative values on innovation processes. In the third section, I will define knowledge management challenges, strategies and the revised knowledge pyramid by Jennex (2019). Finally, I will describe agile project management and dynamic capabilities and how it should be linked to knowledge management.

Sustainability

In this section I will begin with a description of sustainability since the concept was first introduced and to the present. Afterwards, I will introduce the triple bottom line concept and discuss its relevance today and discuss whether it needs to be adjusted to the more recent ways of working with sustainability. Subsequently, I will describe FN's sustainable development goals, discuss their implementation and to what extent they agree with the triple bottom line concept. Finally, I will describe and discuss the difference between leadership in general and a sustainability leadership.

It is difficult to define sustainability in one single caption, as it is a concept which has changed throughout recent years and which has become broader over time.

Sustainability is a concept that has been known since 1987, which, according to the Brundtland Report from 1987, is concerned with mankind aspiring to gain a better life and at the same time coping with the limitations imposed by nature in doing so.

Rauter, Jonker & Baumgartner (2017) conducted interviews with representatives from different companies, who revealed that they perceived sustainability as being a loose or difficult concept as it encompasses a wide variety of definitions and interpretations.

Baumgartner & Rauter (2017) define sustainable development as "...an economic, environmental and social development which meets the needs of the present and does not prevent future generations from fulfilling their needs" (p. 81). Furthermore, they state that sustainable development is defined as a development of solutions which address global, environmental and social challenges. Rauter, Jonker & Baumgartner conducted interviews with representatives from firms that were expected to contribute with significant knowledge to their studies. The firms chosen were significant for having received an award for sustainability and information about them was available on the internet. Some of the representatives from Rauter, Jonker & Baumgartner's (2017) interviews reveal that they support the view that a business should be run with a long-term perspective and in a way that does not prevent future generations from fulfilling their needs. The representatives state that this includes treating humans, animals and nature with respect. For example, they wish to see children grow up in a healthy and natural environment. Furthermore, the respondents state that sustainability is about giving and receiving. Hence, it is essential only to extract the amount of resources that can be replaced within a certain period of time. The respondents mention that social sustainability is important and defines social sustainability as providing work environments that are meaningful and working with social responsibility. Finally, some of the respondents state an interesting viewpoint on sustainability. They consider it 'a way of life', 'an individual ethical stance, and something that is grounded in their personal values and beliefs (Rauter et al., 2017).

The Triple Bottom Line

The triple bottom line (TBL) is a framework that divides sustainability into three parts; the social, economic, and environmental aspect (figure 2). The triple bottom line can be used by organizations to evaluate their performance in a broad perspective. The framework adds the social and environmental aspect to the conventional bottom line, where the organization originally only considers profit. Elkington, the founder of the TBL, states that the three dimensions should be measured.



Figure 1: The Triple Bottom Line Elkington (1994)

When organizations apply the TBL framework, it can be difficult for them to use it as a measure. They need to decide on which techniques and methods are good. At the same time, they need to think about how reliable the values obtained are, as objectivity and reliability can be a challenge (Sridhar & Jones, 2012). There will probably be differences in relevance of some issues across borders or from one market to another market. For example, laws can be different in countries. Hence, the same issue may be very important in one country compared to another. These differences in relevance can possibly lead to selective reporting.

Sridhar & Jones (2012) state that it is hard to quantitatively assess the goodness or badness of a problem. They believe that the social dimension needs a more qualitative approach than Elkington proposes. Social problems will impact on individuals and communities in different ways that cannot be measured quantitatively.

Another critique of the TBL framework that Sridhar & Jones (2012) provides is that the TBL framework lacks the ability to aggregate the results across the three principles; economic, social and environmental. There is no aggregated quantitative or qualitative summary of the three principles, which means that the results can point in three different directions. Hence, the results will lead the corporation to pursue three different objectives, which in turn can create confusion and inefficiency. It will be extremely hard for an organization to follow a clear vision and clear goals. A pure profit objective will be easy to measure with a quantitative approach, and it will be easy for a corporation to make decisions purely based on a profit perspective. However, it is difficult to make decisions based on three dimensions: one on the measurement of profit, another on social dimensions and a third on environmental dimensions.

Finally, Sridhar & Jones (2012) finds that the TBL framework lacks integration across the three dimensions. They emphasize that the three dimensions are likely to conflict according to the TBL framework, but in reality, they are interdependent and complementary. The TBL framework draws distinctive lines between the three dimensions, however all three dimensions can be in interplay at the same time. This is quite a big fallacy of the TBL framework, as it can also lead to a very one-sided way to look at a problem. For example, if a specific problem is treated purely from a profit perspective, but in reality, it includes a social perspective as well. The outcome and the decisions organizations make concerning the problem will only reflect the profit perspective and leave out the social perspective.

Kuhlman & Farrington (2010) raises the same critique towards the TBL framework. They claim that the TBL framework lacks integration between the social and economic dimension. Kuhlman & Farrington suggest that the social and economic dimensions should be replaced by one single dimension called well-being. Well-being includes many aspects, but it defines the objective conditions, which will allow human beings to create their own happiness. According to Kuhlman & Farrington (2010) we can loosely define sustainability "...as a state of affairs where the sum of natural and manmade resources remains at least constant for the foreseeable future, in order that the well-being of future generations does not

decline" (p. 3442). This perspective suits the modern way of viewing sustainability better, as their focus has shifted from a narrow perspective which separates each dimension, to a perspective which includes all perspectives from the social and economic dimension in one concept to provide a clear goal. The focus of this view is to maintain today's living standards in the future or even make them better.

The UN's Sustainable Development Goals

The UN has 193 member countries and they are all committed to abolish poverty and hunger in the world, reduce inequalities, guarantee good education and better health for all, decent jobs and more sustainable economic growth. To obtain this, the UN has made 17 world goals (table 2), which are overall with 169 intermediate aims. The UN's world goals are used as a blueprint for all 193 member countries. It is possible to adjust the goals to each individual country, as they have taken into account the different backgrounds of each country (FN's Verdensmål).

The UN states that "the new agenda acknowledges that social, economic and environmental development, peace, security and international cooperation is closely related, and that it requires an integrated effort to obtain durable development results" (FN's Verdensmål). Sridhar & Jones (2012) critique stated that the TBL framework was lacking integration, which is exactly what the UN attempts to create through the 17 world goals. Additionally, the UN's 17 world goals can all be divided into the two dimensions well-being and environment, as Kuhlman & Farrington (2010) suggested.



Table 2: Sustainable Development Goals (The UN)

Sustainability Leaders

To lead others, means to show others the way and direction. Hence, leaders are decisive for the creation of a sustainable corporation, as they are choosing the direction. Visser & Courtice (2017) propose the following definition of a leader: "A leader is someone who can craft a vision and inspire people to act collectively to make it happen, responding to whatever changes and challenges arise along the way" (p. 2). Leadership is relational, which means that you cannot lead alone, you need people who have the need to be led. Furthermore, leadership is non-hierarchical, which means that leaders can be found at all levels. Finally, leadership is contextual as it is about adding more to what already exists (Visser & Courtice, 2017).

Defining the sustainability leader requires that we understand his or her traits, styles, skills and knowledge. In general, leadership skills are different, depending on the context. Certain skills and characteristics are more prominent for a sustainability leader, however in general they do not deviate from general leadership skills. Visser & Courtice (2017) have investigated how sustainability leaders can contribute to transformational change. Their investigation suggests that "a sustainability leader is someone who inspires and supports action towards a better world" (p. 3).

When sustainability leaders make decisions, they should adopt a long-term view, as we have already mentioned. Furthermore, they should have a clear direction in mind. A clear vision is important for sustainability leaders, as they will be more willing to tolerate risk in pursuing a vision (Rauter, Jonker & Baumgartner, 2017). Tolerating risk is important for sustainability leaders, as sustainability is developing fast. A good sustainability leader integrates sustainability into basic business decisions and take a large number of smaller scale change initiatives, as this will lead the organization towards transformational change (Rauter et al., 2017). It is important for the sustainability leader to work on agility both in terms of the sustainability leader 's own competencies, but also in terms of developing the employees' competencies. A sustainability leader will affect the employees to work with sustainability to a larger degree, if he or she possesses the right capabilities to work with sustainability. As we have also already mentioned, some people perceive sustainability as a part of their lifestyle (Rauter et al., 2017). Sustainability leaders inspire others throughout the organization, as they show a high degree of personal commitment to sustainability. Tollin, Bech & Wilke (2014) states that leaders are found to be strong, positive and significant drivers of commitment to sustainability in a corporation.

Innovation

What is Innovation

Schumpeter (1883-1950) was the first to introduce the concept of innovation within economics, and he described it as the natural destruction of the old. According to Schumpeter (1883-1950) inventions and innovations are necessary to drive economic growth.

Tidd, Bessant & Pavitt (2005) state that there is a difference between invention and innovation; invention is an initial step of putting an idea on the market, and innovation is a process of turning opportunities into new ideas and in turn of adapting these ideas to widely used practices.

Types of Innovation

"Innovation is the renewal of products and services and of the processes and organizations by which the products or services are produced, delivered and marketed" (Sundbo, 2001, p.16). Joseph Schumpeter (1883-1950) identified five types of innovation: product innovation; process innovation; organizational innovation; market innovation; delivery innovation (Sundbo, 2001).

Since then Tidd et al. (2005) have presented the 4 p's, which is 4 types of innovation; product innovation, process innovation, position innovation and paradigm innovation (see Figure 2).



Figure 2: Innovation Space Tidd, Bessant & Pavitt (2005)

Incremental and Radical Innovation

The innovation space in figure 2 represents the space where an innovation can operate. An innovation can be either incremental or radical, depending on its degree of novelty (Tidd et al., 2005). Incremental innovation can be gradual improvements concerning existing offerings, businesses, customers and markets. Radical innovation are drastic changes of existing systems and processes to create products and services which will change the industry.

Sustainable Innovation

Competition plays an important role in determining the success or failure of companies. Innovation is a way to secure competitive advantage, which is essential for any firm. Innovation should lower costs or create differentiation for a company to gain competitive advantage.

Maxwell (2009) emphasizes that "innovation will not only be the driver for global growth in the future but will also have a profound impact in providing potential solutions to some of the most challenging issues that currently face the world such as climate change, environmental pollution, fossil fuel shortages, third world poverty, rising healthcare costs, massive urbanization and aging populations" (p. 144). Vibrant innovation infrastructures are crucial for firms to achieve sustainable financial performance. Maxwell (2009) suggests that innovation leadership should be driven top down by company senior management to ensure the right level of priority throughout the organization in order for innovation to succeed. Sustainability is changing the dynamics of the environment, which in turn is changing the possibilities for firms in different countries to gain global competitive advantage. Low cost innovations from economies such as China and India cause challenges for developed countries with higher cost structures. Hence, optimization of innovation in the value chain is crucial for developed countries to survive.

Normative Values-Based Innovation Management

In this section, I will present values-based innovation management by Breuer and Lüdeke-Freund (2017), which address the potential of values in guiding business innovation and its management.

Companies that focus on values in innovation processes are more successful than those companies which only focus on growth and profit. Values are used in companies in HR departments, where they align the employees with the organizational values. Furthermore, values are used in branding to communicate to/with customers. Finally, values are also used when organizations create value proposition and when they create their vision and mission. However, values are not yet used in innovation processes as a significant driver.

Even though technology plays a huge role in innovation processes, it cannot lead the process on its own. Hence, we need to make use of other resources as well. Breuer and Lüdeke-Freund (2017) suggest that three types of values-based innovation exist; values-based operational or instrumental innovation; values-based strategic innovation; and values-based normative innovation (see figure 3). In the instrumental dimension, values are used to innovate services, products or processes. In the strategic dimension values are used to innovate the business model of the organization, which we have already seen that both Bocken and Baumgartner have done. In the normative dimension, we use values to innovate in networks or in the organizational identity, by redefining the values, aspirations, and the identity of the networks or the organizational identity, which in turn leads to new norms, principles and strategies.



Figure 3: Normative Values Breuer and Lüdeke-Freund (2017)

Breuer and Lüdeke-Freund (2017) questions, how we can relate society to innovation to make society the producers of innovation. We are used to consider society as the users and consumers of innovation and not as the creators. If we consider the values of certain stakeholder groups, we will be able to integrate values as a part of the innovation, let values direct the innovation processes or serve as a heuristic to generate innovations that matter. Values should be used through a normative orientation, where they are taken into account and where we question, what is really driving the organization. The normative orientation emphasizes that networks and organizational identity are driving the organization. Hence, we should focus on what defines the networks and organizational identity and how we can change them to innovate and create growth and prosperity.

In CS we wish to create both economic, social and sustainable growth and prosperity. Therefore, we should redefine the values, aspirations and the identity of the networks and the organizational identity to reflect all three dimensions.

To ensure sustainable development in the organization, sustainability should be a part of the organizational culture. A high level of sustainability awareness within an organization will lead the organization towards more ambitious goals and strategies.

The role of normative management is to implement and create the foundation for the necessary capabilities to be able to redefine the values, aspirations, and the identity of the networks or the organizational identity. Driving normative innovation requires managers to foster commitment, which means that they should support and encourage their employees to take actions and make decisions that foster sustainability. Moreover, they need to create and support a culture of sustainability-oriented innovation, where they welcome and encourage ideas that bring the organization closer to their sustainability goals and vision. More formally, they should be clear about their expectations by integrating sustainability through the organization's governance, policies, strategies and processes. Finally, they should create a structure and a foundation that has the capacity to tolerate the future changes in the organizations. This means that a sustainability manager needs to create an agile organization that tolerates the changes that occur because of sustainability.

Sustainability needs to be a part of the way, the organization is working and thinking. A CSR report, corporate environmental reporting and life cycle analysis are not enough to create a sustainable organization. The implementation needs to take place at all levels and within the organization and include all employees. Everyone in the organization needs to take responsibility for the sustainable development.

The differences between explorative and normative innovation is that the explorative innovation adds new knowledge to existing knowledge, whereas normative innovation follows aspirations, builds targets and develops strategies. Hence, if we want to implement the normative values to the knowledge management system, we shall focus on building an agile knowledge base, which means that we should be prepared for any new knowledge that may come. We need to develop a strategy of how to work with knowledge. Normative managers need to ensure that the organizational identity has the capacity for values-based innovation, renewal, and change at all organizational levels.

Knowledge Management

In this section I will begin by defining the knowledge management concept and knowledge management strategies. Afterwards, I will describe several challenges that organizations and managers face, when working with knowledge management. Finally, I will explain the revised knowledge pyramid by Jennex (2019).

Managing innovation projects is in essence about knowledge management. Knowledge management (KM) is the process of creating, sharing, using and managing the knowledge and information needed to make better decisions, take actions and deliver results. According to Hislop (2005), knowledge is decisive for an organization's competitive advantage, as an organization depends on what it knows - how it uses what it knows - and how fast it can know something new.

Tacit knowledge is personal and shapes how people think and act. This type of knowledge is rooted in contexts and values and therefore difficult to transfer and communicate, as it is subjective and is found in the minds of individuals.

Explicit knowledge is objective knowledge and does not depend on individuals, as it is impersonal. Furthermore, it is independent of context and values, but exists in documents, databases, records etc. Contrary to tacit knowledge it is possible to codify explicit knowledge and easy to share.

Knowledge Management Strategies

Knowledge management will most often fall into one of two strategies, which is either a codification strategy or a personalization strategy. Data and information are growing in organizations, however, the number of tools has become smaller. Information that used to be stored in physical documents, folders and books are now stored in computers and other IT appliances. The codification strategy works with carefully codified and organized knowledge, which is stored in databases, where it can be accessed and used easily by anyone in the organization.

The personalization strategy concerns knowledge which is tied to the person who developed it. Knowledge is shared through communications with other individuals or groups. Hence, this type of knowledge very much depends on the relationship between colleagues and business partners. Computers and other IT appliances are used for communicating knowledge instead of storage by e.g. writing e-mails.

Challenges of Knowledge Management

Several knowledge management challenges have to be dealt with in firms. I will explain some of the most common knowledge management challenges.

Organizations should be aware of certain challenges, when they are working with large amounts of data and information. One challenge can be to filter out the needed data and information for a given task. The ability to do so depends on the amount of knowledge stored and how the organization stores the knowledge. When it comes to the amount of knowledge stored, it is important that organizations only store the needed information to prevent information overload. Information overload will occur, when too much information is stored about a certain topic. Hence, employees will need to spend too much time on filtering information.

As most physical documents are replaced by computers today, it is extremely important to implement storage systems which store knowledge in a manageable and well-arranged manner. It saves a lot of time, as employees otherwise will spend too much time on searching for the needed information. Furthermore, it will help newly employed in gaining the required knowledge for their tasks.

Organizations should be aware of misinformation, which can occur due to inefficient communication processes and geographic distances. False information will misguide employees and affect the outcome of their tasks, which in turn affects the decisions made, actions taken and, in the end, the delivered results in the organization.

Another challenge in organizations is missing information, which appears when information is not delivered to the persons needing the information, or when the needed information for a given task is not available.

Organizational culture, trust and relationships affect tacit knowledge, which can be some of the most complicated challenges. An organizational culture is deeply embedded in the organizational system, and it can be difficult to see through how the organizational culture effects knowledge sharing. It can be difficult to point out the specific challenge caused by organizational culture, and if the challenge is identified, it can be extremely difficult to change an organizational culture. It can take more time to change the identified problem in the organizational culture than to change a problem in a knowledge sharing system in a computer. An organizational culture is built up by invisible structures and unwritten rules.

Trust and relationships are crucial for the flow of knowledge in an organization and affects knowledge management. Trust affects the relationship between knowledge management and organizational effectiveness. However, how much trust affects this relationship depends on whether the organization is a knowledge intensive business. If the organization is a knowledge intensive business, trust will be decisive for the organizational effectiveness. In less knowledge intensive businesses, it will be less, yet still, important. Trust will still affect the relationship between knowledge management and organizational effectiveness. Organizations should focus on preventing internal competition by avoiding silo thinking and not focus on individual performances (Alt om Ledelse).

When an employee achieves more power by gaining more knowledge, knowledge becomes power. The more power employees have, the more influence they have on decisions made in the organization. Status and influence are bound to knowledge, which unintentionally keep employees from sharing knowledge (Alt om Ledelse). To gain better results in an organization, it is important that employees share knowledge. If the competition is high between organizations in the specific market, it can prevent employees from sharing knowledge with external organizations. Additionally, the competition among employees in the organization may be high, if one or more persons are striving for the same position or if the job security is low. Employees may be afraid of others stealing and taking responsibility for their ideas and due to that retain knowledge. Finally, we are more likely to share knowledge with people we like, instead of with the people who may actually need the information. Hence, a good relationship between colleagues, generates a better communication process.

Organizations should make knowledge sharing a priority. This can be done by prioritizing time for meetings concerning complex knowledge. It is important that the focus in the meetings is on sharing complex knowledge and not daily issues that can be dealt with in other less time-consuming ways (Alt om Ledelse).

Revised Knowledge Pyramid

Jennex (2005) defines KM as "the practice of selectively applying knowledge from previous experiences of decision making to current and future decision-making activities with the express purpose of improving the organization's effectiveness" (p. 12).

Knowledge management strategy can be generated using the knowledge management pyramid. However, the KM pyramid is outdated according to Jennex (2019). He suggests that the knowledge management pyramid is too basic and therefore he has revised it to represent reality today.

The revised pyramid reflects the great innovation of technology that we have seen the past decade. It has led to an increased emphasis on KM and information management. Hence, due to the new way of considering initiatives such as big data, internet of things, social media, mobile technologies, etc., organizations are working with new processes and new ways of managing, transferring and utilizing data, information and knowledge.

The knowledge pyramid (see Figure 4) is a graphical representation of the DIKW creation flow, which represents that data leads to information, which leads to knowledge, which leads to wisdom. Data is objective facts such as who, what, when about something. Information is data that is related to each other through a context. Knowledge is information that has been culturally understood and provides insight and understanding into something. Wisdom allows knowledge to be used in different and not necessarily intuitive situations, as knowledge is placed into a framework or nomological net (Jennex, 2019).

Figure 1. The knowledge pyramid Ackoff, 1989.



Figure 4: The Knowledge Pyramid Ackoff (1989)

Data does not exist as unconnected facts. The data we collect are related to our wisdom and knowledge. Tuomi (2000) suggests that we should turn the KM pyramid upside-down, as data is not observed, collected or recorded in a vacuum. He believes that we understand the world through our knowledge and wisdom. Hence, the collection of data and information is rather guided by wisdom and knowledge.

Jennex (2019) posits that the DIKW creation flow is happening in both directions and presents the revised knowledge pyramid (*see Figure 5*). In the modle, wisdom is broadest, then knowledge, then information, and then data. The reason is that, as information is built on data, several combinations of the data is possible. For example, different users of the data, have different purposes of using the data, hence the amount of information will be bigger than the amount of data that the information is derived from. A marketer and an accountant will use the data to generate different information. This same thought counts for knowledge and wisdom. A last difference between the traditional and the revised knowledge pyramid is that Jennex (2019) have decided to remove the apex's, as they imply that there is a final means, which is misleading.



Figure 5. The final revised knowledge pyramid with KM, Big Data, and IoT

Figure 5: Revised knowledge pyramid Jennex (2018)

Managing the process of DIKW creation flow it is necessary to make use of the processes of insight, analysis and sense making, which is represented by the dotted arrow. When the users understand what they are learning, the process will happen in the revised directions. Hence, the creation flow will be bidirectional.

Social networks are represented by the thin horizontal lines between the layers. Social networks are used to transfer data, information, knowledge and wisdom between different users. They refer to any formal or informal, direct or indirect methods used to transfer between different users. For example, published articles, conference presentations, emails, etc. Both directions of the creation flow generate learning in the end.

The application of KM to the pyramid is represented by the vertical arrows pointing inwards. It is the process of capturing, retrieving, applying and storaging the DIKW. KM is about having useful knowledge for the organization. According to Jennex (2019) "the purpose of KM is to make use of specific data, information, knowledge, and wisdom to generate intelligence" (p. 5). Intelligence is actionable knowledge and wisdom, which is needed for decision-making, when organizations perform specific tasks.

Rather than focusing on wisdom and knowledge needed to make a decision, the application of KM creates a focus on intelligence, which can be defined as actionable knowledge, which is needed to make a specific decision in a specific context. "For example, marketing knowledge is needed to create marketing campaigns but specific customer knowledge is needed to make decisions as to how to market to specific customers" (Jennex, 2019).

The thick lines between the layers are representing the strong filters, which is used to focus on specific DIKW. They limit the access of social networks and thereby separate and capture what is needed from what is not.

The strong filters are not used loosely, as the weak filters described before. They are guiding the application of KM processes such as capturing, storage, retrieving, and application. Jennex (2019) the KM filters are the implementation of KM strategies and they are key critical success factors.

Actionable intelligence is data, information and knowledge that has been filtered by KM. The actionable intelligence is shared with specific, limited users and helps in generating courses of action or make specific decisions.

The use of intelligence leads to organizational learning. Jennex (2019) refers to a description of organizational learning (OL), which is defined as a "quantifiable improvement in activities, increased available knowledge for decision-making, or sustainable competitive advantage" (p. 6).

Jennex (2019) furthermore states that organizational learning and KM generally will be topdown processes. The first step in the process of OL and KM is to determine which actions and decisions that need to be taken. When this is in place, the decision about what intelligence, then knowledge, then information, then data that is needed for the chosen actions and decisions to take place. A normal learning process will be bottom-up and start with the interpretation of data. Hence, this is the difference between learning and organizational learning.

McAfee and Brynjolfsson (2012); Chen, et al. (2012) state that the artifacts of knowledge are changing because of big data. Jennex (2019) have added big data to the bottom of the revised knowledge pyramid, and describes it relying research on big data conducted by McAfee and Brynjolfsson (2012); Chen, et al. (2012). Both of them suggest that data is unstructured and that humans cannot analyze big data without aids such as algorithms and analysis tools. However, Chen, et al. (2012) also suggest that analytical tools such as text analytics, web analytics, network analytics, mobile analytics, and data analytics are the fundament of transforming big data to data, information, knowledge, and intelligence. Big data can be used to "identify intelligence for evidence-based decision making, transforming intuitive based decision making to evidence-based decision making to lower levels of the organization" (Jennex, 2019, p. 8). Big data does not replace human insight and vision.

Jennex (2019) have also added Internet of Things (IoT) to the revised knowledge pyramid. IoT is "the network of physical devices that connect to the web, usually through a wireless connection, and communicate with other physical devices for improving service of all devices and create value" (p. 9). IoT is a sensor net for big data. Jennex (2019) resonates that as there exists more big data than data, we must assume that more IoT exists than big data. Moreover, we must assume that there is a layer between IoT and the reality. IoT senses reality and transform it into data, but it does not reflect the entire reality, as there will still be some of the reality that is not received through the sensor net. The shape of the pyramid reflects how there is more in reality that is not captured through sensors. Our ability to capture data has improved with IoT. Jennex (2019) suggest that sensor can both be "our human senses, other's human senses, or mechanical where the sensors are anything that is not human such as a light detector, radio wave detector, pressure meter, a typed in transaction record, a query, etc." (p. 4).

Dynamic Capabilities

In this section I will describe agile project management, followed by a definition on dynamic capabilities and elaboration on, how dynamic capabilities can be used, when firms are operating in VUCA conditions.

Agile Project Management

Companies face competition and disruption, which creates a need to be in the frontline of innovation to survive. Agile project management has become the new big thing and for a reason. Companies need to be able to readjust in a fast-moving world with an increasing number of competitors and disruption of industries. A brief definition of agile values can be the four following dimensions: individuals and interactions over processes and tools; working software over comprehensive documentation; responding to change over following a plan; and customer collaborations over contract negotiation.

Dynamic Capabilities

Ordinary and dynamic capabilities are useful in different situations and affects an organization in different ways. Ordinary capabilities affect the firm efficiency, whereas dynamic capabilities affect the firm growth.

According to the dynamic capability perspective, firms that need to address rapidly changing environments, must develop dynamic capabilities, which are "the firm's ability to integrate, build, and reconfigure internal and external competences..." (Teece, Pisano, & Shuen, 1993).

Firms must be agile and adapt quickly to market changes to stay competitive. Corporate agility is the capacity to sense and shape opportunities and threats, (2) seize opportunities, and (3) maintain competitiveness through enhancing, combining, protecting, and, when necessary, reconfiguring the business enterprise's intangible and tangible assets (David J. Teece).

According to the dynamic capability perspective, three dynamic capabilities are necessary to adapt to changes in the environment and create corporate agility; learning fast and building new strategic assets; integrating new strategic assets, including capability, technology and customer feedback, into the organizational processes; transforming or reusing existing assets which have depreciated.
Learning, which is the first stage, involves the detection of defective activities and strategy that no longer seems to be good for the firm. Furthermore, it involves bringing new strategic assets into the firm from external sources by creating alliances and acquisitions. The second stage, the integration of new assets, involves changing the organizational routines for gathering and processing information. Adequate and correct information is decisive for quality performance. In the last stage, the existing assets are transformed or reused, which involves reconfiguration of the firm's asset structure to accomplish rapid internal and external transformation. Furthermore, it involves decentralization, local autonomy and strategic alliances to support the capability to change quickly. The capability to change depends on the ability to scan the environment, evaluate the market and quickly accomplish reconfiguration and transformation ahead of the competition.

If an organization is facing a dynamic environment, they are in VUCA conditions, which means that they are in a situation where the environment is volatile, uncertain, complex, and ambiguous (Day & Schoemaker, 2016). Companies in a state of sustainable uncertainty must have an innovative mindset. Hence, leaders in those organizations need to be innovative and stimulate innovative services and new business models which aim at exploiting the next big thing (see Figure 6).





Figure 6: How the major components combine – VUCA conditions Day & Schoemaker (2016)

Organizations are in a state of VUCA conditions during sustainable development.

Sustainability leaders will have less focus on detailed planning and other typical leadership tasks. A leader's task during sustainable development is to drive innovation and test new ideas. Hence, they should move their innovation from incremental to radical innovation. When organizations are in the state of VUCA conditions and need to work with disruptive innovation, radical business models and strategic leadership, they should work with three dynamic capabilities; sensing, seizing and transforming.

Sensing the outside market can be done through research, networks, partnerships and corporations. Sensing is a capability that should be implemented in the organization and it means that employees should be able to sense and shape opportunities and threats. The organization should furthermore be able to seize opportunities. The last dynamic capability that Teece considers is transforming, which is the capability to maintain competitiveness through the intangible and tangible assets of the organization by enhancing, protecting, combining and reconfiguring these assets.

For the organization to manage these three dynamic capabilities, they need to focus on how to

develop and deploy the micro-foundations of dynamic capabilities. Teece (2009) states that the micro-foundations of dynamic capabilities are the distinct skills, processes, procedures, organizational structures, decision rules, and disciplines which undergird the enterprise-level dynamic capabilities.

Sensing and seizing capabilities may be appropriate to apply in knowledge management. Bringing these capabilities into knowledge management could possibly lead us to a better understanding about how to operate innovation management.

Knowledge can be a great source of competitive advantage; hence it is essential to develop capabilities in an organization which allows employees to generate and integrate knowledge. In a dynamic environment, it is necessary for organizations to question the quality and effectiveness of their own knowledge base and adjust it according to the changes in the dynamic environment that surrounds them. Teece (2009) implicates that integrating knowledge from the outside as well as within of the organization is essential.

An organization's knowledge base should be agile and able to change according to environmental changes. Hence, it is important for knowledge intensive companies to have the right tools to innovate. It is no longer just a question of transforming according to changes in the market, but it is just as well about being the drivers of innovation.

The micro-foundations of dynamic capabilities will change knowledge management in organizations, as knowledge will change quickly as skills, processes, procedures, organizational structures, decision rules, and disciplines become more agile. These micro-foundations of dynamic capabilities will drive the organization to not only integrate new knowledge, but also generate new knowledge, as they become more innovative.

The organizational outcome of dynamic capabilities is product innovation, service innovation or process innovation. There is no direct link between dynamic capabilities and competitive advantage. Whether the organization obtains a competitive advantage depends on the value, rareness, imitability and substitutability of the innovation. Competitive advantage depends on the organizational resources and capabilities together. Dynamic capabilities cannot drive innovation on its own, but it can drive innovation, if the organization has the right resources. Resources in an organization are both the tangible, intangible and organizational resources. Intangible (human) resources are a part of the organizational resources. Besides human resources, an organization also possesses capital resources, monetary resources and raw materials.

Dynamic Capabilities and the Environment

Even though an organization favors dynamic capabilities, there is no guarantee that the outside environment fits these capabilities. Oppositely, the environment may favor dynamic capabilities, but the organization may simply not have the information processing capacity to support this (Qaiyum and Wang, 2018). Qaiyum and Wang (2018) suggest, based on their findings, that dynamic capabilities demand a greater information processing capacity. The information processing capacity is the amount of information that the organization is able to achieve.

Qaiyum and Wang (2018) have found (through their studies) that it is not every organization that possesses a great information processing capacity. Just because a dynamic environment favors dynamic capabilities, it does not mean that an organization encompasses a great enough information processing capacity. At the same time, the organization may be in possession of a great information processing capacity and possess dynamic capabilities, but the environment may be hostile towards dynamic capabilities (Qaiyum and Wang, 2018).

An organization's performance is affected by environmental dynamisms. The right capabilities can be decisive for an organization to survive environmental changes. Qaiyum and Wang (2018) state that environmental dynamism negatively affects the contribution of ordinary capabilities and positively affects the contribution of dynamic capabilities. Qaiyum and Wang (2018) have found in their study that organizations tend to perform better with ordinary capabilities compared to dynamic capabilities in early stages and the very last stages of their life cycle. However, when the organization is in the middle of the two stages the ordinary capabilities and dynamic capabilities perform equally well. Furthermore, ordinary capabilities are more important to small and medium enterprises, whereas large organizations perform equally well using both ordinary- and dynamic capabilities (Qaiyum and Wang, 2018).

An organization possesses a certain amount of information, and any given task will require additional information. The level of information that the organization needs to obtain determines the uncertainty of the given task. Hence, the uncertainty is the difference between the information that the organization possesses, and the information required for the task (Galbraith, 1973).

Chapter 4: Literature Review

In this chapter, I will present my literature review, which consist of 7 empirical studies investigating the manufacturing industry in respectively Italy, Germany and Denmark. These studies have been selected based on their relevance for my thesis, as all of them investigate the 'ability to acquire knowledge related to processes and practices that may improve sustainable results. They investigate organizational capabilities, dynamic capabilities, organizational cognitive frames, absorptive capacity, and integration of knowledge. I will review each study by making a summary, in which I present the method used, context, theories applied, the purpose of the article and, most importantly, the main findings. Lastly, I will review the knowledge gaps and future research

The Role of External Integrative Capabilities in Green Product

Development

Developing Sustainable New Products in the Textile and Upholstered Furniture Industries: Role of External Integrative Capabilities By Dangelico and Pujari (2013)

This study investigates green product development in the Italian textile and upholstered furniture industry from a resource-based view. The purpose of this study is to investigate the role of capabilities in green product development, and whether green product development opens new product, market, and technology opportunities, as well as leads to better financial performance of NPD programs. The study aims to investigate the role of capabilities for companies that need to integrate knowledge and competencies from outside of the firm, about green product development in terms of both manufacturing process and product design.

The textile and upholstered furniture industries are important for the Italian economy, as the export of both industries are huge. Environmental sustainability issues are becoming increasingly important in these industries, which was the reason that Dangelico, Devashish and Pujari (2013) found that these industries were relevant for their investigation on green product development.

The study is based on Italian textile and furniture companies which are members of the Italian Chamber of Commerce. The respondents are CEOs, marketing directors, R&D directors etc. They participated in a structured questionnaire consisting of close-ended questions, which were sent to them, as they agreed to participate in the study. 700 Italian manufacturing companies operating in the two industries were contacted and 102 responded, which gives a response rate of 14.6% Dangelico et al (2013) use a five point-scale in their questionnaire to record the responses and some of the scales are excising scales from earlier studies on NPD. They make use of eight variables: Networks of collaborations; External knowledge links; Acquisition of know-how; Integration of environmental issues into NPD; Creation of new opportunities; Financial outcomes; Responses on several control variable.

Theoretical Framework and Hypotheses

Dangelico et al (2013) proposed five hypotheses, which were tested in two steps using regression analysis. Firstly, they studied the role of external integrative capabilities in integrating environmental issues into NPD, and secondly, they investigated if and to what extent integrating environmental issues into NPD contributes to improve firm performance. Finally, Dangelico et al (2013) checked whether there are direct effects of external integrative capabilities on performance as well as mediating effects of green product design and green manufacturing process.

The study investigates green product development, which has become of increasing interest worldwide, as challenges are growing due to growth of human population, industrial production and the consumption of nonrenewable resources. Companies and economies need to move toward environmental sustainability. Green product development concerns the entire life cycle of the product.

If a company does not have the resources and competencies needed for NPD, they need to rely on external integrative capabilities. A company may be in a state, where their NPD is based on already existing resources and competencies within the company, which limits their innovativeness. Hence, they need to access external actors and sources that possess the knowledge and resources that they need. In relation to green product development in the Italian textile and furniture industries, Dangelico et al (2013) investigate three types of external integrative capabilities; networks of collaborations, external knowledge links, and acquisition of know-how.

Collaboration among companies included in the product's value chain and other actors, for example governments, is necessary for companies working with green product development. It is an important external integrative capability to create networks, as collaboration along the supply chain, including both customers and suppliers, improves competitiveness while it reduces environmental burdens. Dangelico et al (2013) propose the following hypothesis concerning networks of collaboration:

 H1: Collaboration with actors along the supply chain positively influence the integration of environmental issues into NPD programs, both in terms of (a) manufacturing process and in terms of (b) product design. The acquisition of information from external knowledge sources is another crucial external integrative capability. Companies should engage in knowledge exchange and seek external knowledge to become better and more innovative in their green product development. External knowledge sources can for example be other firms, consultants, and universities and research institutions. It can also be sources that can provide technical data, and regulatory and policy information relevant for green product development. Dangelico et al(2013) propose the following hypothesis concerning external knowledge links:

• H2: The acquisition of information from external knowledge sources positively influences the integration of environmental issues into NPD programs, both in terms of (a) manufacturing process and in terms of (b) product design.

The acquisition of technical know-how is the last crucial external integrative capability that Dangelico et al (2013) investigate. According to Verona (1999), the success of using external knowledge sources such as networks of collaboration and external knowledge links, is associated with a company's ability to merge new knowledge with accumulated knowledge. Technical know-how can for example be training of employees, recruitment of new staff and purchase of software and machinery in which production processes are redesigned. Dangelico et al (2013) propose the following hypothesis concerning acquisition of technical know-how:

• H3: The acquisition of technical know-how and assets positively influences the integration of environmental issues into NPD programs, both in terms of (a) manufac-turing process and in terms of (b) product design.

As already mentioned, Dangelico et al (2013) also investigate whether green product development opens new product, market, and technology opportunities, as well as whether it leads to better financial performance of NPD programs. They investigate the benefits of going green, which is a debate that has intensified over the years. Dangelico et al (2013) propose the two following hypotheses concerning the benefits of going green:

- H4: The integration of environmental sustainability issues into NPD programs, in terms of (a) manufacturing process and (b) product design, leads to the creation of new opportunities for the firm.
- H5: The integration of environmental sustainability issues into NPD programs, in terms of (a) manufacturing process and (b) product design, leads to higher financial outcomes of NPD program, in terms of sales, profitability, and cost performance.

Dangelico et al (2013) have proposed a theoretical framework (see Figure 6) Integrative capabilities are linked to the integration of environmental issues into NPD, which in turn leads to the creation of new opportunities and financial outcome.



Figure 7: A Theoretical Framework – New product development Dangelico & Pujari (2013)

Findings

The results of this empirical study showed that companies engage in developing external integrative capabilities through the creation of collaborative networks with actors along the supply chain and through the acquisition of technical know-how. These two capabilities have been established to be essential for integrating environmental issues into product design. Hence, this implies that firms should focus on acquiring technical know-how and assets, and on training and recruitment. Additionally, firms should focus on collaborations with actors along the supply chains. These proposals will play a significant role for firms in green product development.

Furthermore, the study showed that companies engage in developing external integrative capabilities through the creation of external knowledge links with actors outside the supply chain. External knowledge links are an important part of the integration of environmental sustainability issues into the manufacturing process.

The control variables in the study showed that the size of the firm and the industry had no significant influence on green manufacturing. However, there was a significant positive influence in terms of

the age of the firm age green manufacturing, which implies that older firms seem to be more capable of reducing the environmental impact on their manufacturing processes.

Contrary to the manufacturing process, the product design is influenced by the size of the firm. Smaller firms are more capable of integrating environmental issues into product design, as they are more capable of changing their product design routines. They are more flexible and they are not inhibited by organizational inertia to the same extent as large firms.

The benefits of going green were investigated and the results from this study showed that when integrating environmental sustainability issues into NPD programs in terms of product design, new opportunities were created for firms. New opportunities were for example opening new markets, technologies, and product arenas. On the other hand, green manufacturing does not seem to have a significant influence on the creation of new opportunities.

Large firms seem to be more capable of opening new markets, technologies, and product arenas with their NPD programs, as firm size has a positive significant influence on the creation of new opportunities. The importance of investing in R&D were underlined, as the amount of information coming from internal R&D activities has a positive significant impact on the creation of new opportunities.

Green product design did not necessarily lead to improved financial outcomes, and neither did green manufacturing. The only control variable that effected the financial outcome were large firms, which possibly can be explained by their broader product portfolio.

The Relative Importance of Corporate Sustainability in a Firm's

Organizational Cognitive Frame

How organizational cognitive frames affect organizational capabilities: The context of corporate sustainability By Grewatsch and Kleindienst (2017)

This article aims to investigate "the effects of the relative importance of corporate sustainability in a firm's organizational cognitive frame on the development of distinct organizational capabilities". Grewatsch and Kleindienst (2017) draw on the emerging literature on the micro-foundation of capability development in their study. Organizational capabilities (OC) are highly context specific, which motivates the investigation of the cognitive micro-foundation of OC.

It has been identified that a firm's response to the environment, is affected by the managers' subjective interpretations. According to Gilbert (2006), a cognitive frame represents the underlying structures of beliefs, perception, and appreciation through which managers filter and interpret information.

Grewatsch and Kleindienst (2017) chose to investigate the Danish manufacturing market, as this market has great focus on corporate sustainability. It is mandatory to report on corporate activities and initiatives, and most firms have an agenda for corporate sustainability. Furthermore, Scandinavian businesses are considered to be global leaders in terms of corporate sustainability.

Grewatsch and Kleindienst (2017) use mixed methods in this empirical study. They use a questionnaire to create generalizable results as a "backbone", and afterwards they use semi-structured interviews for additional information and for interpretation of the questionnaires.

The questionnaire was sent to all Danish firms with 100 or more employees, which were 301 firms. Grewatsch and Kleindienst (2017) received 124 valid and useable questionnaires after two months. The response rate was 41.20%. They used a 5-point Likert scale, in which 1 was either "not at all" or " decreased a lot" and 5 was either "to a very great extent" or "increased a lot". Their dependent variables were: stakeholder integration capability, market sensing capability, strategic planning capability, and organizational learning capability. The independent variables were represented by a firm's five main business activities: management, marketing, human resources, production, and supply chain. Control variables were also included: firm size, industry type, years of experience with corporate sustainability, and financial performance.

Grewatsch and Kleindienst (2017) used a partial least squares structural equation modeling (PLS) to test their hypotheses, which is a variance-based path-modeling technique which shows causal relations between characteristics of interest.

Figure 8 below shows the correlations between the variables, which indicate that the relative importance of corporate sustainability, based on measures of the independent variables, influences the organizational capabilities positively, the dependent variables, apart from strategic planning capability, where the measure is negative.



Fig. 1. Structural model.

Figure 8: Structural Model Grewatsch & Kleindienst (2017)

Firm size is the only control variable which showed significant effect on the dependent variables. A positive significant effect is shown on the stakeholder integration capability and on the strategic planning capability. The duration of experience with corporate sustainability do not effect a significant effect on any of the variables, which is rather surprising. However, Grewatsch and Kleindienst (2017) believes that it supports their argument that researchers should focus on the thinking and integration of corporate sustainability in a firm, rather than only measuring the level of corporate sustainability in a firm based on outcome measures.

After the questionnaires were collected and analyzed, Grewatsch and Kleindienst (2017) conducted seven interviews with firms that were collected by "random purposeful sampling". The interviews were semi-structured around the themes of the questionnaire. The interviews were recorded and transcribed, and afterwards they were coded into categories that were derived from the theoretical framework. The following coding categories were used in: organizational cognitive frame; mechanisms of corporate sustainability on organizational capabilities; causality between corporate sustainability and organizational capabilities; and reasons for findings on strategic planning.

The interviews were conducted to attain additional information and for interpretation of the questionnaires. More precisely, they were an attempt to overcome potential problems of common method bias and validity, and a way to gain more in-depth and nuanced understanding of the findings, and clarify disparate results.

Theoretical Framework and Hypotheses

Grewatsch and Kleindienst (2017) apply a cognitive perspective on the development of organizational capabilities in their theoretical framework. According to Eggers and Kaplan (2013) and Laamanen and Wallin (2009) managerial cognition is an important element in the process of organizational capability development. The cognitive frame determines managers' allocation of attention to information and interpretation of information. Hence, managers' allocation of attention is decisive for the development of capabilities.

Some researchers have argued that members of a firm may share a common organizational cognitive frame. It as been argued that top managers have the most impact on the firm, hence these researchers argue that a cognitive frame is mainly shaped through the firm's top managers.

Grewatsch and Kleindienst (2017) argue that the organizational cognitive frame facilitates and/or limits managerial attention to the development of particular organizational capabilities.

Grewatsch and Kleindienst (2017) also applies a cognitive perspective on corporate sustainability in their theoretical framework. Corporate sustainability refers to "the ability of firms to respond to their short-term financial needs without compromising their ability to meet their future needs" (Bansal and Des Jardine, 2014, p. 71). According to World Commission on Environment and Development (WCED) corporate sustainability has three meta-characteristics: it is tridimensional, integrating economic, environmental, and social dimensions in a triple bottom line; it represents intertemporal trade-offs of short-term and long-term aspects, and it consumes only income while maintaining the economic, environmental, and social capital base. According to Boal and Peery (1985) the three meta-characteristics provide a decision-support framework which guides action. Grewatsch and Kleindienst (2017) "argue that corporate sustainability provides a context that shapes a firm's organizational cognitive frame and, as a result, channels actions aimed at the development of distinct organizational capabilities" (p. 609).

Grewatsch and Kleindienst (2017) represents 4 hypotheses concerning stakeholder integration capability, market sensing capability, strategic planning capability, and organizational learning capability:

- H1. The relative importance of corporate sustainability in a firm's organizational cognitive frame is positively related to the development of a firm's stakeholder integration capability.
- H2. The relative importance of corporate sustainability in a firm's organizational cognitive frame is positively related to the development of a firm's market sensing capability.
- H3. The relative importance of corporate sustainability in a firm's organizational cognitive frame is positively related to the development of a firm's strategic planning capability.
- H4. The relative importance of corporate sustainability in a firm's organizational cognitive frame is positively related to the development of a firm's organizational learning capability.

Findings

The Grewatsch and Kleindienst (2017) "paper focuses on the extent to which corporate sustainability has been internalized in the firm and, as a consequence, encourages the development of the firm's specific organizational capabilities" (p. 620). Their paper contributes with the knowledge of the effect that the relative importance of corporate sustainability in a firm's organizational cognitive frame has on the development of organizational capabilities. They found, as shown in the structural model (figure 8), that stakeholder integration, market sensing, and organizational learning are enhanced. However, the strategic planning capability, the last of the four organizational capabilities, was negatively effected.

Grewatsch and Kleindienst (2017) present transcribed interviews which were coded into four categories, which represent their interview findings: organizational cognitive frame, mechanisms of corporate sustainability on organizational capabilities, causality between corporate sustainability and organizational capabilities, and reasons for findings on strategic planning capability.

The first category aimed at identifying specific elements of an organizational cognitive frame within the context of corporate sustainability. The main findings were organized by the three main characteristics of corporate sustainability; triple bottom line approach, long-termism, and consumption of income not capital.

In regards to the triple bottom line approach, they found that corporate sustainability was used as a prerequisite of doing business and as a critical self-reflection on own achievements. The respondents expressed that no business is world champion in sustainability, but all are becoming more sustainable and responsible. Firms are aiming towards a state, where sustainability is a prerequisite and a part of the way firms do business, instead of having the CSR and sustainability departments, as is the current situation.

In regards to long-termism, findings showed that firms are integrating corporate sustainability strategy and business strategy, it is a part of their future orientation and encourages risk-based thinking. One of the respondents states that sustainability is an integrated part of the DNA of the company. Another respondent state that they do not have a separate sustainability strategy, but sustainability is considered a part of their corporate strategy. The first respondent also states that they not only make sustainability a part of their DNA, because it is right, but also because they believe that it is and will be a competitive advantage in the future. The firms that survive will be the ones that act in a sustainable way and do not cut their own raw material source. Some of the respondents state that sustainability issues can be both opportunities and risks. work with them as risks can encourage risk-based thinking, which can be an integrated part of a firm.

In consumption of income not capital, it is found that corporate sustainability has an impact on society and the environment, generates high internal quality standards and that firms should make an assessment of the economic feasibility. The respondents state that they aim to make an impact across the value chain beyond what they can do themselves, by partnering with other actors. Furthermore, they aim to have a positive impact on the environment, by not using more resources than can be reproduced. The respondents also revealed that their internal quality standards are higher than their certificates indicate or their operational targets. One respondent mentions that they have their own internal inspiration or aspiration targets. Finally, the assessment of economic feasibility is mentioned as being crucial. If you do not make any money, it does not make sense in the long-term to be sustainable.

In the second coding category, the findings concerning the mechanisms of corporate sustainability on organizational capabilities are presented. Grewatsch and Kleindienst (2017) aimed at bringing the mechanisms and drivers of corporate sustainability into context and understand if and how they encourage organizational capabilities. The findings are classified based on the four organizational capabilities of interest; stakeholder integration, market sensing, strategic planning, and organizational learning.

In the interviews the firms state that corporate sustainability affects stakeholder integration, when it comes to compliance with laws, regulations, and global sustainability standards, addressing

stakeholder expectations, and the ownership structure. One of the respondents states that they have used the Sustainable Development Goals as a guideline when they developed their new purpose and strategy, hence they are complying with global sustainability standards. Another respondent states that corporate sustainability is a part of the firm's corporate identity, as they use the ISO 14001 and the new ISO 50001 (management systems that enables firms to comply with international standards), which means that they integrate all they do concerning corporate sustainability in procedures, instructions, etc., and in their daily business.

In regard to how corporate sustainability affects market sensing, Grewatsch and Kleindienst (2017) have found that firms listen to their primary customers and that they are concerned about firm image. One of the respondents stated that if your primary customer is public health care systems, you must spend the money in a sustainable manner, as the money probably is taxpayers' dollars. Hence, firms must adapt to sustainability demands from their primary customers. Another respondent states that customers do have a huge impact on, how they react. Furthermore, corporate sustainability affects the branding of their firm image, as respondents express that they want to improve their reputation by telling that they have a green profile and that it makes them stand out in the crowd.

The interviews did not clearly point out corporate sustainability drivers of strategic planning, which is consistent with the prior findings in the structural model. One of the respondents stated that corporate sustainability is very close to their business model. However, no direct drivers were found.

In regard to organizational learning, Grewatsch and Kleindienst (2017) found that the main drivers were the local culture and involvement of employees. The respondents state that the same procedures, instructions, and ideas worldwide, may be influenced by different cultures and different perspectives. To act in an ethical manner in Denmark is not difficult. Corporate sustainability also seems to motivate the involvement of employees, as the respondents state that decisions regarding sustainability are not top-down, but rather the employees are given information and opportunity to take part in the process.

The third coding category concerns causality between corporate sustainability and organizational capabilities. If a firm has excess financial resources, it could be assumed that as they have better capabilities they focus on corporate sustainability. However, the interviews confirmed that it is the firm's corporate sustainability thinking and orientation that direct the development of organizational capabilities. The interviews revealed that the interviewed firms use the CSR as a prerequisite of doing business. The CSR is not measured in financial performance, but it affects the financial performance. Corporate sustainability is perceived as a guiding tool for how to do business, as firms notice that they get better and have better processes, as they incorporate corporate sustainability.

The fourth and last coding category attempts to reason the findings on strategic planning capability. The interviewees mention that managing corporate sustainability is complex and highly demanding, as there are many layers and topics to address. Furthermore, the unpredictability related to

corporate sustainability is mentioned, as it is difficult to do long-term planning. Hence, it is about keeping your finger on the pulse and follow the lead. Additionally, a lack of communication between different departments seems to be a challenge, as different departments talk in different ways about the same trend.

Absorptive Capacity, Environmental Strategy, and Competitive Advantage

Under the Tip of the Iceberg: Absorptive Capacity, Environmental Strategy, and Competitive Advantage By Delmas, Hoffmann, and Kuss (2011)

Delmas, Hoffmann, and Kuss (2011) "analyze the organizational capabilities that underlie a firm's ability to generate competitive advantage from the adoption of proactive environmental strategies" (p. 116).

The study investigates the German chemical industry, which has an average R&D budget of 5.5% of sales. Hence, the heavy research in this industry makes it relevant for investigation of knowledge management and absorptive capacity. Environmental concerns are critical in the chemical industry and research and innovation are important to stay competitive.

This study is a quantitative survey questionnaire with a multi-item scheme and multi respondents for each firm. The data sample are member firms of the chemical industry association of Germany, the Verband der Chemischen Industrie (VCI), with research and production operations based in Germany. Delmas, et al. (2011) contacted 1,143 firms. With some of the firms having been eliminated from the survey, the sample was reduced to 763 firms. 271 firms delivered at least one part of the questionnaire, which represents a response rate of 35.5%, and 157 firms delivered a completely filled questionnaire, which gives a response rate of 20.6%. The respondents were most often the CEO for firm strategy, the R&D director for knowledge management, or the director of the environmental department responsible for the firm's environmental strategy.

The main variables were developed based on constructs developed by scholars in similar contexts; absorptive capacity, environmental proactivity, and competitive advantage through environmental proactivity. The items in the questionnaire were measured on a 7-point Likert scale. 14 items were included to measure absorptive capacity for four constructs; knowledge acquisition, assimilation, transformation, and exploitation. To measure environmental proactivity Delmas, et al. (2011) included 15 items for four constructs: environmental reporting, regulatory proactivity, improvement of operations, and environmental partnerships. The final variable, competitive advantage through environmental proactivity, was measured through ten items for three constructs: comparative cost benefits, innovation and differentiation, and reputation and customer relations.

Theoretical Framework and Hypotheses

For a firm to be environmentally proactive, it is relevant for it to be able to absorb and transform knowledge needed for processes and products related to the environment. Environmental knowledge is most often external to the firm, and furthermore it is complex, tacit and new to the firm. Changes in processes are needed and the firm needs to create processes that give them the ability to absorb the relevant environmental knowledge.

Delmas, et al. (2011) believe that absorptive capacity can help firms design or alter operations, processes and products, which will generate environmental proactivity. Absorptive capacity can be conceptualized as an integrated system, where individual parts together give a firm the possibility to learn from external sources.

Absorptive capacity can be defined by four phases: Knowledge acquisition, knowledge assimilation, knowledge transformation, and knowledge exploitation.

Knowledge acquisition is the uncovering of new external knowledge, knowledge assimilation is the integration of the new knowledge, knowledge transformation is the ability to derive new insights and consequences from the combination of the already existing and the new knowledge, and knowledge exploitation is the application of the acquired, assimilated and transformed knowledge by creating new operations, products, or services, or by changing existing ones.

Delmas, et al. (2011) investigates how absorptive capacity can both facilitate the four phases, just mentioned, related to the natural environment through proactive environmental strategies, and how it can also create a competitive advantage.

Organizational capabilities in a firm that have been developed in one field, can be used in another field as well. If a firm has developed the ability to acquire knowledge in one field, it will give them an edge in acquiring knowledge about environmental practices and technologies.

Firms with developed and efficient intraorganizational communication will be more likely to be able to assimilate and transform external knowledge related to the environment, as environmental processes concern not only one specific department in a firm but span across multiple fields of expertise.

Knowledge exploitation capabilities can be gained by participating in processes concerning industry standards developed in regulatory agencies.

In general, prior knowledge in one field is applicable in another. Hence, firms that already possess these organizational capabilities, will have a higher level of absorptive capacity.

Delmas, et al. (2011) furthermore believe that absorptive capacity facilitates the generation of competitive advantage from environmental proactivity. They investigate three strategies that create the field in which competitiveness and environmental proactivity act together: comparative cost reduction, value creation strategies aiming at innovation and product differentiation, and improved reputation.

Firms with highly developed absorptive capacities will be more able to leverage cost advantages, when they implement environmental changes due to the fact that they are flexible in capability implementation (Zahra & George, 2002).

As both absorptive capacity and environmental proactivity involve complex and tacit processes, it will be difficult to imitate them, which in itself is a competitive advantage.

- Hypothesis 1: The higher the level of absorptive capacity, the greater the environmental proactivity of the firm.
- Hypothesis 2: The higher the level of absorptive capacity, the greater the competitive advantage generated from environmental proactive strategies.

Figure 9 illustrates the two hypotheses: the adoption of environmental proactive strategies and competitive advantage derived from these strategies.



Figure 9: Absorptive capacity, environmental strategies and competitive advantage Delmas, Hoffmann & Kuss (2011)

Findings

Delmas, et al. (2011) found that both hypotheses 1 and 2 were positive. Absorptive capacity has a positive and significant impact on the environmental proactivity of the firm, and environmental proactivity has a significant and positive impact on competitive advantage. Furthermore, they found that absorptive capacity in combination with environmental proactivity has a positive effect on competitive advantage of the firm. They found two mediating effects. Environmental strategies mediate the relation between absorptive capacity and competitive advantage, and management support mediates the relationship between absorptive capacity and environmental proactivity.

The top-management seems to have a significant influence on a firm's absorptive capacity, as Delmas, et al. (2011) found that absorptive capacity is only realised, when the top-management is driving the process. This finding seems to agree with several studies, which have mentioned that the political processes within an organization are important when firms explore new strategies.

Delmas, et al. (2011) suggest that firms should invest in absorptive capacity instead of environmental measures to strengthen their environmental competencies and benefit from a proactive environmental strategy. Investing in absorptive capacity can lead the firm to achieve competitive advantages. To achieve competitive advantage from knowledge, the absorptive capacity concept suggests that processes need to be fully integrated within the firm.

The analysis revealed that absorptive capacity seems to only have the wanted effect and be a valuable capacity, when all four phases are included in the process. If one phase is carried out alone, it may not have a positive effect. Delmas, et al. (2011) found in their analysis that knowledge exploitation has a negative effect on cost reduction, if the capability is performed alone.

The role of Absorptive Capacity in a Multinational Company

On the implementation of a 'global' environmental strategy: the role of absorptive capacity By Pinkse, Kuss and Hoffmann (2010)

In this study, Pinkse, Kuss and Hoffmann (2010) analyse the role the acquisition and integration of external knowledge plays in implementing an environmental strategy by applying the absorptive capacity concept to make a distinction between shared and unit specific levels of absorptive capacity. This investigation is carried out in the multinational chemical company BASF, which is the world's largest chemical company.

BASF' headquarter is placed in Germany and subsidiaries are placed around the world. Pinkse et al. (2010) investigate the global headquarters, regional headquarters and two different subsidiaries. BASF is striving for higher levels of environmental performance, thus it is relevant for this investigation. Pinkse et

al. (2010) have chosen to investigate the chemical industry due to the same reasons as Delmas et al. (2010); the chemical industry is research intensive and knowledge management and absorptive capacity are important to firms in the industry. Additionally, the chemical industry is very focused on improving their environmental performance. BASF' is regarded as the most innovative chemical company worldwide and sustainable development is a strategic goal in the firm. Moreover, they have received awards for their environmental reporting. Consequently, you would suppose that they handle absorptive capacity faultlessly.

The study is a qualitative in-depth investigation of BASF. The study uses an inductive method, as conclusions are drawn from twelve in-depth interviews with employees in BASF alone. As the study investigates the absorptive capacity in the global headquarters, regional headquarters and two different subsidiaries, the approach is an embedded case study.

Pinkse et al. (2010) executed the data collection in three steps; collecting available data about BASF; conducting 12 interviews with employees at BASF; and comparing all data collected.

Before conducting the interviews, Pinkse et al. (2010) collected financial and environmental reports, information on websites, and examined newspapers as well as press releases which involved BASF. The interviewees were all employees that were well-known with the environmental practices and knowledge management in BASF. The interviews were focused around how an influence of absorptive capacity on the ability to implement a global environmental strategy can occur in BASF. The analysis of the interviews were executed with help from a data matrix. Pinkse et al. (2010) created a vertical axis, which represented the theoretical dimension and a horizontal axis, which represented the various subsidiaries. The interviewees were asked to explain their environmental strategy implementation and absorptive capacity, and to compare their environmental and knowledge management abilities both with other subsidiaries within BASF and – to the extent possible – with competitors.

After conducting the interviews, they were compared to the data which were gathered previously, with a focus on environmental initiatives and the unit's knowledge management abilities.

Theoretical Framework and Hypotheses

Pinkse et al. (2010) focus on the environmental dimension of sustainability in their study and how to effectively manage environmental concerns Hart (1995) state that effective environmental learning goes beyond improvements and innovation and suggest that firms should also anticipate future trends and regulation.

For improvement of environmental impact, existing research suggest that it is necessary for firms to possess a degree of local responsiveness. Institutional pressure differs between countries, therefore global standards is a great challenge in Multinational Companies (MNC). MNCs can choose to apply environmental strategies that correspond to local standards, apply the national environmental standards globally, or they can apply an internal global environmental standard in all countries. Dowell, Hart, and

Yeung (2000) state that an internal global environmental standard will lead to highest market values of the three strategies. However, some problems can occur when implementing a global standard strategy, for example if countries are operating at different levels of technology.

Pinkse et al. (2010) also focuses on sourcing and transferring environment-specific knowledge. Location-bound and context-specific knowledge can be a challenge, when a firm wishes to transfer knowledge. It is important to understand local concerns about the environment, as local clusters such as communities, NGOs and regulatory bodies will nurture environment specific knowledge. Hence, the firm needs to acquire and assimilate this knowledge, as it most often lies outside the subsidiary (Hart, 1995). Furthermore, the transfer of environmental technologies across borders will be affected by the technological solutions offered in the local context. Moreover, the knowledge acquired in one location, may not be necessary in another location within the MNC . Gupta and Govindarajan (1994) also states that even though the best choice is to implement a globally standardized strategy, the challenge of relevance for each subsidiary can hinder the applicability of the strategy. The same knowledge may not be needed in the subsidiary as in the headquarters, if their role in the firm is different. Another fallacy is that the subsidiary may possess valuable environment-specific knowledge, which is not recognized, as their role is not within knowledge creation.

Lastly, Pinkse et al. (2010) also focuses on MNCs and absorptive capacity. Knowledge in MNCs is affected by the internal networks, which make learning a dynamic capability, which is crucial for adding value in the firm. Absorptive capacity helps us understand, how MNCs manage the learning process. Absorptive capacity represents

a fundamental learning process, which has been conceptualized as the uptake and integration of new external knowledge by Cohen and Levinthal (1990). The higher the absorptive capacity in a firm, the more adaptable and the faster it is to learn.

The concept of absorptive capacity consists of four capabilities; knowledge recognition and acquisition, knowledge assimilation and transformation, and knowledge exploitation. It is a firm's ability to fosters adaptation to external changes, as it allows firms to create new capabilities when combining existing and new knowledge. Existing strategies can be improved, and new strategies created, when firms apply absorptive capacity.

Subsidiaries in an MNC do not have the same roles, hence their absorptive capacity will not be the same. Therefore, the subsidiaries need to possess high local responsiveness to improve the overall performance of the MNC.

Lane and Lubatkin (1998) suggest that the firm's ability to learn from another firm is affected by, what they refer to as relative absorptive capacity: their similarity of their knowledge bases, organizational structures, compensation policies, and dominant logics are similar. A high level of relative absorptive capacity prevents the firm from extensive local adaption. Lane and Lubatkin (1998) suggest that a unit-specific absorptive capacity will make firms able to be more responsive by improving the effort, intensity, and speed with which they recognize new knowledge. Unit-specific absorptive capacity goes beyond the common absorptive capacity and is context specific and location-bound.

Pinkse et al. (2010) "examine empirically how the absorptive capacity of an MNC's subsidiaries influences the implementation of a global environmental strategy by shedding light on factors that affect the acquisition, assimilation, transformation and exploitation of environment-specific knowledge and technologies" (p. 164).

Findings

The main finding is that a shared level of absorptive capacity across subsidiaries facilitates a common understanding and use of environment-related knowledge. Yet, Pinkse et al. (2010) suggest that there is a need for unit-specific absorptive capacity at a subsidiary level as well, as environment-related knowledge is often context-specific. A unit-specific absorptive capacity will allow subsidiaries to adapt more efficiently to global environmental practices, which will lower the costs related to the implementation of a global environmental standard. Hence, the belief that an MNC's absorptive capacity is a fundamental facilitator of a global environmental strategy, is supported by the results. Sustainable development is one of BASFs four cornerstones of their overall strategy, and external knowledge and absorptive capacity plays a key role in the implementation of environmental practices.

Standardization and shared absorptive capacity

Pinkse et al. (2010) have found that an MNC's ability to adapt to international standards and the shared absorptive capacity are related. They propose that "the higher the level of shared absorptive capacity among subsidiaries of an MNC, the higher the MNC's ability to internationally standardize the practices related to its environmental strategy.

An interview with a manager from the Environment, Health and Safety (EHS) department in the US headquarters revealed that an insufficient shared absorptive capacity affected a knowledge sharing process concerning an environmental strategy. Even though BASF US headquarters operated with a shared knowledge system, which contains a company wiki, expert lists, and other features, which most subsidiaries have access to, they did not possess the prior knowledge and understanding required for the environmental strategy, due to environment-specific knowledge.

They solved the situation by establishing a learning process with environmental trainings, regular personal meetings and coaching sessions to ensure global environmental, health and safety standards. BASF established a common understanding, which allowed the US headquarters and subsidiaries to implement the directive.

Context specificity and unit-specific absorptive capacity

Pinkse et al. (2010) studied the context-specific and unit-specific absorptive capacity in BASF and based on their data analysis, they propose that "the higher the level of unit-specific absorptive capacity of a MNC's subsidiary, the better it will complement the global environmental strategy with context-specific environmental practices at a local or regional level" (p. 172).

I their interviews they found that BASF had experienced difficulties about different regulatory settings in the US and Europe, and as a consequence, they had created a position of a product steward, which is an employee responsible for the environmental management strategy and for minimizing the environmental impact throughout the whole life cycle of a product. Hence, they made it possible to locally acquire, assimilate, transform and commercialize the necessary knowledge – for example by building relationships with local legal requirements, customer demands and other stakeholders. They built a unit-specific absorptive capacity, which enabled them to adapt to global standards.

Moreover, BASF have built absorptive capacity at a regional level by developing networks and steering committees in Asia, the Americas and Europe. Their work concerns upcoming challenges with respect to the environment for manufacturing, raw material supply, regulation and other pertinent areas.

Role specificity and unit-specific absorptive capacity

Pinkse et al. (2010) also studied the role specific and unit-specific absorptive capacity. They found that "he higher the level of unit-specific absorptive capacity of an MNC's subsidiary, the better it will adapt a global environmental practice to its role within the MNC" (p. 174).

The headquarters in Germany serves as the strategy and innovation provider, and the US subsidiaries, except from the catalyst business, represents sales, marketing and production. The US subsidiaries sell the strategy and innovation from the headquarters in Germany.

The US subsidiaries have not built a unit-specific absorptive capacity themselves, but as a result of its work and unit specificities, they have created it. Their unit-specific absorptive capacity is customer oriented due to their sales, marketing and production role. The Catalyst Business develops customer-tailored products, thus their focus is on developing new business in the long-term. They strengthen their absorptive capacity by building relationships with local regulators, local universities, and customers. The subsidiaries effort, intensity, and speed with which it understands the potential of new external knowledge, and their scope of search, prior knowledge and available knowledge sources differ, due to their different roles.

In the interviews Pinkse et al. (2010) found one specific case representing how these differences affect the subsidiaries adoption to new external knowledge. As the global headquarter wanted the

US headquarter to implement a so-called eco-efficiency analysis tool, which showed not to be needed in the US headquarter. However, the US headquarter lacked understanding of the tool and it turned out that they could use the eco-efficiency analysis tool in a different way, which were in line with their role in the MNC.

Knowledge Gaps and Future Research Directions

Several knowledge gaps and future research directions were identified in the empirical studies, which I will outline in this section.

I am using the empirical studies to identify knowledge gaps, which they have identified in their future research of their studies. The empirical studies constitute my empirical foundation, and by applying theory on the knowledge gaps identified, I contribute with new insights. It would be relevant to apply further empirical studies in future research, in order to make generalizations, or conduct a case-study investigation on the knowledge gaps. However, my research is not alone based on future research from my literature review, but the direction have served as inspiration.

Future research directions by Dangelico et al. (2013)

- I. Internal integrative capabilities could be included along with external integrative capabilities.
- II. Greater number of manufacturing industries could be included to investigate the generalizability of the investigation.
- III. It would be relevant to investigate the role of external integrative capabilities in other manufacturing industries with higher levels of investments in R&D. Dangelico et al. (2013) expect that external integrative capabilities will be of less significance to the development of green product, as their R&D generates new environmental knowledge and competencies.
- IV. Green product development could be studied under a contingent and dynamic capabilities perspective. Dangelico et al. (2013) state that the context of environmental sustainability has been characterized by high dynamism over the past decade.
- V. It would also be relevant to identify a set of dynamic capabilities useful to integrate environmental sustainability into product development.

Future research directions by Grewatsch et al. (2018)

I. It is identified that it would be relevant to examine the origin of the development of an organizational cognitive frame an contextual factors, with respect to how corporate sustainability becomes a significant factor in a firm's organizational cognitive frame.

Grewatsch et al. (2018) state that it has been researched how the organizational cognitive frame is a result of political processes involved, however today a predominant collective organizational frame is established, and competition is identified between the individual actors' cognitive frames.

II. Research on the cognitive micro-foundation of organizational capability development with a focus on corporate sustainability would be relevant for further exploration.

Future research directions by Delmas et al. (2011)

- I. Further investigation on the existence of feedback loops as part of a longer process is suggested. Longitudinal data would allow a more dynamic investigation if it were available.
- II. Delmas et al. (2011) suggest that future research should test the application of their model in other industrial contexts where environmental issues are less significant.
- III. Future investigation on the relations between absorptive capacity and successful proactive environmental strategies should analyze the effect of differeing national regulatory settings.

Future research purposed by Pinkse et al. (2010)

- I. The study is limited, as findings are based on a single case study. Including a larger sample, would create a higher level of generalizability.
- II. It could be relevant to investigate the effect of countries that differ significantly more than Germany and the US. Developing countries' implementation of environmental practices is complex.

Chapter 5: Discussion

In this chapter, I will discuss the research questions in relation to my theory and the empirical findings I have presented. My discussion will be followed by suggestions for implications and a discussion of any limitations for my study. Finally, I will make suggestions for future research.

SQ1 What characterizes sustainability in the manufacturing industry?

The empirical findings suggest that firms should be aware of not extracting more resources than can be reproduced. Not only because of the ethical question, but also because they should believe in predictions and indications, based on these empirical findings that the firms that will survive in the longterm, are the ones that act in a sustainable way.

I found that firms tend to focus on long termism in terms of integrating corporate sustainability strategy and business strategy. This can both generate opportunities and risk; thus, it may be contributing with generation of risk-based thinking, which foster improvement. By implementing management systems such as ISO 14001 and the new ISO 50001, it is possible for companies to work with risk-based thinking in a systematic way. By focusing on long termism, firms also consider economic feasibility, as sustainability only makes sense if the firm makes money, as it is crucial for its own survival. However, long-term strategic planning in a dynamic environment such as sustainability is a challenge and therefore firms should not only rely risk-based thinking and on such systems as ISO 14001 and the new ISO 50001. It is just as important that they keep the finger on the pulse and act on present environmental changes. Some businesses may focus on developing new business in the long-term. In this case, it can be relevant for firms to strengthen their absorptive capacity by building relationships with local regulators, local universities, and customers. I will return to absorptive capability later.

I have found that positive emotional associations and experiences with corporate sustainability encourage managers to spend more time and resources on organizational capabilities that foster social and environmental issues. This was found in regard to the effect of relative corporate sustainability in organizational frames on organizational capabilities. Thus, if sustainability is an individual ethical stance, managers are motivated to spend time and resources.

The triple bottom line is a part of way firms think about sustainability; thus, there is a difference between the way firms apply the framework. Some firms measure sustainability, and in BASF, the German multinational company, they have received awards for their environmental reporting. However, they are experiencing challenges with their absorptive capacity in relation to sustainability strategies in their subsidiaries. Firms should invest in absorptive capacity to strengthen their environmental competencies and

benefit from a proactive environmental strategy, instead of measuring their sustainability performance quantitatively.

It is mandatory to report on corporate activities and initiatives in Denmark, and Scandinavian businesses are considered global leaders in terms of corporate sustainability. However, being global leaders is not necessarily because of mandatory reporting. I found that firms use corporate sustainability as a prerequisite of doing business and as a critical self-reflection on own achievements. Some firms perceive sustainability to be a part of their DNA, as it is a part of their daily work, and they state that they are aiming towards a state where sustainability is not about having CSR and sustainability departments. They believe that sustainability should be an integrated part of doing business. Some firms also mention that they use CSR as a prerequisite of doing business, but they do not measure the financial performance, but believe that it does affect financial performance and process are optimized, as they incorporate corporate sustainability.

Measuring sustainability can be a challenge and the insights of a certain problem through measures, may be too narrow. Firms should focus on creating a bigger picture to understand the problem. However, measuring sustainability can be a great contribution to understand a problem, but should not stand alone. The principles of the triple bottom line, the economic, social and environmental principles, are interdependent and complementary, which measures do not reflect. Moreover, firms should be aware that it is difficult to aggregate the measures of the three different principles; economic, social and environmental. Hence, measures may point in three different directions. Thereby, it will be hard to integrate all three dimensions in meaningful way in corporate sustainability.

There is a difference in the importance of problems between countries. Some countries may favor environmental decision more than others, and some countries may have higher ethical standards than others. Additionally, countries have different laws, regulations, local legal requirements, customer demands and other stakeholders. Thus, the understanding and importance of a problem is different from country to country, which may lead the firms to perform selective reporting.

In BASF the headquarters had developed a sustainability strategy, which were supposed to support subsidiaries, when working with sustainability. A subsidiary in BASF did not find the sustainability strategy useful, which is a good example of selective reporting. They found that it was the differences between the headquarters and the subsidiary, and as they learned about how to use the strategy for their own unit, they found that I was useful.

Initiatives to prevent selective reporting can be taken; thus, a firm can create a position of a product steward, which is an employee responsible for the environmental management strategy and minimizing the products environmental impact throughout the whole life cycle of the product. Furthermore, it is necessary to build relationships with local legal requirements, customer demands and other stakeholder. This can also be the job of a product stewards. Moreover, a firm should build an unit-specific absorptive capacity, which I will elaborate on in a later.

Working with sustainability is a dynamic process, and a firm needs to build processes, strategies, procedures, instructions, etc. to build corporate sustainability. To successfully implement sustainability in all of these elements, firms can make use of global sustainability standards. It is a possibility for firms to use the ISO 14001 and the new ISO 50001 (management systems that enables firms to comply with international standards), which is an electronic system. Moreover, they can adapt to the Sustainable Development Goals and use them as guideline. It is possible to adjust them to each individual country, which makes them applicable for all firms.

Sustainability leaders have a great effect on the attention and resources spend on sustainability in the firm. A sustainability leader is more likely to spend time and resources, if they have positive emotional associations and experiences with corporate sustainability. It has been established that absorptive capacity is only realized, if top management is driving the process. Sustainability managers need be able to lead in a dynamic environment; thus, they should lead and inspire people, which is necessary when implementing absorptive capacity. It has been established that sustainable aspiration targets drive internal quality standards. Hence, sustainability leaders should create a clear vision or clear targets.

SQ2 How does normative values contribute to sustainable innovation?

In my literature review, I have one study conducted by Grewatsch (2017), which contributes to the understanding of, how normative values contribute to sustainable innovation. The study investigates how organizational cognitive frames affect organizational capabilities in the context of corporate sustainability. Hence, this study is contributing with the main findings in this research question.

It has beeestablished that it is useful for a firm to move from the instrumental level to the strategic level, when it wishes to generate sustainable innovation. Hence, sustainable innovation is not only concerned specific elements of the business model, but it includes sustainable innovation of the entire business model. However, applying sustainable innovation at the normative level contributes with new opportunities for sustainable innovation. When a firm implements sustainable innovation at the normative level, sustainable innovation is implemented at all levels and in all units of the organization, and it includes all employees. Thus, sustainable innovation is not only the top-management's responsibility, but as a standard procedure everyone in the organization should be taking responsibility for sustainability in their specific job.

In some firms, sustainability is an integrated part of the DNA of the company, which they consider a to be an organizational and innovative asset in the present and a competitive advantage in the future, due to the development of sustainability initiatives and the environmental demand for sustainability. These firms are working with sustainability at a normative level, as the DNA concerns everything in a firm; every single unit and employee in the firm, every process, strategy, instruction, decision etc. is involved.

In other firms, they have integrated sustainability into the daily business and all processes, instructions, procedures, decisions etc. through the use of systems such as the ISO 14001 and the new ISO 50001. Hence, sustainability is implemented at all levels and in all units. Thereby, the decisions regarding sustainability are made at a normative level, contrary to business model innovation, which is made at the strategic level.

A firm's corporate sustainability thinking and orientation direct the development of its organizational capabilities. Three organizational capabilities are enhanced; stakeholder integration, market sensing, and organizational learning. The firm should pay attention to the key stakeholder and consider how they can contribute to the decision-making process and innovation. The relationship between the firm and stakeholders is based on morals and normative commitments. A large number of stakeholders will create a high level of complexity.

At the normative level, everybody with a stake in the firm needs to belong. Consequently, a firm should take society into consideration in decision-making and innovation processes. This is a dynamic process, demanding dynamic capabilities, which I will get back to later. Usually, we consider society as only users and consumers of innovation, and not as the creators. However, it is important to consider society in the innovation process, as everyone can contribute to fostering new ideas and driving development of new opportunities.

Firms should also consider networks as drivers of innovation, growth and innovation. Firms aim to make an impact across the value chain beyond what they can do themselves, by partnering with other actors.

A high level of sustainability awareness within an organization will lead the organization towards more ambitious goals and strategies. Corporate sustainability presents a cognitive context that employs forward-thinking and encourage the development of complex organizational capabilities. Stakeholder integration, market sensing, and organizational learning are characterized by relational and cognitive complexity. Consequently, the role of normative management is to implement and create the foundation for the necessary capabilities. A firm should focus on sustainability awareness, such as integrating sustainability in the DNA of the firm or integrating sustainability strategy and business strategy, to create ambitious goals and strategies.

Managers should foster support and encourage their employees to take actions and make decisions that foster sustainability to drive normative innovation. A manager's perception of the environment influences the decision making, hence their cognitive context frame drives how they interpret strategic issues and identify existing and potential organizational capabilities. The higher the relative importance of corporate sustainability in the manager's cognitive frame, the higher a top-manager's motivation to be openminded. In BASF it was found that implementing corporate sustainability in the cognitive frame cannot drive sustainability alone, as top managers struggled with differences between the headquarters' purpose and the subsidiaries' purpose. Even though BASF have a high sustainability awareness, they experienced knowledge sharing challenges. I will return to this problem later.

Besides a higher level of open-mindedness, it has also been established that a higher level of acknowledgement of the relationship between the firm and the environment is affected by a high relative importance of corporate sustainability in the firm's cognitive frame. Managers need to create an agile organization, which can adapt to environmental changes.

SQ3 How is sustainability managed from a knowledge management perspective?

It is important to store knowledge in a manageable and well-arranged manner to avoid the case of missing information. The multinational company BASF have implemented a storage system, which functions as a wiki in the firm. Hence, it will be easier for subsidiaries to share knowledge, but also for new employees to find information. Even though BASF have a well-arranged and effective storage system for knowledge, it is not enough in terms of knowledge sharing. Tacit or implicit knowledge is unique and important to the firm, but can only be shared informally through collaboration and networking, not through formal storage systems.

The geographical distance between subsidiaries in the multinational company BASF can cause misinformation and misguide employees. They need to be careful, when they transfer knowledge from one subsidiary to another. Location-bound and context-specific knowledge is a challenge in knowledge transfer.

Three suggestions concerning knowledge transfer in geographical distances:

- 1. Local concerns are a priority, as this will affect the interpretation of the knowledge transferred.
- 2. The same level of technological understanding and solutions are needed, as this is necessary for technological knowledge transfer to succeed.
- 3. If the firm wishes to transfer knowledge about a standardized strategy, it is important that the strategy is equally relevant to both parts.

If a strategy from an R&D department is transferred to a marketing and sales department, the necessary information may not be transferred, and the marketing and sales department will consider the strategy unnecessary for their work.

This leads me to the challenge of silo-thinking, which is something that firms should prevent. Departments talk in different ways about the same trend, which can be a challenge in terms of communicating. Firms need to create a high degree of common understanding of a trend such as sustainability. Knowledge sharing should be prioritized in firms and regular meetings are a great way to create a common communication forum for complex knowledge. The meetings need to be focused on the complex knowledge and all other concerns should be managed at other times. BASF introduced regional meetings for knowledge sharing about sustainability issues, as a way to create a common communication channel between different subsidiaries.

Revised knowledge pyramid

Knowledge management depends on previous experiences of decision-making; hence, the prior knowledge of a firm should be taken into consideration in knowledge management. Additionally, available knowledge sources, the scope of search and the potential of new external knowledge affects knowledge management. These three elements affect future decision-making activities together with prior knowledge. Knowledge management is also affected by the effort, intensity, and speed with which a firm achieves knowledge.

The BASF Case

In BASF, knowledge differs among the headquarters and the different subsidiaries, as each unit of the company possess different capabilities of understanding the potential of new external knowledge, and differs in terms of their scope of search, prior knowledge and available knowledge sources. Hence, their knowledge management processes differ.

In the reversed knowledge pyramid, the amount of information is bigger than the amount of data. I found that this fits the examples from BASF, as their subsidiaries have different roles in the company; marketing and sales, research and development, strategy and innovation etc. Thus, they use the same data globally, but each subsidiary generates information for different local purposes.

BASF found that they needed create a unit-specific absorptive capacity. Environment-related knowledge is often context-specific for subsidiaries, which means that knowledge in subsidiaries needs to be adjusted to the specific context. However, due to their different purpose and context, their common absorptive capacity is not adequate for the subsidiary, as they use data, information and knowledge in different ways.

However, in an example where BASF decides to implement a directive, they found that they needed to increase their common level of environment-related absorptive capacity in order to value the same knowledge, when identifying, assimilating, transforming and applying knowledge. BASF' solution was to take some initiatives which ensured global environmental, health and safety standards; environmental experts performed special environmental trainings and held regular staff meetings and coaching sessions.

Consequently, BASF was able to increase the level of common absorptive capacity across subsidiaries, and the subsidiaries were able to implement the directive accurately.

This increase in available knowledge for understanding of the directive, is an example of organizational learning in BASF. Organizational learning is a top-down process, and the first step in organizational learning is to determine which actions and decisions need to be taken, which was decided by the headquarters in BASF. The next steps in organizational learning is to decide what intelligence, then knowledge, then information, then data that is needed for the implementation of the directive to be implemented. Even though BASF have a shared knowledge network, which ensures that knowledge transformation is stored for future processes, it turned out that their shared knowledge network was not sufficient for the implementation of this directive. The prior knowledge needed to implement the directive was environment-specific, which made it difficult to codify. Hence, to create the acquired actionable intelligence, they used the environmental experts. Actionable intelligence is specific, precise and helpful in generating useful courses of action, which was what BASF needed.

Another example in BASF is the transfer of a so-called eco-efficiency analysis, which is a tool to evaluate the environmental performance of the MNC's products and processes. BASF did not understand, how to use this tool. Thus, they needed to increase their understanding of the tool to implement it successfully. The headquarters of BASF made use of the tool in a way that made sense for their role in the company, by using its unit-specific absorptive capacity. Thus, when the headquarters had learned, how to make use of the tool, the process of creating data, information, knowledge and wisdom became bi-directional. Each subsidiary used their unit-specific absorptive capacity to use the tool in the specific way that made sense for their particular role; hence, each subsidiary complemented the tool to serve their specific marketing and sales needs, strategy and innovation needs, research and development needs etc.

The headquarters in BASF shared their knowledge with the subsidiaries about how to apply the eco-efficiency analysis tool by using the unit-specific absorptive capacity. In a multinational company, the different subsidiaries serve as social networks in each other's revised knowledge pyramid; hence, they transfer data, information, knowledge and wisdom to each other. The transfer of knowledge between different units in BASF is reflected in the revised knowledge pyramid by thin lines between the layers, representing the social networks. The social networks are used to transfer data, information, knowledge and wisdom between different users.

Moreover, the headquarters serve as strategy and innovation provider; thus, they transfer data, information, knowledge and wisdom to subsidiaries. Each subsidiary uses their unit-specific absorptive capacity to make sense of the DIKW transferred, and thereby create actionable intelligence and organizational learning that fits their role. Their unit-specific absorptive capacity depends on the available knowledge sources, the scope of search and the potential of new external knowledge.

More Insights on the Revised Knowledge Pyramid

I have found that two external integrative capabilities are essential for integrating environmental issues into product design; the capabilities are the creation of collaborative networks with actors along the supply chain and through the acquisition of technical know-how. Hence, the first capability, the creation of collaborative networks with actors along the supply chain, affects the weak filters in the revised knowledge pyramid, and contributes to the process of learning. It is a firm's ability to merge new knowledge with accumulated knowledge. The strong filters separate and capture what is needed from what is not. Hence, the access of collaborative networks in the process will be filtered based on what is needed and what is not needed to gain actionable intelligence and, in the end, organizational learning. The know-how can for example be training of employees, recruitment of new staff and purchase of software and machineries, as production processes are redesigned. In BASF I found that employees needed training to gain the necessary actionable intelligence to make use of the directive. Know-how creates insight, analysis and sense making, as reflected in the revised knowledge pyramid.

Actionable intelligence is data, information and knowledge that has been filtered by knowledge management, which is represented in the revised knowledge pyramid by the vertical arrows. Absorptive capacity is an important part of this process, as it identifies, assimilates, transforms and applies external knowledge.

If a firm does not have the acquired data, information and knowledge needed to create sustainable innovation, it will not be able to apply actionable intelligence in sustainable innovation. Actionable intelligence is used for generating courses of action and decision-making, which is crucial for a firm's ability to create sustainable innovation. Actionable intelligence creates organizational learning, which is defined as quantifiable improvement in activities, increased available knowledge for decision-making, or sustainable competitive advantage.

In the investigation of corporate sustainability in the firm's cognitive frame, it was established that the main drivers of organizational learning in their study, are the local culture and the involvement of employees. This indicates that applying knowledge management includes normative values as well as descriptive values. It is not only important to make rules and regulations about sustainability standards, it is just as important to create a culture and an involvement which foster sustainable innovation. The culture will affect the data, information and knowledge used and generated in the organization, and in turn the actionable intelligence and organizational learning.

SQ4 How does sustainable innovation and knowledge management contribute to the development of dynamic capabilities?

Agile Manifesto

Agile organizations focus on individuals and interactions over processes and tools, working software over comprehensive documentation, responding to change over following a plan, and customer collaborations over contract negotiation.

In my literature review, I found that corporate sustainability does not directly drive strategic planning. However, in the study, sustainability was found to be close to one of the firm's business models. This, however, does not mean that corporate sustainability drives strategic planning, but would rather mean that the firm aim at using strategic planning to drive corporate sustainability. However, the agile manifesto states that firms should respond to change over following a plan, and that the focus should be on individuals and interactions over processes and tools. Thus, a normative perspective on implementation of sustainability fits this perspective better.

An agile organization should be able to respond and change with the environment. I found that smaller firm are more capable of integrating environmental issues into their product design. Small and medium firms are more flexible, as they are not inhibited by organizational inertia to the same extend aslarge firms. Hence, this implies that large firms should in particular be aware of how agile their firms are. By avoiding processes and tools, comprehensive documentation, following a plan, and contract negotiations, they can avoid organizational inertia to some extent, as it will be much easier for them to change. It is time-consuming and labor-intensive work to change processes and tools, documentation, plans, and contracts.

Corporate sustainability is complex and highly demanding, as there are many layers and topics to address. Firms should therefore integrate dynamic capabilities to manage the complexity. Absorptive capacity constitutes a dynamic capability, as firms apply new knowledge to prior knowledge, and in turn improve existing operations and enhances the capability to adapt to external changes.

Dynamic Capabilities

Three dynamic capabilities are necessary to adapt to changes in the environment and create corporate agility; **learning** fast and building new strategic assets; **integrating** new strategic assets, including capability, technology and customer feedback, into the organizational processes; **transforming** or **reusing** existing assets which have depreciated. Furthermore, the ability to learn fast and integrate quickly involves decentralization, local autonomy and strategic alliances.

As previously mentioned, absorptive capacity is a valuable capacity in creating corporate agility. However, I found that all four phases of absorptive capacity need to be a part of the process to have a positive effect.

Sustainable Uncertainty

Firms are facing sustainable uncertainty today and environments are increasingly becoming more dynamic. A firm is in VUCA conditions, if the firms is in a dynamic environment. VUCA conditions is a volatile, uncertain, complex, and ambiguous environment. It is suggested that firms in VUCA conditions apply three dynamic capabilities; sensing, seizing and transforming.

From a normative perspective, corporate sustainability should be a part of the cognitive context. I found that this will affect how top managers assemble and develop their firms' organizational capabilities, which is stakeholder integration, marketing sensing, and organizational learning. Market sensing is a great capability to encompass in a dynamic environment, even though firms are most often focusing on seizing opportunities and transforming. However, sensing is the foundation for the firm to adapt to market changes. Hence, it is effective to make corporate sustainability a part of the cognitive context if the firms are facing VUCA conditions. Sensing the outside market is an important capability in VUCA conditions, as the firm should be able to sense and shape opportunities and threats.

Organizational learning is also a great capability in VUCA conditions. I just discussed, how organizational learning is developed through the knowledge Management process, where data, information and knowledge is filtered and create actionable intelligence, and in the end, organizational learning. Organizational learning will enable the firm to adapt faster to the environment, due to the increased ability to make decisions and generate meaningful courses of action which is provided by organizational learning.

The Micro-foundations of Dynamic Capabilities

The micro-foundations of dynamic capabilities are the distinct skills, processes, procedures, organizational structures, decision rules, and disciplines. These micro-foundations become more agile, which means that knowledge will change faster and be more dynamic. In BASF we saw that they had a shared knowledge network, which was the foundation of their decisions and processes. However, the shared knowledge network was not sufficient for the implementation of the new directive. Consequently, they had to acquire new knowledge. Acquiring new knowledge also meant that they had to create new actionable intelligence and organizational learning through knowledge management. When firms work with dynamic capabilities, it is necessary for them to have the right resources, as dynamic capabilities cannot create an agile organization alone. It is crucial for knowledge intensive companies to create agile micro-foundations. Implementing dynamic and agile capabilities in knowledge management could be done by implementing the sensing capability in the knowledge pyramid. Implementing the sensing capability in the knowledge

pyramid, will also foster innovation and let firms be the drivers of innovation, instead of adapting to market changes alone.

In the revised knowledge pyramid, the dimension IoT – and other sensors give the impression that there is a sensing capability to be found in the pyramid. However, I suggest that the sensing capability should be reflected in the weak filters in terms of sensing activities. Sensing is reflected by the social networks. However, data, information and knowledge can be gained through other sources than social networks. Inspirational talks, business courses, business events, acquaintances, business trips both in home and foreign countries, and fieldwork are ways to stimulate the sensing capability. Sometimes knowledge to solve a problem comes from unexpected sources.

For example, if BASF had a focus on their sensing capability in their knowledge management work in all layers, they would possibly have been more aware about their lack of understanding about environmental issues. BASF were surprised that they needed environment-specific knowledge to implement the directive. The development of a higher common level of environment-related absorptive capacity could have been detected earlier, if the sensing capability were a part of knowledge management.

Uncertainty in a firm will completely disappear, if the level of data, information, knowledge, wisdom and organizational Learning that they possess equals the level required due to environmental uncertainty. However, this is the ideal scenario, but also rather unrealistic. However, in a world that is becoming increasingly dynamic and knowledge intensive, it should be of high priority to be upfront and possess knowledge management skills at the highest possible level.

Managerial Implications

My study has some managerial implications. First of all, managers need to inspire and motivate employees to make decisions which foster sustainability. Sustainable aspiration targets drive internal quality standards, which implicates that it is useful to create a clear vision and clear targets. They should create a culture of sustainability, as it will affect top managers' development of certain organizational capabilities, if sustainability becomes a part of the cognitive context. The organizational capabilities are stakeholder integration, marketing sensing, and organizational learning.

Engaging in social networks and partnerships is also an important managerial task. Networks should be considered as drivers of innovation and growth, as they can make an impact across the value chain beyond what managers can achieve themselves.

An important managerial implication is that managers should focus on the long-term perspective of sustainability, as it is indicated that the firms that will survive in the long-term are the ones which act sustainably. Furthermore, managers should use corporate sustainability as a prerequisite of doing business. To create corporate sustainability, managers need to restructure some processes, strategies, procedures, instructions, etc. This can be done by applying management systems such as the the ISO 14001 and the new ISO 50001 or by using the Sustainable Development Goals as a guideline. However, when managers evaluate sustainable development, they should do so it, only as a contribution to understanding the reason for this development and learn from it. There are several fallacies in measuring sustainable development.

Managers need to create an agile organization, which can adapt to environmental changes. Additionally, they should apply dynamic capabilities and focus on the sensing capability, as it is important to keep the finger on the pulse in a dynamic environment. Managers should develop and improve the firm's absorptive capacity, as it is a valuable capacity in creating corporate agility. However, it is important for the success of this effort that all four phases of the process of absorptive capacity are applied; managers should identify, assimilate, transform, and apply valuable external knowledge. Absorptive capacity is only realized, if top management is driving the process.

Finally, managers should foster knowledge sharing. Managers should prioritize knowledge sharing, for example by scheduling regular meetings to create a forum for complex knowledge.

Limitations of the Study and Suggestions for Future Research

I have identified several limitations in my study. First of all, I have applied four empirical studies in my literature review, which limits the generalizability of the study. Additional empirical studies would contribute to further insights into the different topics. Normative values were reflected by one article only. The three other studies only contributed to a small degree. Additionally, the empirical studies only included investigation of one multinational company. It would have been relevant to include more studies on multinational companies, to draw lines between the findings and create generalizable results.

The respondents in the surveys and the interviewees in the interviews are primarily CEOs and managers. However, it would be relevant to include insights from employees as well, as they might have other interesting contributions. Two of the surveys were quantitative, which limited the in-depth findings, which are actually relevant on subjects such as knowledge management and dynamic capabilities.

The amount of empirical studies in this research was limited due to time constraints, as the research method changed from case study to literature review due to the outbreak of corona. When it becomes possible to conduct interviews again, it would be relevant to do a case study to gain in-depth insights about sustainable innovation and knowledge management systems in a single firm. In this case, it would also be relevant to conduct expert interviews.

As it was found that there is a difference across countries in regard to how they value the importance of sustainability in the firm, it would be relevant to conduct this study outside of Europe. Some countries may favour sustainability more or less than Denmark, Germany and Italy, or maybe they have lower or higher ethical standards, or different laws, regulations, local legal requirements and customer

demands. Due to the relevance of normative values in this study, it would be relevant to investigate, if cultures that differ significantly from the European cultures would have different results from this study.
Chapter 6: Conclusion

SQ1 What characterizes sustainability in the manufacturing industry?

My research shows that firms expect sustainability to be decisive for their survival in the longterm. Thus, it is important to focus on sustainable innovation. Firms should therefore keep a finger on the pulse, and adapt to environmental changes. Managers play a crucial role in the development of sustainable innovation, and I have found that managers are motivated to spend time and resources on organizational capabilities that have an impact on social and environmental issues, if they have positive emotional associations and experiences with corporate sustainability.

Corporate sustainability can be used as a prerequisite of doing business and as critical selfreflection on own achievements. Management systems such as the ISO 14001 and the new ISO 50001 or guidelines such as the Sustainable Development Goals can help firms build sustainable processes, strategies, procedures, instructions etc.

My research suggests that firms should rather focus on developing their absorptive capacity, instead of spending time on measuring sustainability. Absorptive capacity has appeared to generate proactive environmental strategies. In Denmark, firms are required to measure their sustainable development. This measuring of sustainability should not stand alone, but can be a great contribution. The importance of sustainability issues, ethical standards, laws, regulations, local and legal requirements and customer demands are different across countries.

SQ2 How does normative values contribute to sustainable innovation?

In my study, I have found that firms should move from the instrumental level to the strategic level in terms of generating sustainable innovation. At the normative level, all units of the organization and all employees are a part of the process. The focus on sustainability in firms have become much higher and in some firms, they perceive it as a part of their DNA.

I have found that there are some normative values which foster sustainable innovation. Considering society in the innovation process, can foster new ideas and drive development of new opportunities. Networks that value sustainability can make an impact across the value chain, beyond what they can do themselves.

Managers should encourage employees to make sustainable decisions to drive normative innovation. The higher the relative importance of corporate sustainability in a cognitive frame, the higher is a top-manager's motivation to be open-minded. Corporate sustainability thinking develops three organizational capabilities; stakeholder integration, market sensing, and organizational learning. All three capabilities contribute to sustainable innovation.

SQ3 How is sustainability managed from a knowledge management perspective?

I have found in my study that some knowledge is location-bound and context-specific, which makes it difficult to transfer. Transferring a strategy from an R&D department to a marketing and sales department can be a challenge, due to the different purposes of these departments.

Knowledge sharing should be prioritized in firms and it can be done by scheduling regular meetings for complex knowledge. This will for example allow different departments to share knowledge with each other and in that way prevent silo-thinking.

The different departments use data in different ways, and therefore the amount of information in the revised knowledge pyramid is bigger than data, the knowledge bigger than information aso. As departments use the same data, information, knowledge and wisdom in the same way, firms need to create a unit-specific absorptive capacity to adjust it to the specific context. The unit-specific absorptive capacity depends on the available knowledge sources, the scope of search and the potential of new external knowledge. However, it can also be useful to increase the common level of absorptive capacity in order to value the same DIKW. It depends on the specific situation.

Local culture and involvement of employees is found to be the main drivers of organizational learning. Organizational learning is defined as quantifiable improvement in activities, increased available knowledge for decision-making, or sustainable competitive advantage. The revised knowledge pyramid is bidirectional, as organizational learning is used to make decisions about which knowledge, information, and data that needs to be applied. Social networks affect the knowledge management process. However, strong filters will remove the external knowledge which is not relevant.

Finally, I have found that two external integrative capabilities are essential for integrating environmental issues into product design; these capabilities are the creation of collaborative networks with actors along the supply chain and the acquisition of technical know-how. Both capabilities are a part of the revised knowledge pyramid.

SQ4 How does sustainable innovation and knowledge management contribute to the development of dynamic capabilities?

Corporate sustainability is complex and it should be managed by creating an agile organization which adapts to environmental changes. Dynamic capabilities should be applied to create agility and manage the complexity.

In my study, I found that large firms should focus on a creating agility to a larger extent than small and medium firms, as they are inhibited by their organizational inertia. Furthermore, I found that corporate sustainability does not drive strategic planning, which also aligns with the agile manifesto that firms should not follow plans, but rather respond to changes. I found that firms should apply absorptive capacity. Absorptive capacity constitutes a dynamic capability, as firms apply new knowledge to prior knowledge, and in turn improve existing operations and enhances the capability to adapt to external changes. As mentioned in the managerial implications, it is important that all four processes of absorptive capacity are included to create a positive effect.

VUCA conditions were found to create a need for sensing the outside market. Most often firms focus on seizing and transforming, however the sensing capability makes it possible for firms to quickly adapt to market changes in terms of opportunities and threats.

Finally, the dynamic capabilities create a need for certain resources, as dynamic capabilities cannot create an agile organization alone. A firm should therefore create agile micro-foundations. The micro-foundations of dynamic capabilities are the distinct skills, processes, procedures, organizational structures, decision rules, and disciplines.

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Appendices

Appendices I: Data Collection



Appendices II: Type of Industry and Country

Type of industry	Numer of articles in this industry	Country
Chemical industry	2	German and a Multinational company,
Manufacturing industry	6	4 fra Kina, 1 fra DK, 1 fra Taiwan
Textile and Upholstered Furniture Industries.	1	Italy
The electric power industry	1	Brazil
Information and electronics industry	1	Taiwan
Multiple Industries	1	Germany

Appendices III: Categorizing of Theoretical Framework and Literature Review

SQ1 What characterizes sustainability in the manufacturing industry?

SQ1 What characterizes sustainability in the manufacturing industry?	Dangelico (2013) Developing Sustainable New Products in the Textile and Upholstered Furniture Industries: Role of External Integrative Capabilities	Grewatsch (2017) How organizational cognitive frames affect organizational capabilities: The context of corporate sustainability	Delmas (2011) Under the Tip of the Iceberg: Absorptive Capacity, Environmental Strategy, and Competitive	Pinkse (2010) On the implementation of a 'global' environmental strategy: the role of absorptive capacity2
Sustainability concept Bumgartner & Rauter (2017) defines sustainable development as "an economic, environmental and social development that meets the needs of the present and does not prevent future generations from fulfilling their needs"				
A business should be run with a long-term perspective and in a way that does not prevent future generations from fulfilling their needs.		In regards to long-termism findings showed that firms are integrating corporate sustainability strategy and business strategy, it is a part of their future orientation and encourages risk-based thinking. One of the interviewees states that sustainability is an integrated part of the DNA of the company. Another respondent state that they do not have a separate sustainability strategy, but sustainability is considered a part of their corporate strategy. The first respondent also states that they not only make sustainability a part of their DNA, because it is right, but also because they believe that it is a competitive advantage in the future. Continue:		The Catalyst Business develops customer- tailored products; thus, their focus is on developing new business in the long-term. They strengthen their absorptive capacity by building relationships with local regulators, local universities, and customers.
		Some of the interviewees state that sustainability issues can be both opportunities and risks. work with them as risks can encourage risk-based thinking, which can be an integrated part of a firm. Lastly, the assessment of economic feasibility is mentioned as being crucial. If you do not make any money, it does not make sense in the long-term to be sustainable.		
		The fourth and last coding category attempts to reason the findings on strategic planning capability> Furthermore, the unpredictability related to corporate sustainability is mentioned, as it is difficult to do long-term planning. Hence, it is about keeping the finger on the pulse and go in that direction.		

SQ1 What characterizes sustainability in the manufacturing industry?	Dangelico (2013) Developing Sustainable New Products in the Textile and Upholstered Furniture Industries: Role of External Integrative Capabilities	Grewatsch (2017) How organizational cognitive frames affect organizational capabilities: The context of corporate sustainability	Delmas (2011) Under the Tip of the Iceberg: Absorptive Capacity, Environmental Strategy, and Compet	Pinkse (2010) On the implementation of a 'global' environmental strategy: the role of absorptive capacity2
Treating humans, animals and nature with respect				
Only to extract the amount of resources that can be replaced within a certain period of time.		The firms that survive will be the ones that act in a sustainable way and do not out their own raw material source. Furthermore, they aim to impact the environment, by not using more resources than can be reproduced.		
Social sustainability is providing work environments that are meaningful and working with social responsibility.				
They consider it 'a way of life ', 'an individual ethical stance, and omething that is grounded in their personal values and beliefs (Rauter et al., 2017).		Positive emotional associations and experiences with corporate sustainability encourage top managers to dedicate more attention and resources to organizational capabilities that are aligned with addressing social and environmental issues. The organizational cognitive frames - grounded in their personal values and beliefs		
Tripple Bottom Line The triple bottom line (TBL) is a framework that divides sustainability into three parts; the social-, economic-, and environmental aspect.				
Elkington, the founder of the TBL, states that the three dimensions should be measured. At the same time they need to think about how reliable the values baained are, as objectivity and reliability can be a challenge (Sridhar & Jones, 2012).		Grewatsch et al. (2017) chose to investigate the Danish manufacturing market, as there is a great focus on corporate sustainability. It is mandatory to report on corporate activities and initiatives, and most firms have an agenda for corporate sustainability. Furthermore, Scandinavian businesses are considered to be global leaders in terms of corporate sustainability. In regards to the triple bottom line approach, they found that corporate sustainability was used as a prerequisite of doing business and as a critical self-reflection on own achievements. The interviewees expressed that no business is world champion in sustainability, but all are becoming more sustainability, but all are becoming more sustainability departments, as is the current situation.	Delmas, et al. (2011) suggest that firms should invest in absorptive capadity instead of environmental measures to strengthen their environmental competencies and benefit from a proactive environmental strategy. Investing in absorptive capadity can lead the firm to achieve competitive advantages. To achieve competitive advantages. To achieve competitive absorptive capadity concept suggests that processes need to be fully integrated within the firm.	Furthermore, they have received awards for their environmental reporting. Consequently, you would suppose that they handle absorptive capacity faultlessly.

SQ1 What characterizes sustainability in the manufacturing industry?	Dangelico (2013) Developing Sustalnable New Products in the Textile and Uphoistered Furniture Industries: Role of External Integrative Capabilities	Grewatsch (2017) How organizational cognitive frames affect organizational capabilities: The context of corporate sustainability The interviews revealed that the interviewed firms use CSR as a prerequisite of making business. CSR is not measured in financial performance, but it affects the financial performance, Corporate sustainability is perceived as a guiding tool for how to do business, as firms notice that they get better and have better processes, as they incorporate corporate analinability.	Delmas (2011) Under the Tip of the Iceberg: Absorptive Capacity, Environmental Strategy, and Compet	Pinkse (2010) On the implementation of a 'global' environmental strategy: the role of absorptive capacity2
By example, laws can be different in countries. Hence, the same issue may be very important in one country compared to another. These differences in relevance can possibly lead to selective reporting.	Collaborations among companies included in the product's value chain and other actors, by example governments, are necessary for companies working with green product development. H1: Collaborations with actors along the supply chain positively influence the integration of environmental issues into NPD programs, both in terms of (a) manufacturing process and in terms of (b) product design.	In the interviews the firms state that corporate sustainability affects stakeholder integration, when it comes to compliance with laws, regulations, and global sustainability standards, addressing stakeholder expectations, and the ownership structure One if the interviewees state that they have used the Sustainable Development Goals as a guiding line when they developed their new purpose and strategy, hence they are complying with global sustainability standards. Another respondent state that corporate sustainability is a part of the firm's corporate sustainability is a part of the firm's corporate lidentity, as they use the ISO 14001 and the new ISO 50001 (management systems that enables firms to comply with international standards), which means that they integrate all they do concerning corporate sustainability in procedures, instructions, etc., and in the daily business. -> Prevent selective reporting!!		In their interviews they found that BASF had experienced difficulties about different regulatory settings the US an Europe, and as a consequence, they had created a position of a product steward, which is an employee responsible for the environmental management strategy and minimizing the products environmental impact throughout the whole life cycle of the product. Hence, they made it possible to locally acquire, assimilate, transform and commercialize the necessary knowledge – for example by building relationships with local legal requirements, outcomer demands and other stakeholder. They built a unit- specific absorptive capacity, which enabled them to adapt to global standards.
Sridhar & Jones (2012) state that it is hard to quantitatively assess the goodness or bad of a problem. They believe that the sodal dimension needs a more qualitative approach than Elkington proposes. Sodal problems will impact individuals and communities in different ways that cannot be measured quantitatively.	Focus on envirionment			
Another critique of the TBL framework that Sridhar & Jones (2012) provides is that the TBL framework lack the ability to aggregate the esuits across the three principles; economic, social and environmental. There is no aggregated quantitative or qualitative summary of the three principles, which means that the results can point in three different directions.	Focus on envirionment			
Lastly, Sridhar & Jones (2012) finds that the TBL framework lacks integration across the three dimensions. They emphasize that the three dimensions are likely to conflict according to the TBL framework, but in reality they are interdependent and complementary.	Focus on envirionment	Firms are aiming towards a state, where sustainability is a prerequisite and a part of the way firms do business, instead of having CSR and sustainability departments, as is the current situation.		

SQ1 What characterizes sustainability in the manufacturing industry?	Dangelico (2013) Developing Sustainable New Products in the Textile and Upholstered Furniture Industries: Role of External Integrative Capabilities	Grewatsch (2017) How organizational cognitive frames affect organizational capabilities: The context of corporate sustainability	Delmas (2011) Under the Tip of the Iceberg: Absorptive Capacity, Environmental Strategy, and Competition	Pinkse (2010) On the implementation of a 'global' environmental strategy: the role of absorptive capacity2
Kuhiman & Farrington (2010) raises the same critique towards the TBL framework. They claim that the TBL framework lacks integration between the social and economic dimension. Kuhiman & Farrington suggest that the social and economic dimensions should be replaced by one single dimension called well-being.	Focus on envirionment			
FN's sustainable development goals FN has made 17 world goals, which are overall with 169 intermediate aims.				
it is possible to adjust the goals to each individual country , as they have taken into account the different backgrounds of each country (FN's Verdensmål).		One if the interviewees state that they have used the Sustainable Development Goals as a guiding line when they developed their new purpose and strategy, hence they are complying with global sustainability standards. In regard to organizational learning, Grewatsch et al. (2017) found that the main drivers were the local culture and involvement of employees. The interviewees state that the same procedures, instructions, and ideas worldwide, may be influenced by different cultures and different perspectives. To act in an ethical manner in Denmark is not difficult, but it may be in another country.		
FN states that "the new agenda acknowledges that social, economic and environmental development, peace, security and international cooperation is closely related, and that it requires an integrated effort to obtain durable development results" (FN's Verdensmål). Sridhar & Jones (2012) critique stated that the TBL framework was lacking integration, which is exactly what FN attempts to create	Focus on envirionment			
FN's 17 world goals can all be divided into the two dimensions well- being and environment, as Kuhiman & Farrington (2010) suggested.	Focus on envirionment			
Sustainability Leaders . Their investigation suggests that "a sustainability leader is someone who inspires and supports action towards a better world" (p. 3).				
Visser & Courtice (2017) propose the following definition of a leader: "A leader is someone who can oraft a vision and inspire people to act collectively to make it happen, responding to whatever changes and challenges arise along the way" (p. 2). Leadership is relational , which means that you cannot lead alone, you need people who have the need to be lead.			The top-management seems to have a significant influence on firms' absorptive capacity, as Delmas, et al. (2011) found that absorptive capacity is only realized, when top-management is driving the process. This finding seems to agree with several studies, which have mentioned that the political processes within an organization is important when firms explore new strategies.	

SQ1 What characterizes sustainability in the manufacturing industry?	Dangelico (2013) Developing Sustainable New Products in the Textile and Upholstered Furniture Industries: Role of External Integrative Capabilities	Grewatsch (2017) How organizational cognitive frames affect organizational capabilities: The context of corporate sustainability	Delmas (2011) Under the Tip of the Iceberg: Absorptive Capacity, Environmental Strategy, and Competition	Pinkse (2010) On the implementation of a 'global' environmental strategy: the role of absorptive capacity2
When sustainability leaders make decision, they should adopt a long- term view, as we have already mentioned.				
they should have a clear direction in mind . A clear vision is important for sustainability leaders, as they will be more willing to tolerate risk in pursuing a vision (Rauter, Jonker & Baumgartner, 2017).		The interviewees also revealed that their internal quality standards are higher than their certificates indicate or their operational targets. One respondent mentions that they have sort of inspiration or aspiration targets.		
A good sustainability leader integrates sustainability into basic business decisions and take a large number of smaller scale change initiatives, as this will lead the organization towards transformational change (Rauter et al., 2017).	H3: The acquisition of technical know-how and assets positively influences the integration of environmental issues into NPD programs, both in terms of (a) manufac- turing process and in terms of (b) product design. The benefits of going green were investigated and the results from this study showed that when integrating environmental sustainability issues into NPD programs in terms of product design, new opportunities were for example opening new markets, technologies, and product arenas. On the other hand, green manufacturing does not seem to have a significant influence on the creation of new opportunities.			
It is important for the sustainability leader to work on agility both in terms of the sustainability leader's own competencies, but also in terms of developing the employees' competencies.	H3: The acquisition of technical know-how and assets positively influences the integration of environmental issues into NPD programs, both in terms of (a) manufac- turing process and in terms of (b) product design.	One of the interviewees states that sustainability is an integrated part of the DNA of the company. Another respondent state that they do not have a separate sustainability strategy, but sustainability is considered a part of their corporate strategy. The first respondent also states that they not only make sustainability a part of their DNA, because it is right, but also because they believe that it is a competitive advantage in the future. The results of our study highlight that corporate sustainability represents a cognitive context that shapes firms' organizational cognitive frame and, thus, affects how top mangers assemble and develop their firms' organizational capabilities. In particular, we show that corporate sustainability positively encourages the development of specific organizational capabilities, specifically stakeholder integration, marketing sensing, and organizational learning.		

SQ1 What characterizes sustainability in the manufacturing industry?	Dangelico (2013) Developing Sustainable New Products in the Textile and Upholstered Furniture Industries: Role of External Integrative Capabilities	Grewatsch (2017) How organizational cognitive frames affect organizational capabilities: The context of corporate sustainability	Delmas (2011) Under the Tip of the loeberg: Absorptive Capacity, Environmental Strategy, and Competition	Pinkse (2010) On the implementation of a 'global' environmental strategy: the role of absorptive capacity2
Sustainability leaders inspire others throughout the organization, as they show a high degree of personal commitment to sustainability. Tollin, Bech & Wilke (2014) states that leaders are found to be strong, positive and significant drivers of commitment to sustainability in a corporation.		Positive emotional associations and experiences with corporate sustainability encourage top managers to dedicate more attention and resources to organizational capabilities that are aligned with addressing social and environmental issues.		
	The control variables in the study showed that the size of the firm and the industry had no significant influence on green manufacturing. However, there were a significant positive influence of the firm age on green manufacturing, which implies that older firms are more capable of reducing the environmental impact of their manufacturing processes. -> you may question whether the firm age has a significant impact is due to experience?			

SQ2 How does normative values contribute to sustainable innovation?

A	В	C	D	E
SQ2 How does normative values contribute to sustainable innovation?	Dangelico (2013) Developing Sustainable New Products in the Textile and Upholstered Furniture Industries: Role of External Integrative Capabilitie	Grewatsch (2017) How organizational cognitive frames affect organizational capabilities: The context of corporate sustainability	Delmas (2011) Under the Tip of the Iceberg: Absorptive Capacity, Environmental Strategy, and Competitive	Pinkse (2010) On the implementation of a 'global' environmental strategy: the role of absorptive capacity2
Normative Values The differences between explorative and normative innovation is that the explorative innovation adds new knowledge to existing knowledge, whereas normative innovation follow aspirations, builds targets and develop strategies. A CSR report, corporate environmental reporting and life cycle analysis are not enough to create a sustainable organization. The implementation needs to take place on all levels and in of the organization and include all employees. Everyone in the organization needs to take responsibility for the sustainable development.				
In the instrumental dimension , values are used to innovate services, products or processes.				
In the strategic dimension values are used to innovate the business model of the organization, which we have already seen that Bocken and Baumgartner have done.				

SQ2 How does normative values contribute to sustainable innovation?	Dangelico (2013) Developing Sustainable New Products in the Textile and Upholstered Furniture Industries: Role of External Integrative Capabiliti	Grewatsch (2017) How organizational cognitive frames affect organizational capabilities: The context of corporate sustainability	Delmas (2011) Under the Tip of the Iceberg: Absorptive Capacity, Environmental Strategy, and Competitive	Pinkse (2010) On the implementation of a 'global' environmental strategy: the role of absorptive capacity2
In the normative dimension , we use values to innovate in networks or in the organizational identity , by redefining the values, aspirations, and the identity of the networks or the organizational identity, which in turn leads to new norms, principles and strategies.		The interviewees also revealed that their internal quality standards are higher than their certificates indicate or their operational targets. One respondent mentions that they have sort of inspiration or aspiration targets. Another respondent state that corporate sustainability is a part of the firm's corporate identity, as they use the ISO 14001 and the new ISO 50001 (management systems that enables firms to comply with international standards), which means that they integrate all they do concerning corporate sustainability in procedures, instructions, etc., and in the daily business. Continue:	Delmas, et al. (2011) believe that absorptive capacity can help firms design or alter operations, processes and products, which will generate environmental proactivity.	

A	В	C	D	E
SQ2 How does normative values contribute to sustainable innovation?	Dangelico (2013) Developing Sustainable New Products in the Textile and Upholstered Furniture Industries: Role of External Integrative Capabilitie	Grewatsch (2017) How organizational cognitive frames affect organizational capabilities: The context of corporate sustainability	Delmas (2011) Under the Tip of the Iceberg: Absorptive Capacity, Environmental Strategy, and Competitive	Pinkse (2010) On the implementation of a 'global' environmental strategy: the role of absorptive capacity2
		The results of our study highlight that corporate sustainability represents a cognitive context that shapes firms' organizational cognitive frame and, thus, affects how top managers assemble and develop their firms' organizational capabilities. In particular, we show that corporate sustainability positively encourages the development of specific organizational capabilities, specifically stakeholder integration, marketing sensing, and organizational learning.		
How we can relate society to innovation to make society the producers of innovation. We are used to consider society as the users and consumers of innovation and not as the creators.				

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The normative orientation emphasizes that networks and organizational identity are driving the organization. Hence, we should focus on what defines the networks and organizational identity and how we can change them to innovate and create growth and prosperity. <i>Fra min egen teori: In CS we wish to create both economic, social and sustainable growth</i> <i>and prosperity. Therefore, we should redefine the values, aspirations and the identity of the</i> <i>networks and the organizational identity to reflect all three dimensions.</i>		H1. The relative importance of corporate sustainability in a firm's organizational cognitive frame is positively related to the development of a firm's stakeholder integration capability. They found, as shown in the structural model (figure 1), that stakeholder integration, market sensing, and organizational learning are enhanced. However, the last of the four organizational capabilities, the strategic planning capability, were negatively effected. The interviewees state that they aim to make an impact across the value chain beyond what they can do themselves, by partnering with other actors. Continue:		

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		If a firm has excess financial resources, it could be assumed that as they have better capabilities they focus on corporate sustainability. However, the interviews confirmed that it is the firm's corporate sustainability thinking and orientation that direct the development of organizational capabilities.		
To ensure sustainable development in the organization, sustainability should be a part of the organizational culture . A high level of sustainability awareness within an organization will lead the organization towards more ambitious goals and strategies.		Our findings show that, instead of firms becoming locked in a vicious cycle of declining organizational capabilities, they employ forward-thinking and encourage the development of complex organizational capabilities. Stakeholder integration, market sensing, and organizational learning represent organizational capabilities characterized by high relational and cognitive complexity (Maguire et al., 2006).		

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The role of normative management is to implement and create the foundation for the necessary capabilities to be able to redefine the values, aspirations, and the identity of the networks or the organizational identity.		Our findings show that, instead of firms becoming locked in a vicious cycle of declining organizational capabilities, they employ forward-thinking and encourage the development of complex organizational capabilities. Stakeholder integration, market sensing, and organizational learning represent organizational capabilities		
Driving normative innovation requires managers to foster commitment, which means that they should support and encourage their employees to take actions and make decisions that foster sustainability.		Cognitive context is the lens through which top managers interpret strategic issues and identify existing and potential organizational capabilities The managers' perception of the environment influences the decision making		
Moreover, they need to create and support a culture of sustainability-oriented innovation, where they welcome and encourage ideas that bring the organization closer to their sustainability goals and vision.		 H2. The relative importance of corporate sustainability in a firm's organizational cognitive frame is positively related to the development of a firm's market sensing capability. A high relative importance of corporate sustainability in a cognitive frame motivates a firm's top management to be open-minded and to acknowledge the relationship between the firm and the environment. 		

A	В	C	D	ΕΕ
SQ2 How does normative values contribute to sustainable innovation?	Dangelico (2013) Developing Sustainable New Products in the Textile and Upholstered Furniture Industries: Role of External Integrative Capabilitio	Grewatsch (2017) How organizational cognitive frames affect organizational capabilities: The context of corporate sustainability	Delmas (2011) Under the Tip of the Iceberg: Absorptive Capacity, Environmental Strategy, and Competitive	Pinkse (2010) On the implementation of a 'global' environmental strategy: the role of absorptive capacity2
they should be clear about their expectations by integrating sustainability through the organization's governance, policies, strategies and processes.		Some of the interviewees state that sustainability issues can be both opportunities and risks. work with them as risks can encourage risk-based thinking, which can be an integrated part of a firm.		It is a challenge to be clear about expectations across subsidiaries, as they have different roles and are placed in different countries.
This means that a sustainability manager need to create an agile organization that tolerates the changes that occurs because of sustainability (Bertels et al., 2010).		The organizational capabilities that decision-makers focus and act on, depend on the particular perceived context of the firm's situation A high relative importance of corporate sustainability in a cognitive frame motivates a firm's top management to be open-minded and to acknowledge the relationship between the firm and the environment.		

SQ3 How is sustainability managed from a knowledge	management perspective	e?		
SQ3 How is sustainability managed from a knowledge management perspective?	Dangelico (2013) Developing Sustainable New Products in the Textile and Upholstered Furniture Industries: Role of External Integrative Capabilities	Grewatsch (2017) How organizational cognitive frames affect organizational capabilities: The context of corporate sustainability	Delmas (2011) Under the Tip of the Iceberg: Absorptive Capacity, Environmental Strategy, and Competitive	Pinkse (2010) On the implementation of a 'global' environmental strategy: the role of absorptive capacity2
Challenges				
One challenge can be to filter out the needed data and information for a given task . The ability to do so depends on the amount of knowledge stored and how the organization stores the knowledge.				
Information overload will occur, when too much information is stored about a certain topic. Hence, employees will need to spend too much time on filtering information.				
As most physical documents are replaced by computers today, it is extremely important to implement storage systems which store knowledge in a manageable and well-arranged manner.		Another respondent state that corporate sustainability is a part of the firm's corporate identity, as they use the ISO 14001 and the new ISO 50001 (management systems that enables firms to comply with international standards), which means that they integrate all they do concerning corporate sustainability in procedures, instructions, etc., and in the daily business.		It is important to store knowledge in a manageable and well-arrange manner to avoid the case of missing information. BASF have implemented a storage system, which functions as a wiki in the firm. Hence, it will be easier for subsidiaries to share knowledge, but also for new employees to find information. Even though BASF US headquarter operated with a shared knowledge system, which contains a company wiki, expert lists, and other features, which most subsidiaries have access to, they did not possess the prior knowledge and understanding required for the environmental strategy, due to environment-specific knowledge.
Organizations should be aware of misinformation , which can occur due to inefficient communication processes and geographic distances .				Pinkse et al. (2010) found that location- bound and context-specific knowledge is a challenge in knowledge transfer. Based on literature research, they made three suggestions concerning knowledge transfer in geographical distances.

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Another challenge in organizations is missing information , which appears when information is not delivered to the persons needing the information, or when the needed information for a given task is not available.				
An organizational culture is deeply embedded in the organizational system, and it can be difficult to see through how the organizational culture effects knowledge sharing.				
Trust and relationships are crucial for the flow of knowledge in an organization and affects knowledge management.				
If the organization is a knowledge intensive business , trust will be decisive for the organizational effectiveness. In less knowledge intensive businesses, it will be less, yet still, important. (refering to trust and relationships)				
Organizations should focus on preventing internal competition by avoiding silo thinking and not focus on individual performances (Alt om ledelse).		Furthermore, the unpredictability related to corporate sustainability is mentioned, as it is difficult to do long-term planning. Hence, it is about keeping the finger on the pulse and go in that direction. Additionally, a lack of communication between different departments seems to be a challenge, as different departments talk in different ways about the same trend.		
Status and influence are bound to knowledge, which unintentionally keep employees from sharing knowledge (Alt om ledelse).				
Organizations should make knowledge sharing a priority . This can be done by prioritizing time for meetings concerning complex knowledge.				It is recommended to prioritize time for meetings concerning complex knowledge. Hence, BASF seems to make the right choice, when they introduced regional meetings for knowledge sharing about sustainability issues.

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Revised Knowledge Pyramid The revised pyramid reflects the great innovation of technology that we have seen the past decade. It has lead to an increased emphasis on KM and information management. Hence, due to the new way of considering initiatives such as big data, internet of things, social media, mobile technologies, etc., organizations are working with new processes and new ways of managing, transferring and utilizing data, information and knowledge.				
Jennex (2005) define KM as "the practice of selectively applying knowledge from previous experiences of decision making to current and future decision-making activities with the express purpose of improving the organization's effectiveness" (p. iv).				The subsidiaries effort, intensity, and speed with which it understands the potential of new external knowledge, and their scope of search, prior knowledge and available knowledge sources differ, due to their different roles.
Tuomi (2000) suggests that we should turn the KM pyramid upside-down, as data is not observed, collected or recorded in a vacuum. He believes that we understand the world through our knowledge and wisdom.	Absorptive capacity is about learning to understand		Absorptive capacity is about learning to understand	BASF subsidiaries need to learn about the sustainability strategy to understand what data to collect – still with regards to their role in the firm.
Jennex (2018) posits that the DIKW creation flow is happening in both directions.				

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In the graph, wisdom is broadest, then knowledge, then information, and then data. For example, different users of the data, have different purposes of using the data, hence the amount of information will be bigger than the amount of data that the information is derived from .		One of the interviewees stated that if your primary customer is public health care systems, you must spend the money in a sustainable manner, as the money probably is taxpayers' dollars. Hence, firms must adapt to sustainability demands from their primary customers.		The main finding is that a shared level of absorptive capacity across subsidiaries facilitates a common understanding and use of environment-related knowledge. Yet, Pinkse et al. (2010) suggest that there is a need for unit-specific absorptive capacity on a subsidiary level as well, as environment-related knowledge is often context-specific A unit-specific absorptive capacity will allow subsidiaries to adapt more efficiently to global environmental practices, which will lower the cost related to implementation of a global environmental standard. Hence, the belief that an MNC's absorptive capacity is a fundamental facilitator of a global environmental startegy, is supported by the results.

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				Pinkse et al. (2010) also studied the role specific and unit-specific absorptive capacity. They found that "the higher the level of unit-specific absorptive capacity of an MNC's subsidiary, the better it will adapt a global environmental practice to its role within the MNC" (p. 174). The headquarter in Germany serves as the strategy and innovation provider, and the US subsidiaries, except from the catalyst business, represents sales, marketing and production. The US subsidiaries sell the strategy and innovation from the headquarter in Germany.
A final difference between the traditional knowledge pyramid and the revised knowledge pyramid is the removal of apex's . This was done to remove confusion as an apex tends to imply that there is an ultimate point, such as the ultimate key wisdom				According to the unit-level absorptive capacity - no ultimate point / wisdom

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Managing the process of DIKW creation flow it is necessary to make use of the processes of insight, analysis and sense making, When the users understand what they are learning, the process will happen in the revised directions. Hence, the creation flow will be bi-directional . Both directions of the creation flow generate learning in the end.	The importance of investing in R&D were underlined, as the amount of information coming from internal R&D activities has a positive significant impact on the creation of new opportunities.			An interview with a manager from the Environment, Health and Safety (EHS) department in the US headquarter revealed that insufficient shared absorptive capacity affected a knowledge sharing process concerning an environmental strategy. Even though BASF US headquarter operated with a shared knowledge system, which contains a company wiki, expert lists, and other features, which most subsidiaries have access to, they did not possess the prior knowledge and understanding required for the environmental strategy, due to environment-specific knowledge. Continue:

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				They solved the situation by establishing a learning process with environmental trainings, regular personal meetings and coaching sessions to ensure global environmental, health and safety standards. BASF established a common understanding, which allowed the US headquarters and subsidiaries to implement the directive. When the subsidiaries gain an understanding of, what the strategy is supposed to be used to, they can apply it in their own work and the flow will be bi- directional.

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Social networks are represented by the thin horizontal lines between the layers. Social networks are used to transfer data, information, knowledge and wisdom between different users.	The results of this empirical study showed that companies engage in developing external integrative capabilities through the creation of collaborative networks with actors along the supply chain and through the acquisition of technical know-how. These two capabilities have shown to be essential for integrating environmental issues into product design. Additionally, firms should focus on collaborations with actors along the supply chains.		We argue that absorptive capacity facilitates the adoption of successful environmental strategies because environmental strategies require the combination of knowledge from various sources that are often outside of the firm. Jennex: KM is more than strategy, while strategy guides KM, KM also includes processes and technologies for storing, capturing, manipulating, and retrieving data/information/knowledge/actionable intelligence.	Moreover, BASF have built absorptive capacity on a regional level by developing networks and steering committees in Asia, America and Europe. Their work concerns upcoming challenges with respect to the environment for manufacturing, raw material supply, regulation and other pertinent areas.
The application of KM to the pyramid is represented by the vertical arrows pointing inwards. It is the process of capturing , retrieving , applying and storaging the DIKW.	The importance of investing in R&D were underlined, as the amount of information coming from internal R&D activities has a positive significant impact on the creation of new opportunities.	In regard to how corporate sustainability affects market sensing, Grewatsch et al. (2017) have found that firms listen to their primary customers and that they are concerned about firm image.		
Actionable Intelligence Actionable intelligence is data, information and knowledge that has been filtered by KM. The actionable intelligence is shared with specific, limited users and helps in generating courses of action or make specific decisions. Used for decision-making process	Absorptive capacity captures, retrieves, applies and storage the DIKW and generate intelligence to be used in decision-making		Absorptive capacity captures, retrieves, applies and storage the DIKW and generate intelligence to be used in decision-making	they create actionable intelligence in their unit-specific absorptive capacity process

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The strong filters are not used loosely, as the weak filters described before. key critical success factors The thick lines between the layers are representing the strong filters, which is used to focus on specific DIKW. They limit the access of social networks and thereby separate and capture what is needed from what is not.	The results of this empirical study showed that companies engage in developing external integrative capabilities through the creation of collaborative networks with actors along the supply chain and through the acquisition of technical know-how. These two capabilities have shown to be essential for integrating environmental issues into product design. Hence, this implies that firms should focus on acquiring technical know-how and assets, and on training and recruitment. Furthermore, the study showed that companies engage in developing external integrative capabilities through the creation of external knowledge links with actors outside the supply chain. External knowledge links is an important part of the integration of environmental sustainability issues into the manufacturing process.	The interviewees state that they aim to make an impact across the value chain beyond what they can do themselves, by partnering with other actors. In the interviews the firms state that corporate sustainability affects stakeholder integration, when it comes to compliance with laws, regulations, and global sustainability standards, addressing stakeholder expectations, and the ownership structure.		Key critical success factors can be something like regulations and consumer demands.

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The use of intelligence leads to organizational learning. Jennex (2018) refers to a description o organizational learning (OL), which is defined as a "quantifiable improvement in activities, increased available knowledge for decision-making, or sustainable competitive advantage (Cavaleri, 1994; Dodgson, 1993; Easterby-Smith, 1997; Miller, 1996)" (p. 6).	H4: The integration of environmental sustainability issues into NPD programs, in terms of (a) manufacturing process and (b) product design, leads to the creation of new opportunities for the firm. (Dangelico et al. 2013)	In regard to organizational learning, Grewatsch et al. (2017) found that the main drivers were the local culture and involvement of employees. The interviewees state that the same procedures, instructions, and ideas worldwide, may be influenced by different cultures and different perspectives. To act in an ethical manner in Denmark is not difficult, but it may be in another country. Corporate sustainability also seems to motivate the involvement of employees, as the interviewees state that decisions regarding sustainability is not top-down, but rather the employees are given information and a part of the process.		They solved the situation by establishing a learning process with environmental trainings, regular personal meetings and coaching sessions to ensure global environmental, health and safety standards. BASF established a common understanding, which allowed the US headquarters and subsidiaries to implement the directive. > increased availabe knowledge for decision-making

Skrifttype SQ3 How is sustainability managed from a knowledge management perspective?	Dangelico (2013) Developing Sustainable New Products in the Textile and Upholstered Furniture Industries: Role of External Integrative Capabilities	Grewatsch (2017) How organizational cognitive frames affect organizational capabilities: The context of corporate sustainability	Delmas (2011) Under the Tip of the Iceberg: Absorptive Capacity, Environmental Strategy, and Competitive	Pinkse (2010) On the implementation of a 'global' environmental strategy: the role of absorptive capacity2
Jennex (2018) furthermore states that organizational learning (OL) and KM generally will be top- down processes. The first step in the process of OL and KM is to determine which actions and decision that needs to be taken. When this is in place, the decision about what intelligence, then knowledge, then information, then data that is needed for the chosen actions and decisions to take place. A normal learning process will be bottom-up and start with the interpretation of data.	Creating new sustainable products and opportunities	The results of our study highlight that corporate sustainability represents a cognitive context that shapes firms' organizational cognitive frame and, thus, affects how top managers assemble and develop their firms' organizational capabilities. In particular, we show that corporate sustainability positively encourages the development of specific organizational capabilities, specifically stakeholder integration, marketing sensing, and organizational learning. Increasing the devel-opment of stakeholder integration, market sensing, and organizational learning capabilities might further encourage the development of other organizational capabilities, such as innovation capability and new product development (Hull and Rothenberg, 2008). (Grewatsch and Kleindienst, 2017, p. 621)		In the interviews Pinkse et al. (2010) found one specific case representing how these differences affect the subsidiaries adoption to new external knowledge. As the global headquarter wanted the US headquarter to implement a so-called eco-efficiency analysis tool, which showed not to be needed in the US headquarter. However, the US headquarter. However, the US headquarter lacked understanding of the tool and it turned out that they could use the eco-efficiency analysis tool in a different way, which were in line with their role in the MNC.
Big data can be used to "identify intelligence for evidence-based decision making, transforming intuitive based decision making to evidence-based decision making, and pushing decision making to lower levels of the organization" (Jennex, 2018, p. 8). Big data does not replace human insight and vision.				
IoT is "the network of physical devices that connect to the web, usually through a wireless connection, and communicate with other physical devices for improving service of all devices and create value" (p. 9).				

SQ4 How does sustainable innovation and knowledge management contribute to the development of capabilities?	Dangelico (2013) Developing Sustainable New Products in the Textile and Upholstered Furniture Industries: Role of External Integrative Capabili	Grewatsch (2017) How organizational cognitive frames affect organizational capabilities: The context of corporate sustainability	Delmas (2011) Under the Tip of the Iceberg: Absorptive Capacity, Environmental Strategy, and Competitive	Pinkse (2010) On the implementation of a 'global' environmental strategy: the role of absorptive capacity2
Agile Project Management				
Corporate agility is the capacity to sense and shape opportunities and threats, (2) seize opportunities, and (3) maintain competitiveness through enhancing, combining, protecting, and, when necessary, reconfiguring the business enterprise's intangible and tangible assets (David J. Teece).	Contrary to the manufacturing process, the products design is influenced by the size of the firm. Smaller firms are more capable of integrating environmental issues into product design, as they are more capable of changing their product design routines. They are more flexible and they are not inhibited by organizational inertia to the same extend as larger firms.			Moreover, absorptive capacity constitutes a dynamic capability that allows firms to create new capabilities based on the recombination of absorbed knowledge with existing knowledge (Kogut & Zander, 1992; Zahra & George, 2002). These new capabilities can improve existing operations and augment adaptation to external changes.
Individuals and interactions over processes and tools				
Working software over comprehensive documentation				
Responding to change over following a plan		The interviews did not clearly point out corporate sustainability drivers of strategic planning, which is consistent with the prior findings in the structural model. One of the interviewees stated that corporate sustainability is very close to their business model. However, no direct drivers were found. The fourth and last coding category attempts to reason the findings on strategic planning capability. The interviewees mention that managing corporate sustainability is complex and highly demanding, as there are many layers and topics to address.		

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Customer collaborations over contract negotiation		The interviewees state that they aim to make an impact across the value chain beyond what they can do themselves, by partnering with other actors.		
Dynamic Capabilities and Strategic Management According to the dynamic capability perspective, firms that need to address rapidly changing environments, must develop dynamic capabilities, which are "the firm's ability to integrate, build, and reconfigure internal and external competences" (Teece, Pisano, & Shuen, 1993).				Moreover, absorptive capacity constitutes a dynamic capability that allows firms to create new capabilities based on the recombination of absorbed knowledge with existing knowledge (Kogut & Zander, 1992; Zahra & George, 2002). These new capabilities can improve existing operations and augment adaptation to external changes.
Dynamic Capabilities and Strategic Management According to the dynamic capability perspective, firms that need to address rapidly changing environments, must develop dynamic capabilities, which are "the firm's ability to integrate, build, and reconfigure internal and external competences" (Teece, Pisano, & Shuen, 1993).				Moreover, absorptive capacity constitutes a dynamic capability that allows firms to create new capabilities based on the recombination of absorbed knowledge with existing knowledge (Kogut & Zander, 1992; Zahra & George, 2002). These new capabilities can improve existing operations and augment adaptation to external changes.

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According to the dynamic capability perspective, three dynamic capabilities are necessary to adapt to changes in the environment and create corporate agility; learning fast and building new strategic assets; integrating new strategic assets, including capability, technology and customer feedback, into the organizational processes; transforming or reusing existing assets which have depreciated.	Contrary to the manufacturing process, the products design is influenced by the size of the firm. Smaller firms are more capable of integrating environmental issues into product design, as they are more capable of changing their product design routines. They are more flexible and they are not inhibited by organizational inertia to the same extend as larger firms.	Increasing the devel- opment of stakeholder integration, market sensing, and organizational learning capabilities might further encourage the development of other organizational capabilities, such as innovation capability and new product development (Hull and Rothenberg, 2008). (Grewatsch and Kleindienst, 2017, p. 621)	Absorptive capacity has a positive and significant impact on the environmental proactivity of the firm, The analysis revealed that absorptive capacity seems to only have the wanted effect and be a valuable capacity, when all four phases are a part of the process. If one phase is carried out alone, it may not have a positive effect. Delmas, et al. (2011) found in their analysis that knowledge exploitation has a negative effect on cost reduction, if the capability is performed alone.	
Furthermore, it involves decentralization, local autonomy and strategic alliances to support the capability to change quickly.	Strategic alliances	Corporate sustainability also seems to motivate the involvement of employees, as the interviewees state that decisions regarding sustainability is not top-down, but rather the employees are given information and a part of the process. (In OL process)		Pinkse et al. (2010) studied the context- specific and unit-specific absorptive capacity in BASF and based on their data analysis, they propose that "the higher the level of unit-specific absorptive capacity of a MNC's subsidiary, the better it will complement the global environmental strategy with context- specific environmental practices on a local or regional level" (p. 172).
Sustainable uncertainty If an organization is facing a dynamic environment, they are in VUCA conditions, which means that they are in a situation where the environment is volatile, uncertain, complex, and ambiguous (Day & Schoemaker, 2016).				
Hence, leaders in those organizations need to be innovative and stimulate innovative services and new business models which aims to exploit the next big thing.				
Sustainability leaders will have less focus on detailed planning and other typical leadership tasks. A leaders task during sustainable development is to drive innovation and test new ideas. Hence, they should move their innovation from incremental to radical innovation.				
SQ4 How does sustainable innovation and knowledge management contribute to the development of capabilities?	Dangelico (2013) Developing Sustainable New Products in the Textile and Upholstered Furniture Industries: Role of External Integrative Capabili	Grewatsch (2017) How organizational cognitive frames affect organizational capabilities: The context of corporate sustainability	Delmas (2011) Under the Tip of the Iceberg: Absorptive Capacity, Environmental Strategy, and Competitive	Pinkse (2010) On the implementation of a 'global' environmental strategy: the role of absorptive capacity2
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When organizations are in the state of VUCA conditions and needs to work with disruptive innovation, radical business models and strategic leadership, they should work with three dynamic capabilities; sensing, seizing and transforming.				
Sensing the outside market can be done through research, networks, partnerships and corporations. Sensing is a capability that should be implemented in the organization and it means that employees should be able to sense and shape opportunities and threats.		The results of our study highlight that corporate sustainability represents a cognitive context that shapes firms' organizational cognitive frame and, thus, affects how top managers assemble and develop their firms' organizational capabilities. In particular, we show that corporate sustainability positively encourages the development of specific organizational capabilities, specifically stakeholder integration, marketing sensing, and organizational learning.		
The organization should furthermore be able to seize opportunities.				
The last dynamic capability that Teece consider is transforming , which is the capability to maintain competitiveness through the intangible and tangible assets of the organization by enhancing , protecting , combining and reconfiguring these assets.				
The micro-foundations of dynamic capabilities Teece (2009) states that the micro-foundations of dynamic capabilities is the distinct skills, processes, procedures, organizational structures, decision rules, and disciplines which undergird the enterprise-level dynamic capabilities.				

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The micro-foundations of dynamic capabilities Teece (2009) states that the micro-foundations of dynamic capabilities is the distinct skills, processes, procedures, organizational structures, decision rules, and disciplines which undergird the enterprise-level dynamic capabilities.				
Sensing and selzing capabilities may be appropriate to apply in knowledge management. Bringing these capabilities into knowledge management could possibly lead us to a better understanding about how to operate innovation management.		Their paper contributes with the knowledge of the effect that the relative importance of corporate sustainability in a firm's organizational cognitive frame has on the development of organizational capabilities. They found, as shown in the structural model (figure 1), that stakeholder integration, market sensing , and organizational learning are enhanced. However, the last of the four organizational capabilities, the strategic planning capability, were negatively effected. In regard to how corporate sustainability affects market sensing, Grewatsch et al. (2017) have found that firms listen to their primary customers and that they are concerned about firm image.		
In a dynamic environment, it is necessary for organizations to question the quality and effectiveness of their own knowledge base and adjust it according to the changes in the dynamic environment that surrounds them.				

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Teece (2009) implicates that integrating knowledge from the outside as well as within of the organization is essential.		Their paper contributes with the knowledge of the effect that the relative importance of corporate sustainability in a firm's organizational cognitive frame has on the development of organizational capabilities. They found, as shown in the structural model (figure 1), that stakeholder integration, market sensing, and organizational learning are enhanced. However, the last of the four organizational capabilities, the strategic planning capability, were negatively effected.		Thus, a firm that seeks to build and extend its absorptive capacity has to invest in resources that foster the respective processes including investments in R&D or by addressing specific roles in the knowledge integration and conversion process such as the role of a gatekeeper (Cohen & Levinthal, 1990).
An organizations knowledge base should be agile and able to change according to environmental changes. It is no longer just a question of transforming according to changes in the market, but it is just as well about being the drivers of innovation .				
The micro-foundations of dynamic capabilities will change knowledge management in organizations, as knowledge will change quickly as skills, processes, procedures, organizational structures, decision rules, and disciplines become more agile. These micro-foundations of dynamic capabilities will drive the organization to not only integrate new knowledge, but also generate new knowledge, as they become more innovative.				Moreover, absorptive capacity constitutes a dynamic capability that allows firms to create new capabilities based on the recombination of absorbed knowledge with existing knowledge (Kogut & Zander, 1992; Zahra & George, 2002). These new capabilities can improve existing operations and augment adaptation to external changes.
The organizational outcome of dynamic capabilities is product innovation, service innovation or process innovation.				

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Whether the organization obtains a competitive advantage depends on the value, rareness, imitability and substitutability of the innovation. Competitive advantage depends on the organizational resources and capabilities together.			environmental proactivity has a significant and positive impact on competitive advantage.	
Dynamic Capabilities and the Environment				
Even though an organization favors dynamic capabilities, there is no guarantee that the outside environment fits these capabilities. Oppositely, the environment may favor dynamic capabilities, but the organization may simply not have the information processing capacity to support this (Qalyum and Wang, 2018).				but the organization may simply not have the information processing capacity to support this
Qaiyum and Wang (2018) suggest, based on their findings, that dynamic capabilities demands a greater information processing capacity. The information processing capacity is the amount of information that the organization is able to achieve.				
Qaiyum and Wang (2018) has found in their study that organizations tend to perform better with ordinary capabilities compared to dynamic capabilities in early stages and the very last stages of their life cycle.				
However, when the organization is i n the middle of the two stages the ordinary capabilities and dynamic capabilities perform equally good .	The control variables in the study showed that the size of the firm and the industry had no significant influence on green manufacturing. However, there were a significant positive influence of the firm age on green manufacturing, which implies that older firms are more capable of reducing the environmental impact of their manufacturing processes. > They are probably better, as they are good at performing dynamic cababilities (compared to firms in the first and last stages (use the life cycle of firms model here?)			