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The inferences between design thinking and innovation management

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Monet megatrendit, kuten digitalisaatio, muokkaavat yritysten toimintaympäristöä yhä nopeampaan tahtiin. Kulutustottumukset muuttuvat tämän myötä yhä vaativammiksi, mikä johtaa siihen, että yritysten täytyy olla entistä innovatiivisempia. Design thinking eli vapaasti käännettynä muotoiluajattelu on noussut monessa yrityksessä keskiöön, kun on pohdittu keinoja parantaa yritysten innovointikyvykkyyttä. Muotoiluajattelun yhteys innovaatiojohtamiseen on silti jäänyt epäselväksi. Tämän tutkimuksen tarkoitus on yhdistää muotoiluajattelu ja innovaatiojohtaminen sekä tutkia minkälainen tämä yhteys on. Aikaisempi tutkimus osoittaa, että muotoiluajattelun linkittäminen innovaatiojohtamiseen kaipaa lisää empiiristä tutkimusta sekä kokonaisvaltaisempaa ymmärrystä siitä, mitä muotoiluajattelu oikeastaan on sekä siitä, miten sitä voidaan implementoida innovaatiojohtamiseen. Tämä kvalitatiivinen monitapaustutkimus käyttää kahta erilaista vertailevaa analyysimenetelmää ja tutkii muotoiluajattelun vaikutuksia suurissa ja keskisuurissa yrityksissä niin organisaatio- kuin projektitasolla. Tutkimus osoittaa, että muotoiluajattelu on ennen kaikkea filosofia, joka ohjaa ja tukee yritysten innovaatiojohtamista tuomalla ongelmanratkaisua painottavan asiakaslähtöisen tekemisen lähemmin mukaan yritysten prosesseihin. Tulokset osoittavat, että muotoiluajattelulla ja sen ilmentymillä on positiivinen yhteys innovointiprojekteissa. Yritysten täytyy tuoda muotoiluajattelun filosofia osaksi yrityksen kulttuuria lähtien ylimmästä johdosta, sekä kannustaa innovointiin ja kokeiluun. Tunnistamalla innovaatiojohtamista tukevia muotoiluajattelun ilmentymiä ja mahdollistajia tämä tutkimus tuo kaivattua yhtenäisyyttä ja ymmärrystä aiheen ympärille.

## **ABSTRACT**

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Digitalization and other megatrends shape companies' operating environment in a fast pace. Furthermore, consumers are becoming more demanding which means that companies need to become more innovative. Design thinking has raised interest among managerial discussion when companies have searched ways for being more innovative but it has yet remained unclear, how design thinking actually inferences with innovation management. Thus, this study links design thinking and innovation management and explores how these are connected. Previous studies regarding design thinking and innovation management suggests that this field of study requires more empirical evidence and more coherent understanding about what design thinking actually is and how it can be implemented into organizations. The method adopted for this study is a multi-method qualitative study. This includes the comparative case study and qualitative comparative analysis (QCA). This qualitative study studies design thinking's impact in large and medium sized companies at both organizational and project level. The findings indicate that design thinking is a philosophy that supports and guides companies' innovation management by bringing customer centered problem solving and empathy closer into companies' processes. In addition, the findings indicate that design thinking, has a positive impact in innovation projects. This means that companies' higher management must understand and support design thinking and implement it into the company culture, which must also support innovation and experimenting. By recognizing the different embodiments and enablers of design thinking that support innovation management, this study brings the much-needed coherence and understanding to this field of study.

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When starting my university studies five years ago, I had no idea about how interesting, fun and yes, sometimes tough, it would be. During my studies, I have not just learned new things and developed my skills in understanding this complex world, but also formed everlasting friendships and identified my own strengths and interests. While I have learned numerous interesting theories and increased my capabilities in understanding academic research, I believe my journey in learning is just starting and this thesis is just one way to indicate what I have learned so far, in a certain context.

Even though I have now spent quite a long time in a design thinking and innovation management bubble, I do not think I have had enough about it just yet. I believe my studies in strategy, innovation and sustainability have given me a good starting point to extend my learning even more in the future positions. An addition to being a good indicator of my academic capabilities, writing a master's thesis for me was a way to deepen my understanding around a chosen subject and develop my skills in in-depth and long-term learning. I am happy to be able say that this process has definitely taught me those skills.

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## TABLE OF CONTENTS

1	INTRODUCTION .....	8
1.1	Background .....	9
1.2	Focus of the study: research questions.....	12
1.3	The research framework.....	15
1.4	Structure of the thesis .....	17
2	LITERATURE REVIEW .....	18
2.1	The methods of the analysis of the literature review .....	18
2.2	Design thinking: literature analysis and definition .....	19
2.3	Design thinking as a resource for innovative organizations .....	22
2.3.1	The models and tools of design thinking .....	24
2.3.2	Main contributions of design thinking to innovation.....	31
2.3.3	Paradoxes regarding design thinking .....	35
2.4	The field of innovation management .....	37
2.4.1	Defining innovation management.....	39
2.4.2	Innovation management: literature review and analysis.....	41
2.4.3	The measurement of innovation management .....	49
2.5	Connecting the literature review between design thinking and innovation management .....	52
2.5.1	Presenting the core studies of design thinking and innovation management	52
3	RESEARCH DESIGN AND METHOD .....	59
3.1	Research method .....	60
3.2	Research context and the description of the case companies.....	61
3.3	Data collection: case studies .....	63
3.4	Comparative case study and content analysis .....	65
3.4.1	Qualitative comparative analysis (QCA).....	67
3.5	Reliability and validity .....	70

4	RESULTS .....	72
4.1	Multiple comparative case analysis: design thinking at an organizational level ..	72
4.1.1	Comparative case study results .....	82
4.2	QCA results: project level associations between design thinking and innovation	86
4.2.1	The crisp-set QCA results .....	89
4.3	Measuring innovation management success .....	93
5	DISCUSSION .....	96
5.1	The nature of design thinking .....	96
5.1.1	Design thinking's embodiments and dimensions .....	97
5.2	The inferences of design thinking and innovation management.....	101
5.2.1	Design thinking transforming innovation management.....	103
5.2.2	Implementing design thinking into innovation management .....	105
6	CONCLUSIONS .....	108
6.1	Theoretical contributions .....	108
6.2	Managerial implications.....	112
6.3	Limitations and future directions .....	114
	REFERENCES .....	118
	APPENDICES .....	127
	Appendix 1. The key words used in the key word search for the study .....	127
	Appendix 2. The structure of the interview in the form of the interview questions .....	128
	Appendix 3. The design thinking condition explanations for QCA .....	129
	Appendix 4. The truth table of the crisp-set QCA .....	130
	Appendix 5. The qualitative evidence of the design thinking conditions in the QCA ..	130

**List of figures**

Figure 1.	The research framework for the study.....	15
Figure 2.	The integrative literature review process of this study.....	19
Figure 3.	The practical model of design thinking (adapted from Brown, 2009) .....	26

Figure 4. Double diamond model (adapted from Design Council, 2018) .....	28
Figure 5. The dimensions of design thinking .....	32
Figure 6. The framework combining organizational learning, market orientation and innovation (adapted from Slater and Narver, 1995; Hurley and Hult, 1998; Adams et al., 2006) .....	44
Figure 7. Comparing and combining open and closed innovation (adapted from Chesbrough, 2012) .....	46
Figure 8. The cyclic innovation model (adapted from Berkhout et al., 2010).....	48
Figure 9. Research design and methodology selections for the study .....	60
Figure 10. The QCA process (adapted from Bekdik and Thuesen, 2015).....	68
Figure 11. Design thinking explained through its different enablers and embodiments ...	101
Figure 12. The customer-centric role of design thinking in innovation management .....	106

### **List of tables**

Table 1. The evolution of the definition of DT by different authors .....	21
Table 2. The different models and tools of DT.....	25
Table 3. Indicators for the paradoxes around the concept of design thinking .....	36
Table 4. The different frameworks or models for innovation management .....	42
Table 5. Different innovation management metrics (adapted from Henttonen et al., 2016).....	51
Table 6. The core studies on DT's impact on innovation management and their results ....	53
Table 7. Basic information about the companies used in this study (Company A, B, C and E financial statements, 2016; company D financial statement 2015) .....	62
Table 8. The division of the themes used in the analysis by research questions .....	66
Table 9. Cross case results of design thinking in the organizational level .....	82
Table 10. The intermediate solution of the crisp-set QCA .....	89
Table 11. Innovation management metrics used in the case companies .....	94
Table 12. The main theoretical contributions .....	108

## 1 INTRODUCTION

Innovation is a core business activity (Trott, 2012, 2-3). Companies' ability to innovate has been highlighted as an important factor to companies' long-term competitiveness and success (Teece, 2010). In many innovative companies, it seems that the capability to innovate and be design driven requires a powerful visionary at the top (Martin, 2011). Illustrative examples like Apple and Google, have adopted a collaborative and co-creative approach to innovation, including open or closed innovation (Gruber, De Leon, George and Thompson, 2015). What both of these companies have in common is that they have succeeded with experimenting and transforming innovation management with external co-creators and stakeholders to co-create value.

The need to keep up with the changing market environment has also been highlighted considerably in the innovation literature and managerial practice discussion (e.g. Teece, 2010; Dobni, 2008,). Innovative companies have been able to move from satisfying their customers' needs to delighting them (Martin, 2011). This is done through innovation management (from now on also referred as IM), which can be defined as a way to enable the exploitation and creation of new ideas and value. As a result companies are adapting more agile tools in their operations and are continuously thinking about ways to be more innovative and customer centric (Teece, 2010). In order to succeed in this, companies need good IM.

Capability to innovate has been seen as a key success factor of many companies, whether big or small. There are many scholars (e.g. Chesbrough, 2003) who have created theories for innovation. Different theories will be presented later. These theories act as a good base when looking deeper into why some companies succeed in innovation better than others. However, this research will mainly focus on one tool, methodology and innovation philosophy, design thinking (from now on also referred as DT). DT has been gaining attention recently, at least it has become a buzzword among managerial discussions. DT is often linked to innovation process as a way of thinking or a tool. Furthermore, DT has become a preferred approach and tool for enabling companies to solve problems through a customer or human oriented mindset and empathy (Ulrich, 2011). An example of a design-driven company is Walmart,

which managed to increase the number of unique visitors on its website by 200 percent by designing their e-commerce from the users point of view (Kilian, Sarrazin and Yeon, 2015). Nowadays there are many similar examples of companies that have invested in being more design or customer oriented. This orientation is what DT is all about.

This master thesis aims to look deeper into the inferences between innovation management and design thinking. The main research gap in this study is these interferences between design thinking and innovation management. The research aims to understand the multiple approaches to design thinking, as a tool, a methodology and/or a philosophy, and how it might support innovation management. This is done by exploring how DT is understood and implemented in a set of different companies that has been implementing DT as a tool, method and philosophy to innovate in the last years. In the next sections, the focus of the study, research questions and research framework will be explained.

## **1.1 Background**

IM has an important role in company's competitiveness. Innovation creates long-lasting advantages and shifts competitive positioning of firms (Dobni, 2008). If a company is good at innovating, it will provide the company a competitive advantage and if a company is great at it, it will provide major industry-wide disruptions (Dobni, 2008). Christensen's (1997) theory of innovator's dilemma gives proof to the argument above by explaining how companies sometimes fail to see the new technologies or organizational innovation as competitive advantage due to their focus on the existing product or service offering and the technology related to this. If companies want to avoid this innovator's dilemma, they need to keep innovating and adopt innovations and new technologies. If this does not happen, firms usually fail to answer competition and market needs and thus fail. Nokia is a good example of a company, which suffered from innovator's dilemma, when not realizing the potential of touch screen technology in mobile phones. Companies can compete with size or other assets but more often, the competitive advantage is actually greater within companies who can mobilize knowledge and technological skills and experience and create new products or services, or in other words, innovate (Tidd, Bessant and Pavitt. 2005, 5).

Many new businesses have also risen from realizing the importance of innovation to firm's competitiveness. Management consultants are rather busy helping firms to improve their

innovation capabilities (Trott, 2012, 2-3) and larger companies are eager to cooperate with startups and partners in order to create innovations and thus find better competitive advantage. New technologies have created massive amounts of new startups. The innovation capability and the ability to bring these new ideas to the markets is often better in startups than within larger and older companies. When looking at lists of most valuable companies or brands, in the top ten there are companies such as Amazon, Facebook, Apple and Google (Forbes 2017; Fortune 2016) and these companies all have in common their capability to innovate. They all have realized the importance of innovation to competitiveness. All these companies are also rather young and due to this young age, they have adapted and built more agile ways to innovate from the beginning.

Due to the importance of innovation as a competitive advantage, there is a wide discussion related to different innovation tools, methodologies and philosophies. Companies need to find ways to manage different innovation approaches and thus find the best ways to make changes in the company (Tushman, 1997). Many publications have been made to guide managers in innovation (e.g. Le Masson, Weil and Hatchuel, 2010; Brown, 2008; Liedtka and Ogilvie, 2011; Tidd et al, 2005) and these publications all highlight the importance of finding the right approaches and tools to innovate. The importance of these innovation approaches is essential for companies' competitiveness. The use of these approaches and tools might depend on contextual factors such as the company size and market environment. New tools are presented in a quick pace and tested in the managerial practice. A strong debate about open versus closed innovation, for example, has been going on for more than a decade already. The theory of open innovation has been adopted by hundreds of academic articles and has been implemented into large number of companies (Chesbrough, 2012). Chesbrough's (2003) theory of open innovation changed the way companies innovate based on opening up technologies to others and making the most use of different technologies both inside and outside the company.

One of the main stakeholders to collaborate with are consumers and end users. Companies usually aim to collaborate with them to experiment their needs and behavior. A main tool and methodology for end-users innovation that has been adopted by leading companies in the last decades is DT. DT has been adopted by leading innovation firms, such as Ideo in Palo Alto (Ideo, 2018). Furthermore, DT has lately attracted the attention of scientists.

Scholars have studied DT as main approach to innovation that helps companies to understand customers and end-users innovation (e.g. Brown, 2008; Liedtka, 2015; Carlgren, Elmquist, and Rauth, 2014). Some scholars see DT as a philosophy that companies apply to innovation based on the idea of attempting to develop new ways of thinking that do not abide by the dominant or more commonly used problem solving methods. The core idea of DT is to transform the innovation or product/service development process by analyzing and creating understanding of how users or customers interact with products and studying the conditions in which they operate.

Defined and discovered by Brown (2008), the concept of DT is a customer centric approach to innovation that stems from the way professional designers view customer needs. This is the philosophical nature of DT. One element of DT is to use ethnography to falsify previous assumptions in order to make it possible to prove whether they are valid or not, analyzing and living the real conditions of end-users and users problems, and therefore, finding obvious solution-generation processes that reflect the real constraints of every-day life of that particular problem. Thus, DT aims to dig deeper in ethnography, observing and living real problems, deconstructing them, acting as researchers in real life, and finally prototyping and testing alternative solutions, products and services to uncover new ways of improving the product, service or design (e.g. Brown, 2009; Liedtka, 2015). In contrast, DT can also be studied either as a tool or a methodology. DT is seen as a tool or a methodology when companies apply DT processes (e.g. Brown, 2008; Liedtka, 2015). Here it becomes a collection of hands-on methods and tools. DT has raised similar interest in managerial and academic discussion and it has become a popular notion in the field of innovation (Kleinsmann, Valkeburg and Sluijs, 2017; Kimbell, 2011).

For the past decade both practice and academia have raised a growing interest towards DT (e.g. Brown, 2008; Martin, 2009; Johansson-Sköldberg, Woodilla, and Çetinkaya, 2013; Liedtka, 2015; Kleinsmann et al., 2017). Even though the concept has gained attention just lately, the origins of the concept dates back to the 1960's when Simon (1969) studied how people design artefacts. At that time, the concept was not named DT. Simon's (1969) definition of design as the transformation of existing conditions into preferred ones, gained a lot of attention and created the base for DT (Johansson-Sköldberg and Woodilla, 2009). Professional design is nowadays operating within an expanded and complex field when

solving social issues (Kimbell, 2011). Companies who have been design centric, have maintained rather significant stock market advantage for the past decade. (Rae, 2015). The design value index presents how design centric companies have been able to reach over 200 percent return over the S&P 500 index (S&P, 2018; Rae, 2015). This index shows that design centric companies have thus performed very well, compared to other S&P 500 companies. This again gives proof to the fact that DT or design centricity could be one explanatory factor for stellar company performance.

Nowadays DT has advanced from design centric to customer experience. Companies are more often highlighting, that their strategic focus is in delivering better end-user innovation. Managers have recently realized how DT approach empowers them to develop alternative or new solutions to different management problems. Linked to this discussion, in managerial practice is usually the somewhat popular concept of DT (Liedtka, 2015). Rodriguez, Paredes and Yi (2016) emphasize how the future retailing business is going to focus on engaging with customers at a personal level and this trend is based on improving customer experience at different levels. DT is then a main tool of managing innovation, however few research has studied how their inference work. This identified research gap combined with the lack of empirical evidence (Carlgren, Elmquist, and Rauth, 2016; Liedtka, 2015) on DT's influence on innovation or new product development (NPD) and IM is the core focus point of this study. Thus, based on the lack of clarity of the complex nature of DT, the focus of study is presented next.

## **1.2 Focus of the study: research questions**

Several studies aim to define or conceptualize DT and conclude that DT has a remarkable role in for example customer experience development, innovation, project management or large organizations in general (Rodriquez et al., 2016; Meyer, 2015; Mahmoud-Jouini, Midler and Silberzahn 2016; Carlgren, et al., 2016; Garlgren et al., 2014; Liedtka, 2015). These studies provide valuable insights to the different relationships or connections that DT has on the environment it exists. Because DT is most commonly seen very closely linked to IM, among other things, and due to the great impact of successful IM on competitiveness, the focus of this study is in exploring the relationship between DT and IM. Thus, the first research question is aiming to figure out, what kind of impact DT has on IM or how DT

shapes IM. RQ 1 is built under the need for better IM within companies, and DT as suggested, might play crucial part in better IM.

*RQ1: How does design thinking shape innovation management?*

As explained in the previous section, DT is a new approach that has been studied by different scholars but has not yet developed a common ground and understanding of its nature. When approaching DT research, many suggestions have been made by different scholars that DT is a more concrete process with different phases (e.g. Brown, 2008; Liedtka, 2015) and other scholars have spread the concept of DT more towards being a methodology or a philosophy (e.g. Johansson-Sköldberg et al., 2013). Despite the many understandings of DT in academia, companies have a growing need to test and use DT. Some relate DT as a part of other IM tools, such as Lean or Scrum while others relate DT to service design or web design, which are more concrete ways of working. In addition, DT can be related to a customer centered way of thinking that many companies aim to fulfill in their everyday actions. All these examples support the notions that DT has not yet received a standardized position in either academic discussion or in practice. Thus, this study aims to figure out what DT actually is, and how the aforementioned manifold nature of DT is outlined both in academia and practice. RQ2 of this study is aiming to find answers to this question.

*RQ2: What is design thinking?*

Many companies might struggle with the implementation of DT into the company and IM. Depending on what DT actually is, the implementation might differ. If implementing DT requires changes in organizational culture, it might be rather different than when for example changing some single habits of working. When comparing companies with different company cultures, the implementation of new ways of working, thinking or managing, might differ rather widely. Argyris' (1977) theory of double loop learning explains these differences and when exploring these theories of organizational learning, answers to the third research question can be found.

RQ3 of this study aims to figure out how DT can be better implemented in companies. This question aims to find out, in the context of this research data, how companies have

implemented DT into IM. The focus is in organizational learning and organizational change and the aim is to explore this phenomenon through the core theories and practice. In conclusion, the RQ3 of this study is the following:

*RQ3: How is design thinking implemented into companies?*

These three research questions will aim to open up the field of study related to DT and IM and thus the focus is in studying especially these two concepts and their relationship. In addition, this study will aim to provide in-depth qualitative data regarding the use of DT in development or innovation projects within different firms.

The study approach in this thesis is qualitative and the data sample was collected from large or medium sized companies. This also narrows the focus of this study into larger companies. The aim is to find answers to the research questions presented above in the context of larger companies, who operate in international markets that are shaped by different megatrends thus meaning that these companies have a need for providing new products and services for their customers. This is also the part where IM plays the most crucial role.

The study approach in this study is a multi-method qualitative. Qualitative data was collected through in-depth interviews from a total of five case firms. This interview data was used for two different analysis methods. First, a comparative case study was made to see how DT acts in these firms in the organizational level and second, qualitative comparative analysis (QCA) was used to study DT in the project level.

### 1.3 The research framework

The research framework for this study can be seen in figure 1 below.

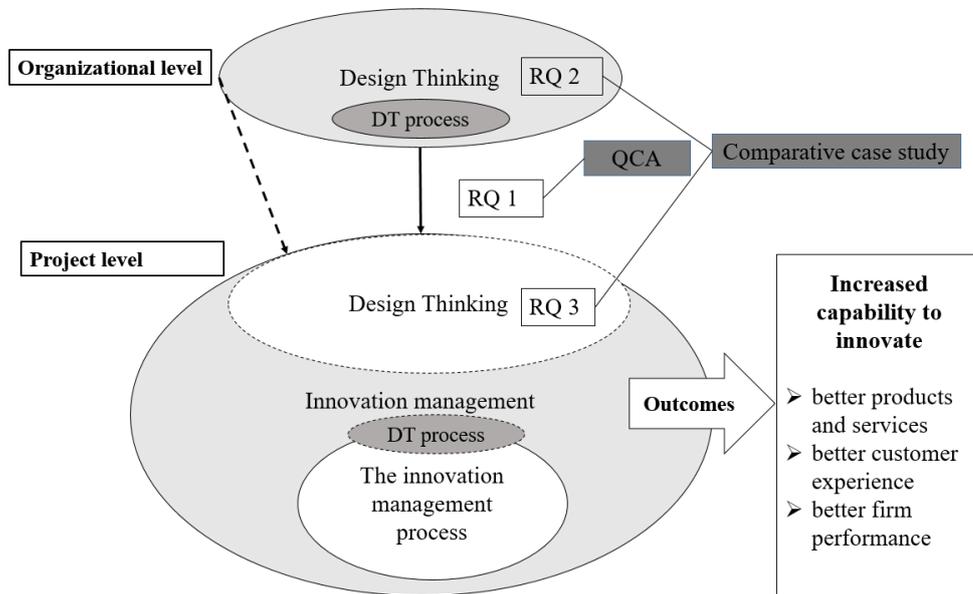


Figure 1. The research framework for the study

Figure 1 explains the research agendas in this study. As can be seen from figure 1, the first research question aims to figure out the connection between DT and IM. Previous studies that will be presented more in-depth in the literature review, suggest that there is a positive connection between these two concepts. It is commonly understood in the managerial discussion that DT helps in the innovation process and thus helps managing innovation. This study focuses on exploring the inferences from one direction instead of assuming that the connection between these two concepts is two-way. The focus is in figuring out what kind of impact DT has on IM.

The second research question is located within design thinking and thus aims to answer what design thinking is. There is no common understanding of DT in literature. In addition, some studies indicate that even though DT is a common buzzword in the managerial practice, there is still very different understanding of the concept itself. Thus, the second research question will aim to combine the different understandings of DT from both academia and practice and create a more coherent understanding of the concept.

The third research question aims to figure out how DT is or can be implemented into IM and into the organization. Even though DT is used widely in today's business, it did not just start to exist in innovation practices but instead companies started to implement it through their IM. Some companies however, have been very DT oriented from the very beginning. In these cases, the implementation has started very early on. The third research question aims to find out how this implementation has happened and how DT can be implemented into companies.

In order to find answers to the research questions, there must be a theoretical understanding of how these questions could be answered. After building this understanding, the subject can be empirically tested or studied. The literature review will present the core theories of innovation and DT related to the context of this study. These theories act as a base for the theoretical framework for this study. The previous studies of DT's relationship with IM indicate that there is a positive impact of DT to IM. This positive impact that DT has on IM comes from the different elements of DT. From this process of combining DT and IM through organizational learning, the outcomes are better capability to innovate and create new innovations which leads to better products and services, better customer experience and better firm performance.

The research framework shows DT in two levels, organizational and project level. This division has been made based on the results of the literature review to better understand how DT is actually associated with IM. The project level research provides better understanding of the concrete embodiments of DT. This way DT's actual nature and its support in innovation projects can be seen more clearly. The focus is on having specific project level knowledge of DT's usage and embodiments and on seeing how it has affected innovation projects. In order to provide clear and general understanding, the organizational level study aims to look at DT in a bigger picture and really create understanding of what DT is and how it has been implemented. This is done by studying DT in the organizational level and in a bigger picture. This way DT and IM can be studied closely together.

Through these two level analysis, a coherent understanding of DT can be created and the research questions can be answered. The hypothesis is, that DT has a positive impact on IM, which again leads to better products and service and customer experience at the product

level, and this transforms the innovation at the organizational level. One of the core ideas in DT is to really understand customer needs and by adding this DT philosophy into IM, these products and services created can really serve customers better and thus increase firm performance.

#### **1.4 Structure of the thesis**

The structure of the thesis is as follows: This study starts by presenting the literature review that is divided into three parts. First part presents the key insights of DT, by looking into the concept, the definitions and the dimensions and ambiguity in the concept. ; The second part of the literature review presents the key insights of innovation management and the various models and approaches to innovation management. It also includes the analysis of the metrics of IM. Third, the literature review presents some of the previous studies made on the topic and thus provides key insights for this study.

The second part presents the research design and methodology which discusses research choices and justifications. This section also includes the data description and data analysis. After presenting the research design and methodological choices for the study, the findings of the research are presented. The third part thus presents the outcomes or results of the study and the QCA research. Fourth, the discussions chapter connects the most important findings to the literature. Finally, theoretical contributions and the managerial implications of this study are presented including the limitations and future directions, which are proposed in order to provide clear understanding of what this thesis showed and what could the future directions be.

## **2 LITERATURE REVIEW**

This literature review follows an integrative analysis (Torraco, 2005; 2016) on the literature of DT and IM. The aim of integrative literature review is to use existing literature to create new knowledge about a certain subject (Torraco, 2005; 2016). First, the literature review starts by analyzing previous literature and defining the concept of DT. Due to the rather wide and ambiguous discourse surrounding DT literature, the concept of DT is explained through an integrative multi-level analysis including different reviews based on the analysis of philosophy and practical models and tools of DT that have been created along the years. The complex nature of DT is also explained by looking at different dimensions of DT and thus clarifying the connection that the concept has on its environment. Additionally, the ambiguity in the concept of DT is presented in more detail. Second, this literature review presents the core theories and concept of IM and looks into the different metrics, approaches and models of IM. The final part of the literature review consists of presenting the previous studies that have explored the connection of DT and IM.

### **2.1 The methods of the analysis of the literature review**

In order to proceed with the integrative literature review (Torraco, 2005; 2016), the methods for conducting the review must be explained. The process of the literature review can be seen in figure 2. Torraco (2005) proposes that an integrative literature review should include clear explanations for how the literature review is conducted. In addition, Torraco (2005) suggests that the integrative literature review starts by organizing the review including the conceptualization of the topic. This is followed by the description regarding how the literature review was conducted (Torraco, 2005). Lastly, the actual writing of the thesis follows these two steps (Torraco, 2005).

First, following this suggested structure to conduct the literature review (Torraco, 2005) the selection of a keyword list based on the main research questions was validated by LUT supervisors. The key words used in this study can be seen in appendix 1. The keywords were chosen due to their relevance to the study and new keywords appeared when some relevant literature was found. Second, the literature review process moved on to searching literature from different databases: Scopus, EBCSO and Google Scholar (Google Scholar, 2018; Scopus, 2018; EBSCO, 2018).

The first keyword search resulted in 20-30 chosen relevant documents. Third, this was followed by the first process of analyzing these references which was based on the analysis of title, abstracts and keywords. Fourth, based on this process, there were finally approximately 80 articles and books and thus snow-balling technique was also used in order to find the best and most relevant literature. Fifth, the process involved reading and analyzing all these documents, classifying and analyzing the material as the integrative literature review analysis process suggests (Torraco, 2005). Sixth, the aim of this literature review is to summarize the existing literature that is relevant for this study and thus point out the various gaps from the literature that this study aims to fulfill.

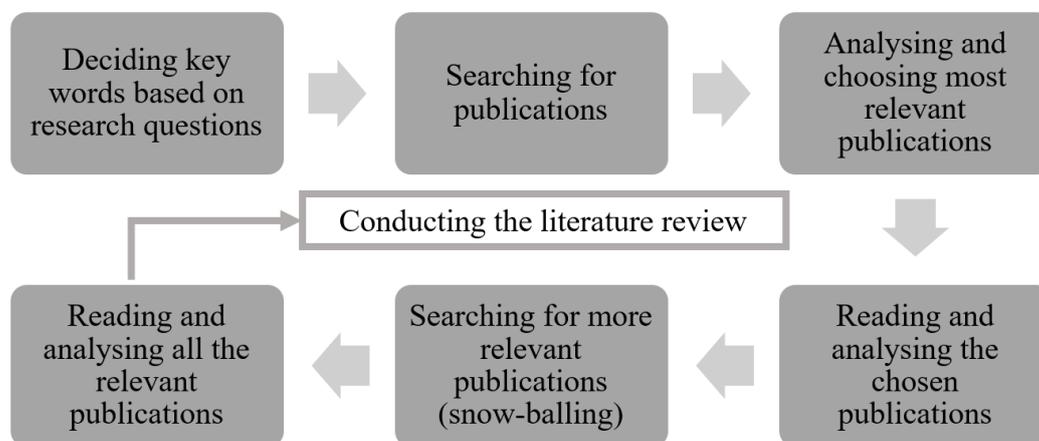


Figure 2. The integrative literature review process of this study

## 2.2 Design thinking: literature analysis and definition

The first finding of the literature analysis is to highlight that DT does not have a universal definition and it has been even argued that it does not need one (Johansson-Sköldberg et al., 2013; Liedtka, 2015; Carlgren et al., 2014; Meyer, 2015). The concept of DT also has different layers due to the ambiguity around the concept and thus defining it may be difficult and depend on how it is perceived. DT can be studied as a tool, a methodology or a philosophy. As the wording of the concept of DT implies, design has something to do with it. Thus, before defining DT, it is important to see how design is defined. As often as there is a need for defining in academia, there is usually some ambiguity involved (Ulrich, 2011). Ulrich (2011) adapts an information processing view of design and defines it as a part of human problem solving activity that begins with a perception of a certain gap in user's experience that leads to a planning of a new artifact, and comes out as a production of that

artifact. This artifact can be either a product or a service or even a new way of behaving. Thus, this is a broad definition including different forms of design, for example graphic design and product design. (Ulrich, 2011) In addition to design being a part of human problem solving, Von Stamm (2004) defines design as the process through which information is transformed into a more tangible outcome. This study relies on a combination of these definitions of design as a problem solving activity where certain gaps are filled by transforming information into a more tangible outcome or solution.

Regardless, DT has been defined in literature many ways. Brown (2008) who is the current CEO of IDEO (2017), one of the most appreciated design firm in the world, defines DT as a creative, human-centered, exploratory, participative and problem solving process that emphasizes different perspectives of a problem, both existing problems and possible future problems. This definition clearly sees DT as a tool for innovation. Similarly, Lockwood (2009) defines it as a human-centered innovation process that puts emphasis on observation, collaboration, visualization of different ideas, fast learning, rapid prototyping of concepts and simultaneous business analysis. In contrast, Owen (2007) states that DT contains a wide range of creative qualities as well as other special qualities of distinct value to decision makers. This definition implies that DT is seen as a value making and special way to contribute to decisions making and thus the emphasis is more in the “thinking” part of the design thinking.

Docherty and MacBryde (2015) have identified DT in management and business practices as the mechanism that in general adds value, generates economic benefits and creates innovation. This view on DT is more linked to seeing DT as a philosophy. Galgren et al. (2014) argue that DT is a user-centered approach to innovation that firms can learn from. Liedtka (2015) examines how the definition of DT has varied and evolved. Design thinking process can be seen as a hypothesis-driven process that is both problem and solution focused (Liedtka, 2015). DT relies on abduction and experimentation involving multiple possible solutions that actively mediate various tensions between limitations and possibilities and is best fitted with decision contexts in which uncertainty and ambiguity are high. Iteration is seen as a central task in DT (Liedtka, 2015).

In the context of the study, DT is defined as a customer/user centric philosophy that highlights the importance of having customer insight, testing and prototyping and continuous learning in the process of innovation. Design thinking is influenced by the way designers view customer needs and thus contributes to decision making when understanding what the customer values. Table 1 combines the different views and definitions of DT presented above and classifies these definitions as either tools or philosophies or both.

Table 1. The evolution of the definition of DT by different authors

<b>The definition of DT</b>	<b>Author</b>	<b>The viewpoint on DT</b>
Value making and special way to contribute to decisions making	Owen (2007)	Philosophy
Creative, human-centered, exploratory, participative and Problem solving process that emphasizes different perspectives of a problem	Brown (2008)	Philosophy
Discipline that uses the designer's sensibility and methods to match people's needs with what is technologically feasible and what a viable business strategy can concert into customer value and market opportunity	Brown (2008)	Tool
Human-centered innovation process that puts emphasis on observation, collaboration, visualization of different ideas, fast learning, rapid prototyping of concepts and simultaneous business analysis	Lockwood (2009)	Tool
User-centered approach to innovation from which firms can learn from	Galgren et al. (2014)	Philosophy
Mechanism that in general adds value, generates economic benefits and creates innovation	Docherty and MacBryde (2015)	Philosophy and tool
Hypothesis-driven process that is both problem and solution focused	Liedtka (2015)	Philosophy

### **2.3 Design thinking as a resource for innovative organizations**

DT has been studied using different approaches by different scholars. Kimbell (2011; 2012) identified DT to have three strands in the literature: DT as a cognitive style, DT as general theory of design and DT as a resource for organizations. This master thesis considers DT mainly as the resource for organizations. Hence these different ways of DT being a resource for organizations in the scope of this study are presented next.

#### *DT and innovation*

Brown (2008; 2009) created the concept of DT as many know it today (Johansson-Sköldberg et al., 2013). Brown's (2008) idea behind DT is that it inspires and creates innovation and thus transforms organizations. According to Brown (2008) DT develops in three stages: 1) inspiration, 2) ideation and 3) implementation and the core idea behind these stages is that the focus is always on the customer or user and his/her experience. When engineers focus on the product and how to build it, designers focus on the customer and what the customer thinks about the product. Here lies the core difference that DT has given to innovation, the customer centered focus from the very start of the innovation process.

Additionally, Galgren et al. (2014) argue that DT is a user-centered approach to innovation that firms can learn from. The learning comes especially from the practice of designers in the managerial context (Carlgren et al., 2014). DT has generated important attention in business as a problem focused methodology that is enhancing and encouraging innovation (Liedtka, 2015). Liedtka (2015) studies how DT can produce success in innovation and thus links the concept of DT closely to innovation. Meyer (2015) expands the idea that DT is a crucial part of today's innovation at firms to stating that DT is used to create interactions between different parts of the organization, such as people and systems by combining strategic objectives and technical business requirements with emotions and conceptual thinking. This leads to connecting DT and organizational development, which is the core in Meyer's (2015) study. Brown (2008) also states that DT develops the organization through innovation. It is also linked to the strategy literature as a way to design business models (Meyer, 2015; Teece, 2010). The core of this idea is that by carefully assessing customer needs, companies can better design their business model (Teece, 2010). Mahmoud-Jouini et al. (2016) link DT to strategy orientation and formulation by emphasizing the meaning of innovative projects.

### *DT and organizational development*

In addition to DT being closely linked to innovation and strategy, Sato, Lucente, Meyer and Mrazek (2010) presented a managerial case study that connected design thinking and organizational development and organizational change. The findings of this study were positive and the results suggest that DT can be a helpful tool in making organizational change happen. DT has many other applications than innovation as Sato et al. (2010) with their study pointed out. Still, Sato's et al. (2010) study argues how DT is closely linked to organizational learning and organizational change and DT itself is a driver for change. This study indicates well the manifold nature of DT. When implementing DT into organizations, organizational development and company cultural changes are the main focus points. Thus DT and organizational development are very closely connected.

### *DT and problem solving*

DT is also commonly seen as problem solving tool or methodology (e.g. Liedtka, 2015; Johansson-Sköldberg et al., 2013; Buchanan, 1992) but some scholars have also stated DT to be in fact a more solution focused methodology. Shearer (2015) points out that design cannot find solutions but instead it can find possible resolutions. Buchanan (1992) wrote about DT being a good methodology when solving so-called wicked problems. Wicked problems are characterized as not having a single solution and thus a lot of creativity is needed to solve these problems (Buchanan, 1992; Pavie and Carthy, 2015). In addition Buchanan (1992) identifies four areas of DT where problems and solutions can be reconsidered. He links these four areas with different forms of design: symbolic and visual communication or graphic design, activities and organizational services or service design, material objects or industrial design and complex systems or environments for different activities or interaction design (Buchanan, 1992).

Beckman and Barry (2007) identified DT as more of a problem formulating process where there is no one solution but instead the solution selection plays a higher role. Beckman and Barry (2007) see the innovation process as problem and solution finding and selecting process where problems can be more abstractive and solutions more concrete. As can be seen from the various opinions from the literature, DT as a concept cannot be clear on whether or not the starting point of DT is in solving problems or finding solutions, but the

key is that DT makes the process easier. In the center of the concept of DT is the fact that even though there are professional designers such as industrial designers and graphic designers from whose way of thinking some parts of DT is borrowing, anyone can implement and use DT in their work (Meyer, 2015; Brown, 2008).

### *DT and quality management*

The concept of DT can be linked to total quality management (TQM) theory (Brown, 2008; Liedtka, 2015). The basic idea behind TQM is that there is an explicit identification and measurement of customer requirements, use of cross-functional teams to identify and solve problems, use of scientific methods to monitor performance and the identifying of points of high leverage for performance improvement, use of process-management heuristic to enhance team effectiveness and creation of supplier partnerships (Hackman and Wageman, 1995). In order to better understand how the characteristics of the concept of DT are formed, it is best to look at what kind of models of DT there are in the literature and how literature defines DT.

It is important to understand, that when studying DT as a concept, one must consider DT as more than just a tool for managing innovation, but as an evolving concept that is seen and studied differently by different scholars. In addition, DT is practiced differently in different contexts, which makes the concept even more complex. As proved above, many scholars have studied DT and have argued that DT has connections with different managerial areas. It is important to understand that while DT is a concept that can tackle many managerial issues, the core of it is always in its customer-centric way of viewing problems. By looking into the different models of DT, the manifold nature of the concept can be better explained.

#### **2.3.1 The models and tools of design thinking**

Different scholars and organizations have introduced several models of DT through which DT can be applied in companies. There has also been many scholars who have listed different DT tools. These models and tools are listed in table 2. In the following, these models and tools will be presented in more detail.

Table 2. The different models and tools of DT

<b>The models of DT</b>	<b>The idea/steps</b>
Brown (2008; 2009) three steps model	Inspiration, ideation and implementation
Stanford Design School model	Emphasize and define, prototype and test and ideate
Double Diamond model	Discover, define, develop and deliver
Gruber et al. (2015) category model	Discovering, defining, ideating, delivering
Pavie and Carthy (2015) model of five steps	Understand, co-create, design, co-evaluate and develop
<b>The tools of DT</b>	<b>List of tools</b>
Liedtka (2015) tools of DT	Visualization, deep user understanding, sense making, surface assumptions, prototyping, co-creation, field experiments
Brown (2008)	Observing the problem, identifying business constraints, involving people multifunctionally, paying attention to different customer needs, facilitating, scouting of potential ideas, using technology, organizing information, sketching, framework building, customer perspective thinking, transparent communication and strategy, spreading and developing innovation
Carlgren et al. (2016)	User focus, problem framing, visualization, experimentation, diversity
Seidel and Fixson (2013)	Need-finding, brainstorming and prototyping

The first model was introduced by Brown (2008; 2009). This is a model with three core phases through which the process of DT is rotating. These steps are inspiration, ideation and implementation (Brown, 2009). In the first stage, the opportunities or problems are identified, then the solutions are created and then these solutions are implemented. When

creating innovations through DT the key idea is to see how people actually see and use things (Brown, 2009). It also explores how people interact as groups or cultures. When using DT, a person moves between four mental states (Brown, 2009). According to Brown (2009) divergent thinking is the first state where alternative generation and more choices are given to the present reality. Convergent thinking is used when these alternatives need to be sorted and decided and lastly analysis and synthesis is used when patterns need to be broke and put in to meaning (Brown, 2009). In order to be able to use these ways of thinking, that professional designers are using daily, organizations must be able to have an attitude of experimentation and take risks (Brown, 2009). Risk taking is always a crucial part of innovation and DT even though being a helpful, new way to innovate, is not taking the risk out of the process of innovation.

Second, Stanford Design School has also created a model and done some cooperation with IDEO in modeling DT (Liedtka, 2015; Brown, 2009). This model is very similar to Brown's (2008) model. In this model the steps are emphasize and define, prototype and test and ideate (Liedtka, 2015). This model is a more practical model and sees DT more as a tool than a theory or methodology. There are several more generalized and practical models of DT that all more or less follow the flow presented in figure 3.

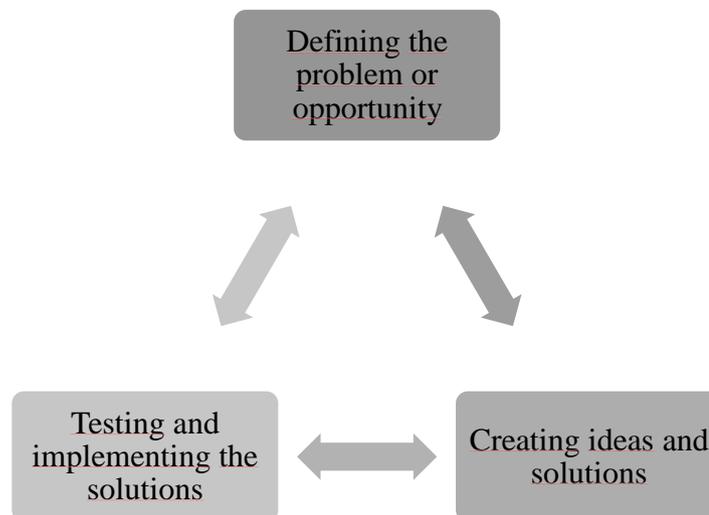


Figure 3. The practical model of design thinking (adapted from Brown, 2009)

In figure 3 the phases or stages of DT are in boxes and the arrows between the stages go both ways. This indicates that the model is not linear and does not have a specific starting or ending point or order that the stages follow. Even though Brown (2008) presented the model

the way that there is an order to follow, he also mentioned that the process is best described as a system of spaces instead of orderly steps. Whether this three stepped model is a DT model or could be seen more as a general problem solving model is debatable. Still, it is often seen in the DT literature, thus meaning that it has a close linkage to DT.

A third commonly known model of DT is called a double diamond model. Even though this model is not academically discussed widely, it is a model that explains well the process of DT. This process has four stages: discover, define, develop and deliver (Design Council, 2018). These stages present how the problem becomes defined and how the solution to this problem is delivered. It demonstrates that in the discover phase, there are several problem areas identified, through which then the actual core problem is identified and defined in the define stage. From here the process moves on to the second diamond, where the potential solutions are all presented and evaluated and after narrowing these down, delivered to the users or customers as solutions to the original problem (Design Council, 2018).

Nessler (2016) develops this double diamond into having two stages. First, doing the right thing covers the first two stages, discover and define, of the original double diamond model. The second stage is then about doing things right, which covers the last two steps of the diamond model, develop and deliver (Nessler, 2016). This model has also been used by Clune and Lockrey (2014). They presented this double diamond model's stages in two: defining and designing. As can be seen, there are many different ways to present this model, but the key point that this model presents, is that it describes the process of DT in two diamonds, that visualize how the problems and the solutions can be narrowed down into new innovations, whatever their nature. This double diamond model is presented in figure 4 below.

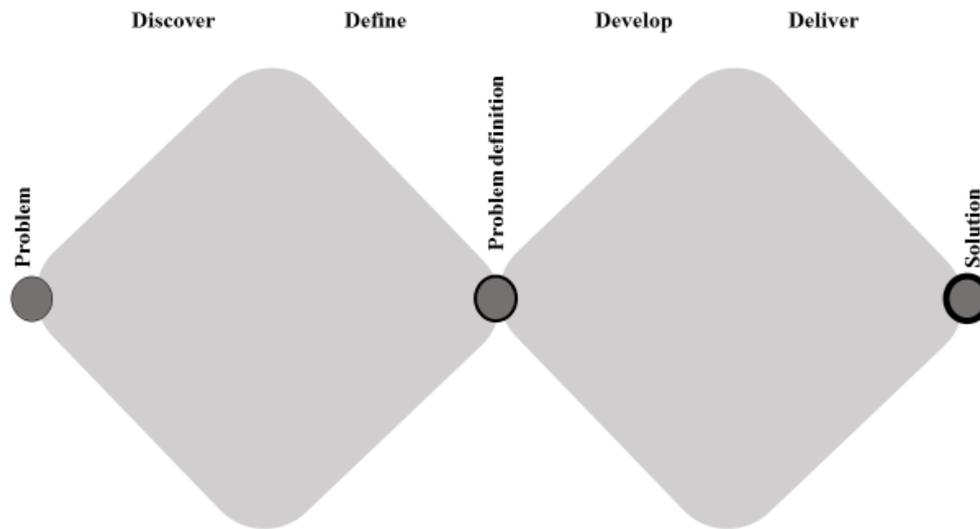


Figure 4. Double diamond model (adapted from Design Council, 2018)

Fourth model of DT presented here is Gruber's et al., (2015) model of DT in which some phases of DT are divided into different categories depending on their connection to real world versus ideal world (concrete versus abstract) and whether the action is happening now or in the future (analyzing versus creating). In this model, the process of DT starts from discovering, which comes from the real world and focuses on finding a current problem by studying and observing the situation (Gruber et al., 2015). The second phase is defining, where the problem is framed through developing different insights (Gruber et al., 2015). From here, this model moves through the ideation or development phase to the delivery phase where the prototypes are tested in all levels, with the customer and iterated at the same time. In the development phase, the focus is more in the future and in the abstract ideas whereas delivery phase is more concrete and future oriented (Gruber et al., 2015).

Lastly, Pavie and Carthy (2015) studied DT as five stages: understand, co-create, design, co-evaluate and develop. These stages then consisted of different elements such as the multidisciplinary group work and workshopping, among other things (Pavie and Carthy, 2015). These five stages presented are very similar to what other scholars have presented and give good proof that DT is having somewhat common ground as a tool or a methodology among many scholars.

In addition to modelling DT process in the more general level, different scholars (e.g. Brown, 2008; Liedtka, 2015; Carlgren et al., 2016) have identified several tools of DT. Brown (2008) describes how these many tools can be placed in the three different phases of the core DT process presented above in figure 2. In the inspiration stage there are tools such as observing the problem or opportunity in real life, seeing what are the business constraints, involving people from different operations, paying attention to different kind of customers, having organized project facilities, scouting of potential ideas that are hidden, using the technology and organizing information (Brown, 2008). In the second stage the tools and actions are in sketching, building creative frameworks, thinking things constantly from the customer perspective, prototyping and testing with the users and keeping the communication transparent (Brown, 2008). Lastly, in the implementation the tools and activities are engineering the innovation, creating the communication strategy and spreading the innovation, developing it and moving on to the next project (Brown, 2008).

Similarly to Brown (2008), Seidel and Fixson (2013) identified three main methods that have been commonly seen as the key methods or tools of DT. These three methods are need-finding, brainstorming and prototyping. These methods do not equal as being the definition of DT but can well indicate the concrete ways of using DT. In addition, Liedtka (2015) has listed seven tools of DT that are not categorized to any specific stage of the different DT models but are instead more general tools that characterize DT. First, visualization helps in perceiving the problem (Liedtka, 2015). Second, deep understanding of users by using qualitative research helps to bring the customer to the center (Liedtka, 2015). As the third tool Liedtka (2015) suggests sense making through collaborative ideation and concept developments which encourage the set of behaviors that create more innovative solutions. Fourth tool by Liedtka, (2015) is used to surface through assumptions that identify assumptions around scalability, execution, value creation and defensibility that support the new idea. Fifth tool is prototyping through which innovation can be made more tangible and verifiable (Liedtka, 2015). Prototyping aims at to enhance the accuracy of feedback conversations by allowing decision-makers to create more effective declarations for the future (Liedtka, 2015).

Co-creation as the sixth tool means that DT is not something that can be done alone but needs not just people from many parts of the organization but also the involvement of the

user or customer in idea generation, development and testing (Liedtka, 2015). Lastly, the seventh tool of DT is field experiments and tests that are done in order to give proof whether or not the solutions create value (Liedtka, 2015). Both Liedtka (2015) and Brown (2008) identify the importance of prototyping and testing as well as taking the user insights into account. The main difference between the tools these scholars have identified is that Liedtka (2015) has classified or categorized the tools. These tools presented give good practical insight to what DT is or how it is used in practice. These tools can be seen as one embodiment of DT.

Carlgren et al. (2016) identify five themes of DT that were identified through a qualitative research of six case companies. The first theme, user focus, refers to the core of DT in terms of empathy building towards users, deep understanding of the needs and wants of the users and user involvement in the development process and idea generation (Carlgren et al., 2016). The second theme is problem framing. This refers to the idea of not just trying to solve the problem but instead challenging and reframing the problem and trying to find the core problem through different techniques such as “painstorming” (Carlgren et al., 2016). This is a form of brainstorming where the focus is in identifying the problems users might experience. The third theme of DT is visualization that same as Liedtka (2015) stated, refers to making ideas tangible through low-budget and fast built sketches that might then become more developed prototypes (Carlgren et al., 2016). The fourth theme of DT according to Carlgren et al. (2016) is experimentation, which refers to the testing and validation of the ideas and prototypes. The core idea behind the experimentation is the iterative way to develop the ideas and continuous learning through the experimentation (Carlgren et al., 2016). The last theme Carlgren et al. (2016) identify is diversity. This refers to gathering a diverse team to the collaboration. Enabling this leads to the integration of many perspectives both inside and possibly outside the company, such as universities and customers.

Before DT was conceptualized, there were already scholars who studied DT under different names as an influencing force to innovation and new product development (NPD). Two of these scholars were Veryzer and De Mozota (2005) who studied user-centered design and its influence on NPD. They identified key characteristics of user-centered design that are very similar to the characteristics or tools of DT listed above. These characteristics are user drivenness, solution focus, multidisciplinary team work, focus on external design,

specialization in user experiment, focus on competition, developing of user validated designs, user view of quality, prime focus on user measurement and focus on both current and future customers. (Veryzer and De Mozota, 2005) The linkages of these characteristics to other scholars are quite clear, for example the connection of having user-focus and multidisciplinary teams is directly linked to Carlgren's et al (2016) diversity and user-focus themes. What stands out from Veryzer's and De Mozota's (2005) listing is the focus on competition and other scholars have not mentioned this as being in the core of DT. Due to different challenges of global competition that is pushing many firms to develop better products and services DT has become more and more important. This is why Veryzer and De Mozota (2005) also list the focus of competition as one of the key focus points in user-centered design.

What can be seen from the different models, themes and tools of DT presented, is that many of the models are overlapping or have the same core idea. In addition, the different tools of DT were rather overlapping, some were more general (e.g. Carlgren et al., 2016) and some were more specific (e.g. Liedtka, 2015) This suggests that there is no commonly understood single way of talking about DT. While Brown (2008) and Liedtka (2015) talk about user centeredness as a tool, Carlgren et al. (2016) talk about user focus as a theme. DT is used rather differently in different organizations and DT methods vary from one organization to another. (Pavie and Carthy, 2015). Due to this overlap, the next part in the literature review will aim to synthesize the dimensions of DT.

### **2.3.2 Main contributions of design thinking to innovation**

In order to better conceptualize DT, it is important to study the commonalities of the main contributions of DT in the literature. These commonalities and contributions that different scholars have on DT can be seen as the different dimensions of DT. Figure 5 indicates the most important commonalities, the relationships, or linkages that DT has in organizations.



Figure 5. The dimensions of design thinking

#### *Customer centricity and market orientation*

First, it seems that one of the driving forces of DT is the customer-centered take on everything. Customer or user is placed into the center from the start and is kept there throughout the process. Whatever DT is trying to accomplish, it relates to customers. As many researchers point out, the key insights always comes from the customer, what they either might want or must have. (e.g. Liedtka, 2015; Carlgren et al., 2016; Brown, 2008).

#### *Problem solving*

If the customer is the starting point of DT, what comes hand in hand with it is solving problems. Many researchers have highlighted that DT is useful when solving problems but the key is not just to solve existing problems but instead find the right problems and then the right solutions (Carlgren et al., 2016; Johansson-Sköldberg et al., 2013). Earlier in this chapter, it was pointed out how DT is more problem focused than solution focused and that the main argument was that by focusing on the problems of the users, either existing ones or more hidden problems, the customer-centeredness is taken into account. Even though problems are more in the center of DT, the solutions are also very important. It can be

reasoned that solutions cannot be excluded from problems and the other way around. In the core of DT, there is also experimentation as Carlgren et al. (2016) listed as one of the themes of DT. In addition, the diamond model (Nessler, 2016; Design Council, 2018) points out how the starting point of DT process, is in problem solving and defining.

### *Experimenting*

Majority of the DT scholars have pointed out in one way or another that in order to truly see what customers think about, new ideas, solutions or innovations these must be tested with real customers and iterated (e.g. Carlgren et al., 2016; Brown, 2008; Liedtka, 2015). Thus, experimentation of all the different suggested solutions is listed as one of the dimensions.

### *Innovation and strategy*

Although the definition of innovation is examined more closely in the following chapters, innovation needs to be included as an important part of DT due to the scope of this study, where the linkage of DT and IM is studied. Many researchers have pointed out how there is a lot of innovation potential in DT and many companies have thus implemented DT to their organizations (e.g. Carlgren et al., 2016; Carlgren et al., 2014; Liedtka, 2015; Furue and Washida, 2017). Strategy can be seen as a keen part of DT and thus as a dimension of it as well. This linkage between DT and strategy has been studied by Meyer (2015) and when stating that DT is an important tool in creating new business models, it is and has to be a strategic choice for companies.

### *Collaboration*

Davis, Docherty, and Dowling (2016) argue DT to be about iterative, human-centered and co-creative way to support innovation. Co-creation and collaborative teams have been mentioned by other researchers as well (Liedtka, 2015, Johansson-Sköldberg et al., 2013; Carlgren et al., 2016; Gruber et al, 2015). Collaboration as a key part of DT is arguably one of the strengths of the whole philosophy and this collaboration includes both the internal and external stakeholders. This is important because finding and developing solutions to customers' problems or needs requires the best knowledge and all the important information from for example the companies' existing processes or products.

Gruber et al. (2015) list in total 14 different characteristics or ways of working for DT. DT is in relation to conditioned inventiveness, human centered focus, environment-centered concern, ability to visualize, tempered optimism, bias for adaptivity, predisposition toward multifunctionality, systemic vision, view of the generalists, ability to use language as a tool, affinity for teamwork, facility for avoiding the necessity of choice, self-governing practicality and ability to work systematically with qualitative information (Gruber et al., 2015). These different characteristics can be linked to the dimensions presented above. For example multifunctionality and affinity to teamwork are linked to cooperation of multifunctional teams and conditioned inventiveness and ability to visualize are closely linked to innovation. In addition systemic vision and view of the generalists are linked to market orientation.

Figure 4 demonstrates these dimensions of DT presented and explained above. These dimensions have been chosen to be the most important ones to characterize the concept of DT for two reasons. First, majority of the literature reviewed on DT highlights these dimensions and describes DT through these dimensions. These dimensions can be seen as some sort of characteristics of DT the same way that one can characterize a person to be tall or short. Strategy, as a dimension of DT is somewhat more unclear than the other dimensions due to it not being mentioned clearly in the literature regarding DT. The context of this study itself indicates that successful innovation management is seen as a key to companies' success and thus it has to be considered to be a strategic choice for companies to implement DT into IM. The second reason for why these dimensions of DT were chosen is that these dimensions can be clearly seen in practice in companies which have implemented DT into their organization. For example Apple and Amazon have both made the strategic decision to experiment, innovate, be market oriented and problem solving and collaborate through multifunctional teams. Does it then mean that these two companies have implemented DT? If looking at these characteristics of DT and these companies' ways of operating, then the answer is yes. Whether or not these companies state that they have implemented DT is another question and cannot be clearly stated due to differences in the way academia and practice understand the concept of DT. These dimensions of DT indicate that DT has a touch point with all these dimensions. It does not yet take into consideration the process or structure, in which these dimensions are linked to DT. Even though these different dimensions of DT indicate that, it has many different connections within organizations, DT

has not achieved a common level of understanding among scholars or in practice. These different viewpoints or paradoxes of DT will be discussed next.

### **2.3.3 Paradoxes regarding design thinking**

The study of Johansson-Sköldberg et al. (2013) related to DT pointed out that, there has not been a sustained development of DT as a concept even though there is academic and practical literature around the concept. Carlgren et al. (2016) stated that the concept of DT is rather difficult to study due to its lack of unity in the field of academia and practice. Moreover, Meyer (2015) points out that there are differences in the way academia and practice understand the concept. The basic starting point of DT was to introduce a new idea of thinking for more innovative thinking, that practitioners could use (Meyer, 2015). The business practice discussion related to DT has implied that the concept if DT exists only in the actions of people or organizations and as a result classifying it is rather difficult both in practice and academia. This is one of the reasons why Carlgren et al. (2016) created a framework for DT and identified five themes that characterize the concept: user focus, problem framing, visualization, experimentation and diversity. Carlgren et al. (2016) also divide the ambiguity around DT into three different categories that are discipline, approach and way of thinking. DT as a discipline can be in other words described as a field of study. This would support the idea that DT is more than a tool for innovation process. DT is a way of thinking which means that through DT, changes can be made to something that was previously thought otherwise. DT as an approach is more concrete and can be linked to the different models (e.g. Brown, 2008) presented earlier.

Design thinking has roots in literature in the late 1960's and after Brown's (2008) article, DT has been studied rather widely (Johansson-Sköldberg et al., 2013). Johansson-Sköldberg et al. (2013) have recognized that DT literature has two discourses, designerly thinking and design thinking. The first discourse refers to academic and theoretical reflections on how professional designers act and thus links the theory and practice from the design perspective. The latter discourse is a more simplified version of designerly thinking, in which the design competence and practice are used beyond the context of design and thus it is closer to a way of describing designer's methods that are combined with both academic and practical discourses (Johansson-Sköldberg et al., 2013). This division of the two discourses can also be linked to Carlgren et al's (2016) framework, in which DT is studied as both the idea that

is linked to designerly thinking and the enactment of the idea linked more to design thinking. Many other researchers have also recognized this twofold ambiguity around the concept (Liedtka, 2015).

A rather recent approach to DT is Furue’s and Washida’s (2017) approach that criticizes DT as being too focused on current problems and not being able to consider possible future problems. This might in some cases lead to DT not being able to produce breakthrough innovations for example. This results from DT’s focus on what customers need and want and not too strongly, on what customers might need and want. Table 3 below lists the different views on DT and thus shows and concludes the ambiguity that surrounds the concept.

Table 3. Indicators for the paradoxes around the concept of design thinking

Design thinking as a tool	Vs.	Design thinking as a philosophy		
Design thinking focusing best on the current needs	Vs.	Design thinking focusing on current and future needs		
Design thinking as an idea	Vs.	Design thinking is an enactment of the idea		
Design thinking as a field of study	Vs.	Design thinking as an approach	Vs.	Design thinking as a way of thinking
Design thinking (practical)	Vs.	Designerly thinking (academic)		

As can be seen from the table 3 there is a lot of different ways to perceive or classify DT. One can argue that DT is not actually a concept at all due to the amount of ambiguousness surrounding it. Others might argue that DT cannot be studied in an academic context due to the lack of coherence; although still many studies (e.g. Liedtka, 2015; Johansson-Sköldberg et al, 2013) state that there is no need for a clarity. Instead, it is important to understand the complexity of the concept when studying it. This is also taken into account in the context of this study and the literature review above regarding DT clarifies the ambiguity and thus provides a more coherent whole from a rather complex subject. Hence, in this research DT is mainly seen as a philosophy that guides organizations to innovate in a more customer-centered way and to use different tools and methodologies while doing so. Thus, it cannot

be stated that this study only views DT as a philosophy, but also considers the more process like nature including the different tools and methodologies of DT.

#### **2.4 The field of innovation management**

The second part of the literature review studies IM. IM is a rather wide field of study and has gained a lot of attention during recent years due to companies' growing need to change and stay in the competition. Innovation is seen as the main source of competitive advantage by many bigger companies (Von Stamm, 2004) especially when the smaller and younger companies are constantly beating the bigger ones when it comes to the ability to innovate. If firms want to truly succeed in innovating, they need good IM. IM as a concept can be understood in many ways but researchers have surprisingly unified understanding of which components the concept consists of.

Adams, Bessant and Phelps (2006) studied how innovation management can be measured. They created a framework for IM process that consists of seven categories: inputs management, knowledge management, innovation strategy, organization and culture, portfolio management, project management and commercialization. These seven categories can be seen as a balanced scorecard for measuring innovation (Adams et al., 2006). Inputs management focuses on the resourcing of innovation activities and includes factors such as financing and arranging human and physical resources so the innovation generation is possible (Adams et al., 2006). Knowledge management is related to the management of implicit and explicit knowledge (Adams et al., 2006). According to Adams et al. (2006) it is concerned with obtaining and communicating information and ideas that underlie competencies of innovation. Furthermore, Adams et al. (2006) identify three areas of knowledge management that are important for innovation, idea generation, knowledge repository and information flows. Innovation strategy consists of different decisions that allocate the firm resources so the organizational objectives are fulfilled (Adams et al., 2006). Certain characteristics of organizational culture and structure that both allow the freedom for the exploration of creative possibilities and at the same time have certain control to manage innovation in an effective and efficient fashion, are needed to have successful IM. Portfolio managements' importance in innovation is highlighted in the rapidity at which resources are consumed and in the process of innovation and the need for these to be managed (Adams et al., 2006). Project management is linked to how the processes that turn

innovation into marketable innovation is controlled (Adams et al., 2006). Lastly, Adams et al. (2006) highlight commercialization which is linked to making the innovative process or product a commercial success and this includes issues such as marketing and distribution.

Dobni (2008) studied the DNA of innovation and stated that pursuing innovation is often rather difficult for managers due to the lack of DNA of innovation. Innovation DNA sequence consists of knowledge management, cluster management, value management and alignment and the outcome of these four factors is the strategic architecture to support innovation, innovation mapping of strategic initiatives and value creation (Dobni, 2008). These outcomes then again have an impact on competitive innovation that creates sustainable competitive advantage (Dobni, 2008). Similar to the categorization of Adams et al., Dobni (2008) highlights knowledge management as one key part of innovation management. Moreover, value management can be linked to portfolio management because both are highlighting the risk propensity. Alignment covers the ability of employees to adjustment capabilities and together with cluster management can be linked to input management and the organization and culture categories by Adams et al. (2006). As can be seen from both Dobni's (2008) and Adams et al.'s. (2006) studies, IM has many measurement parts, consists of many sequences, and can thus be seen as a manifold concept.

Von Stamm (2004) identified that many firms have challenges to improve their innovation performance due to cost-cutting and efficiency being in the center of the company culture. In these companies, managers are recruited and trained based on their efficiency and effectiveness instead of their ability to take calculated risks and experimentation (Von Stamm, 2004). According to Von Stamm (2004) these characteristics or capabilities are important when improving organizations' innovation performance and the next step from having these capabilities is to bring the people on board who have the skills. Designers are argued to be the kind of people who can take this role (Von Stamm, 2004). This argument gives proof that DT has linkages to IM.

Coccia (2017) stated that innovation is driven by several related determinants and different scholars of technology and economics have identified three underlining approaches to technological change. Induced innovations is an approach that shows the importance of demand-pull as a critical factor in supporting innovation and evolutionary theory of technical

change is an approach where production function is critical. Third approach is the path-dependent development of innovations which considers a set of micro-level historical events for the evolution of innovations such as the current technology that influences the future characteristics. (Coccia, 2017) These different approaches for the technological change describe well the manifold nature of IM where in the center is the demand and technology related factors.

IM as a concept is identified in both academia and practice and as can be seen from the ideas of different scholars presented above, it is closely linked to knowledge, technology and risk taking. In order to better figure out the concept of IM as a whole, it is best to look how IM is defined by different scholars and how different scholars have approached IM.

#### **2.4.1 Defining innovation management**

As discussed above, IM can be divided into different categories (Adams et al., 2006) and seen through different determinants (Coccia, 2017). While this is the case, innovation and IM can and should still be defined in order to better understand the environment these exists in and the scope of the existence. It is best to start from the definition of innovation first, and then clarify the definition for IM.

Innovation has been defined in multiple ways and is notoriously ambiguous, and thus lacking a single definition or measurement (Adams et al., 2006). Despite the many different understandings of innovation, many attempts have been made in defining the concept of innovation starting from the late 1880's (Pavie and Carthy, 2015). Schumpeter's (1934) stated that the main objective for innovation is to face competition and create monopoly to address specific needs through creative destruction. This definition of innovation generated wide discussion among the innovation scholars. Among many other descriptive qualities of innovation, Pavie and Carthy (2015) highlight uncertainty as a key feature of innovation. Von Stamm (2004) identifies that innovation is commonly defined as the commercially successful exploitation of ideas. Still in the fast-changing world this definition is not enough but instead innovation can be and should be in all aspects of organizations (Von Stamm, 2004). This means that innovation is the skill of making new connections and continuously challenging the current situation or status without truly changing things just because change seems to be needed (Von Stamm, 2004). Von Stamm (2004) argues that innovation is

actually more about a certain frame of mind than a tangible product as the common definition states.

Damanpour (1991) has defined innovation as the adoption of an internally generated or purchased service, product, system, policy, process, program or device that is new to the organization. Later, Damanpour (1996) defines innovation in the organizational level as the adoption of an idea or behavior which is new to the adopting organization. This adoption of innovation is seen as a process that includes phases such as generation, development and implementation of these new ideas (Damanpour, 1996). Closely linked to innovation is also the factor of change that stems from internal and external factors (Damanpour, 1996). Innovation can be also divided into different dimensions, such as the following: administrative and technical, product and process, radical and incremental and initiation and implementation (Damanpour, 1996).

Furthermore, Coccia (2017) studies these different forms of innovation that Damanpour (1996) also identified and identifies problem-driven innovation as the process of relevant and consequential needs or problems of consumers generating problem solving in firms. This problem driven innovation can start from the technological change or radical innovation and evolve as incremental innovations as long as there is another technological paradigm change or radical innovation. (Coccia, 2017) Radical innovation is thus related to a creation of something that needs a paradigm change in technology and radically changes the environment it exists in. In comparison to radical innovation, incremental innovation is the kind of innovation that shapes its environment slowly and builds upon the existing features or technology.

Prajogo and Ahmed (2006) identify two main streams in the innovation management literature: technological stream and human stream. The technological stream is the stream that focuses on emphasizing the importance of technology and research and development and while the human stream focuses on the organizational structure and culture (Prajogo and Ahmed, 2006). Due to these different streams in the literature, IM does not have a clearly and commonly understood definition in the literature but instead it depends on the context and the approach. As presented earlier in this chapter, IM is associated with different kind of tasks or management objects within organizations. Innovation management can be

presumed rather differently depending on companies businesses and strategies (Damanpour, 1991). Still, successful innovation is about creating value (Von Stamm, 2004) and thus successful IM is about enabling this value creation. The different perspectives on defining innovation and IM presented above are transformed into the context of this study.

*Innovation: successful exploitation of ideas that bring value to the users and require skills in making new connections and challenging continuously the existing status.*

When innovation is the exploitation of ideas that bring value to users, IM is the process of enabling this exploitation. Thus, the definition of IM in the context of this study is the following:

*Innovation management: Enabling the exploitation of new ideas and the value creation process that can be called innovation.*

While some might argue that innovation in its best has to be a process that can flow free without limits and thus does not have to be managed, it can be pointed out that in many companies, there has to be a controlled process of innovation due to the culture and the structure of these companies. In the case of startups, innovation process might flow free but in the more organized larger companies, innovation process has to be managed. If nothing else, innovation does not create itself but it needs people and technology and these need to be managed. This idea about innovation being dependent on people and technology, will be clarified next by explaining the different approaches that have been identified in the innovation management literature.

#### **2.4.2 Innovation management: literature review and analysis**

In order to better understand the concept of IM, the different models or frameworks that have been created around it are examined. There can be three different streams of literature identified within IM. While Prajogo and Ahmed (2006) identified the technological and human stream, the combination of these two streams can be identified as the third stream of innovation management literature. These different streams or approaches and the frameworks created around these streams are listed in table 4. Next, these different streams

of IM and the different frameworks or models that have been built in these streams are discussed more in-depth.

Table 4. The different frameworks or models for innovation management

<b>The model/framework</b>	<b>The stream: human, technological, combined</b>	<b>The author(s)</b>
The framework for organizational learning, market orientation and innovation	Human	Hurley and Hult (1998)
The framework for organizational learning and double loop learning	Human	Slater and Narver (1995); Argyris (1977)
The categories of innovation management	Combined	Adams et al. (2006)
Transformational leadership and the top management leadership	Human	Jung et al. (2003) and Elenkov and Manev (2005)
The theory of open innovation	Technological	Enkel, Gassmann and Chesbrough (2003), Chesbrough (2012) and Gassmann and Enkel (2004)
Managing different streams of innovation through technological cycles	Technological	Tushman (1997)
Gartner's hype cycle	Technological	Linden and Fenn (2003)
The integrated model of innovation management	Combined	Prajogo and Ahmed (2006)
The cyclic innovation management model	Combined	Berkhout et al. (2010)

*Human stream of innovation*

Hurley and Hult (1998) studied innovation in the context of market orientation and organizational learning. They presented a framework for organization and market driven innovation where they identified that some structural and process characteristics together with some cultural characteristics that are linked to innovativeness lead to the capacity to innovate (Hurley and Hult, 1998). This capacity to innovate again leads to better competitive advantage and performance, which leads to getting feedback and reinforcing the cultural characteristics (Hurley and Hult, 1998). According to Hurley and Hult (1998) the characteristics for structure and process are age, differentiations, formalization, loose coupling, hierarchy, market intelligence and planning. Furthermore, the cultural characteristics are market focus, learning and development, status differentials, participative decision making, support and collaboration, power sharing, communication and tolerance for conflict and risk (Hurley and Hult, 1998). As Von Stamm (2004) also identified, risk taking is a part of firm's innovativeness. This framework for innovation management highlights the importance of learning and market orientation as the key for the capability to innovate.

Slater and Narver (1995) have also studied learning organizations and they separated the process of organizational learning into generative learning and adaptive learning. Argyris (1977) states that this adaptive learning or single loop learning is occurring within a set of recognized and unrecognized constraints that reflect the organization's assumptions about itself and its environment. Generative learning is what Argyris (1977) called the double loop learning. This kind of learning occurs when the organization is willing to question the announced long-term assumptions related to its mission, capabilities, customers or strategy (Slater and Narver, 1995). This means that organization must look at the change and understand the systems and relationships that combine the key events and issues (Slater and Narver, 1995). According to Slater and Narver (1995) in the process of organizational learning, there are three ongoing processes: information acquisition, information dissemination and shared interpretation and these combined are the organizational memory. These processes create the basis for the learning and depending on whether or not to cross the learning boundary, the learning itself is either adaptive or generative.

Slater and Narver (1995) also present a framework for the learning organization where culture and climate influence organizational learning that again leads to customer

satisfaction and new product success, which leads to profitability and sales growth. In this model, culture consists of entrepreneurship and market orientation and climate consists of organic structure, facilitative leadership and decentralized strategic planning. Figure 6 combines the frameworks from Slater and Narver (1995) and Hurley and Hult (1998) and demonstrates how organizational learning and market orientation influence innovation.

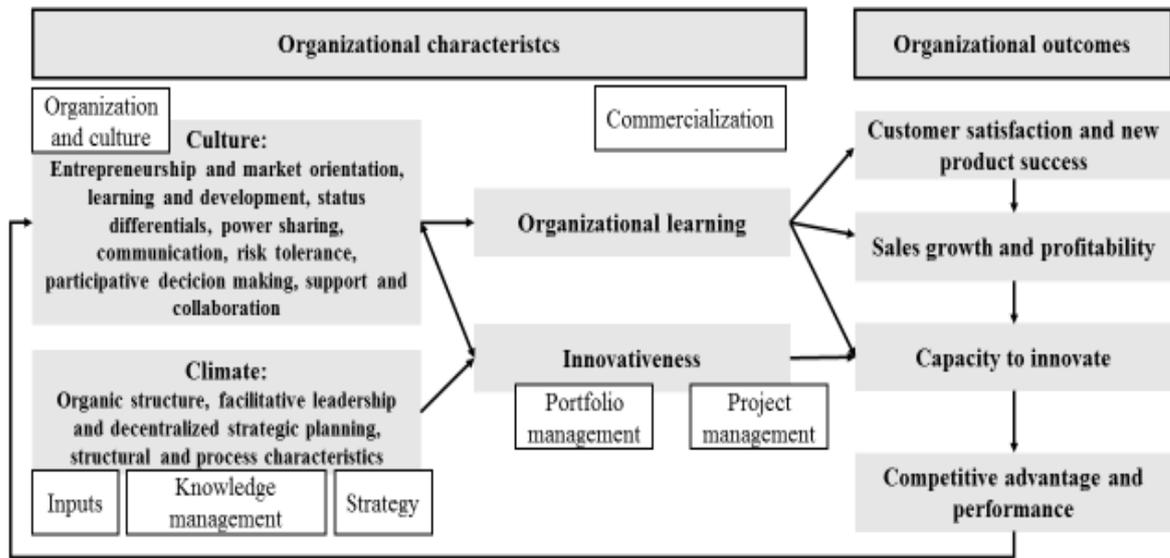


Figure 6. The framework combining organizational learning, market orientation and innovation (adapted from Slater and Narver, 1995; Hurley and Hult, 1998; Adams et al., 2006)

As can be seen from figure 6 there are many things that affect learning in the organization, these can be roughly divided into cultural things and climate related things. Culture and climate which lead to learning and innovativeness all together belong to organizational characteristics. The outcomes from learning and innovativeness at the end lead to competitive advantage and better company performance. The key here is to figure out which parts in this figure relate to IM. As Adams et al. (2006) presented, innovation management measurement can be divided roughly into seven categories. These seven categories, in figure 6 presented as white boxes, can be linked to the framework presented above into different parts depending on what kind of action of IM is in question. Figure 6 concludes well, how IM can be closely linked to organizational learning and thus the actions of IM can be also linked to the organizational learning process.

Jung, Chow and Wu (2003) identified that top managers' leadership style is one of the most important factors affecting organizations capability to innovate. They propose that top managers' leadership style affects both directly and indirectly through empowerment and organizational climate to organizations capability to innovate (Jung et al. 2003). This type of leadership that the top management must practice is called transformational leadership (Jung et al. 2003). In addition, Elenkov and Manev (2005) study proved that top management leadership has a positive and significant impact on innovation. Transformational leadership has the most important impact on innovation and different sociocultural factors have a direct impact on how this transformational leadership factor is included in the top management leadership. Jung et al. (2003) and Elenkov and Manev (2005) findings give support to the framework presented above in figure 5. These different organizational characteristics can be very context dependent, meaning that there is no one right answer to which type of organizational structure is the best one in order to be innovative. For example, Damanpour (1991) suggests that the type of organization should be a primary contingency variable, meaning that by distinguishing these different types of organizations is important in order to see the differences in their innovation capabilities.

#### *Technological stream of innovation management*

When thinking about the technological stream of IM, the theory of open innovation plays a crucial role. Open innovation can be seen as a form of innovation in comparison with radical and incremental innovation presented earlier. It can also be seen as a way to manage innovation (e.g. Enkel, Gassmann and Chesbrough, 2009; Chesbrough, 2012; Gassmann and Enkel, 2004). Open innovation can have multiple meanings from where one clear definition is the use of purposive inflows and outflows of knowledge to accelerate internal innovation and expand markets for external use of innovation (Chesbrough, 2012). Enkel et al. (2009) explored the phenomenon of open innovation and open research and development (R&D) process. Enkel et al. (2009) and Gassman and Enkel (2004) studies indicates that there is three different processes of open innovation: outside-in process, inside-out process and coupled process that refers to co-creation with complementary partners. The outside-in process is enriching the company's own knowledge base by integrating different stakeholders' knowledge sources into their own sources (Enkel et al, 2009; Gassmann and Enkel, 2004). The inside-out process refers to earning profits by bringing ideas to market, multiplying technology by transferring ideas to the outside environment and selling

intellectual property (Enkel et al, 2009; Gassmann and Enkel, 2004). Enkel et al. (2009) state that in the business reality, the key is the simultaneous usage of open and closed innovation depending on what you are innovating.

Chesbrough (2012) explains closed innovation system as a funnel that starts with many explorations of ideas within a company that when developed get more specific and come out from the funnel as new products or services ready to be launched at existing markets. In the open innovation model by Chesbrough (2012) there is both internal and external technology base that explores new ideas in the research phase, then in the funnel these ideas are developed and added through technology insourcing and taken out as outlicensing that is considering other firm's markets and technology spin-offs that create or serve new markets. Also from the end of the funnel, the new products that serve the current markets will emerge. Figure 7 explains and combines these open and closed innovation processes in one picture.

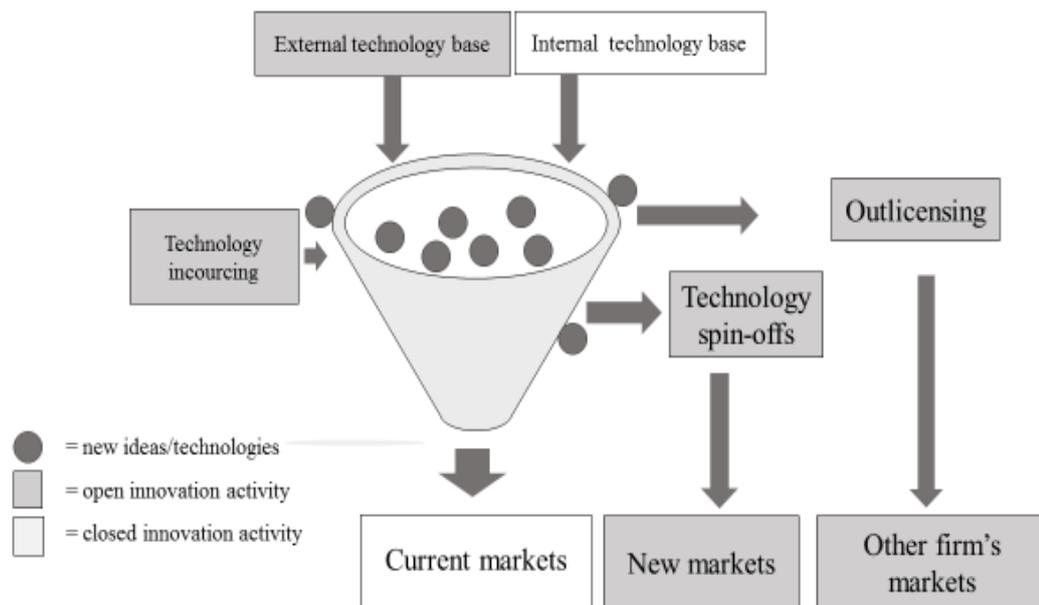


Figure 7. Comparing and combining open and closed innovation (adapted from Chesbrough, 2012)

Tushman (1997) wrote about winning through innovation and studied how firms compete successfully by managing different innovation streams. These streams are processes for incremental, architectural and radical innovations. Managing these streams requires manager's capability to encourage continuous improvement in current offering while allowing the flexibility to create and experiment more radical ideas. This kind of IM requires

also the capability to identify different technology cycles. This cycle begins by identifying a new possibility, a radical innovation. When this possibility is identified a dominant design is created and there will be new variations of the technology. This development leads to incremental changes and architectural innovations. There is two streams controlling this cycle that Tushman (1997) identifies as product innovations and process innovations. Process innovations focus on how to better produce and deliver the product and product innovation considers the actual changes in the existing product. This cycle starts again when other radical technologies appear. Tushman (1997) states that once in a while innovation managers must make a bet and trust and analyze these cycles. This is critical for IM to succeed and stay in the competition or create the competition. These technological cycles can be managed through transformational leadership. There are some companies, which have done research on these technological transformations happening in different markets.

Gartner's hype cycle is one very popular way to present how these different technologies or other inventions shape the markets. Linden and Fenn (2003, p.5) introduced how to understand these hype cycles and react to markets at the right time. For example Fenn and LeHong (2011, p. 9) introduce a hype curve for emerging technologies, from where one can see that different technologies such as internet TV will be in the mainstream adoption 5 to 10 years. This means that in the year 2018, internet TV is already accepted widely among consumers.

#### *Combined stream of innovation management*

Similar to the framework presented above in figure 6, Prajogo and Ahmed (2006) present an integrated model of innovation management that combines the two streams of innovation management, human and technical. The starting point of this framework is the innovation stimulus that comes from leadership, people management, knowledge management and capability management which are all factors of the human stream of IM. These factors lead to innovation performance which include both product and process innovation. Innovation capacity acts as a mediating factor in this framework and includes the technological management and R&D management, which belong to the technological stream of IM.

Berkhout, Hartmann and Trott (2010) presented a model of cyclic innovation management. The key idea behind this model is that innovation is not linear but is instead a more cyclic

process of creating technical functions, technical capabilities, social insight and customer value (Berkhout et al., 2010). This is done through scientific explorations, technological research, product creation and market transitions (Berkhout et al., 2010). In the middle of all these different changes or researches is entrepreneurship and all these changes in science, technology, markets or industry are interconnected through different cycles (Berkhout et al., 2010). According to Berkhout et al. (2010) this model characterizes a modern day open work environment that exceeds institutional boundaries. Berkhout et al. (2010) state that this is the ideal model of innovation and demonstrates what really happens in innovative environments. Figure 8 demonstrates the model of cyclic innovation management. As can be seen from figure 7 the cyclic model considers the role of entrepreneur whether an individual or a team, a key focus point and the innovation process is dependent on actions of the entrepreneur. This model also takes into account the complex interactions that happen between new technologies and new societal needs.

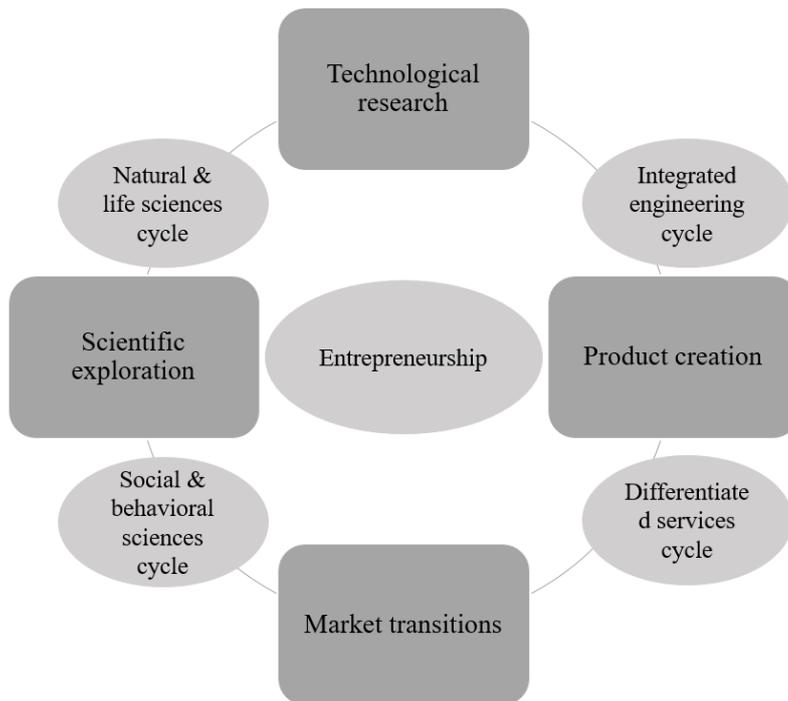


Figure 8. The cyclic innovation model (adapted from Berkhout et al., 2010)

As can be clearly seen, IM has two main streams in the literature and in addition, there is the third stream that aims to combine these two streams. These different models of IM presented above demonstrate that innovation process can be explained and understood differently depending on the approach that has been chosen. It is clear that IM as a concept is well

identified in the literature and these different frameworks explain the innovation management process, but these theories do not explain how to measure whether the process is successful or not. In general, it seems to be difficult to measure IM due to the different approaches that scholars have on it. For this, IM needs measurement criteria. Thus, different metrics for IM are presented next.

### **2.4.3 The measurement of innovation management**

Figuring out how IM can be measured, can help in understanding the concept itself. In the context of this study, it is crucial to understand what is good IM and what are the factors that indicate that IM is done correctly or successfully. Thus identifying the suitable measurement criteria for IM is important. Selecting the right measurement criteria for IM is one of the most important issues influencing the usefulness of measures in practice (Henttonen, Ojanen and Puumalainen, 2016). Success is usually multifaceted and difficult to measure especially when firms can assess the success or the failure of a development project in many ways (Griffin and Page, 1996). Many newer aspects of innovation management are often lacking performance measurement and especially the literature surrounding project level performance measurement is rather scarce (Henttonen et al., 2016). Measuring the R&D project performance has been debated in the innovation and R&D literature extensively and its importance has been recognized among different development managers as well (Chiesa, Frattini, Lazzarotti and Manzini, 2009).

Success in development or innovation projects can be measured in terms of customer satisfaction, financial return and technical advantage and also in different levels, not just a product level but in program level too (Griffin and Page, 1996). IM can be measured in different functions as well. Innovation management measurement can be divided into knowledge management, portfolio management, organization and culture, project management, commercialization, inputs and strategy, as already presented above (Adams et al. 2006). Furthermore, some measures, such as customer satisfaction and the level of innovativeness, are seen to be important in every innovation and development project (Henttonen et al., 2016). There is a rather clear understanding among innovation management measurement scholars that there is no one universal right way to measure innovation management performance but instead it is very dependent on what is the nature of the development project (Henttonen et al., 2016; Griffin and Page, 1996; Chiesa et al.,

2009). Although some measurement criteria, such as the ones already mentioned, can seem universal, these metrics are highly affected by the type of the project (Henttonen et al., 2016). Innovation performance measurement can be divided into five measurement scales which are futures' focus, market impact, capabilities and image, process and sustainability and overall effectiveness (Birchall, Chanaron, Tovstiga and Hillenbrand, 2011). In these scales, there is then the most suitable measures for each scale. This division gives a clear image of the innovation measurement criteria's manifold nature and helps in understanding this subject as a whole.

Henttonen et al. (2016) study suggests that in the case of product innovation, process innovation and organization or market innovation projects the most important metrics for performance are customer satisfaction, time to market and multifunctional cooperation. Thus, internal stakeholders and customers have the greatest impact on success in these types of projects. Furthermore, research project success should be measured in its level of innovativeness and risk-taking factors. In addition, some more quantifiable measures, such as the number of patents, are seen important. Interestingly, there seems to be a relatively low significance within financial metrics' importance for innovation projects in general. (Henttonen et al., 2016) There is a wide range of different metrics of R&D and innovation projects, thus the real issue is in the validity and reliability of these metrics (Birchall et al., 2011). There is also a lack of good models of innovation to what innovation measures can be set (Birchall et al., 2011). This lack of good or proper innovation models stems from the lack of coherence in the innovation literature, starting with the definition of innovation (Birchall et al., 2011) which was already pointed out above.

Griffin and Page (1996) highlight an important factor in relation to IM which is the measurement level of IM within the company. Some measurement criteria is better for measuring one product development project and some criteria is better at measuring organizational level IM (Griffin and Page, 1996). What is important to understand when looking into different IM measurements, is the context of innovation and this might not be clear from the very start of the innovation project. Thus, it might be impossible to decide on the best measurement criteria in advance but instead it must be decided on while the innovation project develops. Chiesa et al. (2009) divide innovation management metrics according to what perspective the metrics take on innovation. These perspectives are

financial, customer, innovation and learning and business process perspectives (Chiesa et al., 2009). In table 5, these perspectives can be seen in relation to the most used innovation metrics according to Henttonen et al. (2016). Table 5 combines the most common different innovation measurement metrics adapted from Henttonen et al. (2016) and highlights the most important metrics that different scholars (e.g. Birchall et al., 2011; Chiesa et al., 2009) have pointed out to be important and useful metrics for IM, depending on the context.

Table 5. Different innovation management metrics (adapted from Henttonen et al., 2016)

<b>Innovation management metrics (* the most important metrics according to the different scholars)</b>	<b>The type of innovation it can be best used (product, process, marketing/organization)</b>	<b>The type of perspective it takes on innovation (business process, customer, innovation and learning, financial)</b>
*Effort and commitment to established objectives	Product	Business process
Cost development of projects	Marketing/organizational	Business process
*Time to market	Product innovation	Customer
*Level of innovativeness	Product	Innovation and learning
*Multifunctional cooperation	Process	Innovation and learning
*Risk taking	Product	Innovation and learning
*Orientation for change	Marketing/organizational	Business process
Press/media coverage	Marketing/organizational	Customer
*Number of patents/inventions/ Number of publications	Product/process	Innovation and learning
Market share goals	Product	
Revenue goals/revenue growth goals	Product/process	Financial

*Customer satisfaction	Marketing/organizational or product	Customer
*Customer acceptance	Marketing/organizational	Customer
Break-even time	Process	Financial
Margin goals/ Profit goals	Process	Financial
ROI or IRR	Process	Financial

## **2.5 Connecting the literature review between design thinking and innovation management**

The main goal of this literature review is to find the interferences between DT and IM in the previous literature. As presented above, DT and IM can be approached in many ways. Thus, when wanting to study the inferences between these two concepts, it is important to understand, how these two concepts can be studied together. DT's influence on IM has been scarcely studied. The field of research is lacking empirical evidence and coherence (e.g. Carlgren et al, 2014). Although, some scholars have been able to study DT empirically and have made some advance regarding the relationship between DT and IM, the knowledge is lacking. As it is often the case in the IM literature, as in many other fields of studies as well, there cannot be universal generalizations made easily in a matter that is highly context dependent. Thus, the connections between these two concepts have to be made cautiously.

The nature of DT makes it hard to study. The rather manifold understanding of the concept in academia but especially in practice makes empirical studies on DT difficult. In order to better understand how these two concepts are linked, it is best to look at previous studies done on the exact subject. It is important to understand that the nature of DT in these different studies might be understood differently. Whether or not this effects on the impact that DT has on IM, is debatable.

### **2.5.1 Presenting the core studies of design thinking and innovation management**

Although DT's relationship with IM has not been studied widely, there are studies that address this subject. Table 6 includes nine studies found including their approaches and main results.

These different studies indicate well, that there is a connection between innovation and DT but this connection has not yet been studied widely enough. Also the results of these studies clearly state that DT as a concept is still very complex and does not have a common understanding in practice or academia. Many see that this customer-centric philosophy has to be in the core of innovation but it still needs further studies and empirical examination.

Table 6. The core studies on DT's impact on innovation management and their results

<b>Scholars</b>	<b>The context of the study</b>	<b>The main results</b>
Liedtka (2015)	Linking DT with innovation outcomes and how DT reduces cognitive bias in decision making.	Innovation outcomes are better when using DT, because it helps to reduce decision makers cognitive biases. Prototyping, testing, user centeredness and customer data help in reducing the possibility of cognitive bias.
Furue and Washida (2017)	DT and scanning, their impact on NPD.	DT takes into account only the existing needs of the customers. DT has a positive impact on innovation management.
Veryzer and De Mozota (2005)	The impact of user oriented design on NPD, linking design and user-centered thinking together with NPD.	Positive impact of user oriented design to NPD. UOD's important to strategy was highlighted.
Carlgren et al. (2014)	How DT is used and perceived in large organizations.	DT is used in large organizations and is seen as a key to answer customer needs. Many new research agendas were raised. DT's impact on Innovation management was seen

		positive but it is still lacking empirical evidence.
Davis et al. (2016)	DT's influence on knowledge creation that leads to new ideas and innovations.	DT enhances knowledge creation and thus also innovation.
Mahmoud-Jouini et al. (2016)	DT's impact on project management in the innovation context.	DT has a positive impact on project management in an innovation context by supporting and enabling more efficient and customer centric take in every aspect of a project.
Fraser (2007)	DT and breakthrough strategies.	DT creates innovation which creates breakthrough strategies and new business models for success.
Battistella et al. (2012)	DT, design driven innovation and creating new meaning and meaning strategies.	DT supports creating new meaning for products and business models and thus helps create a meaning strategy.
Kleinsmann et al. (2017)	DT as a way of capturing value in innovation practices.	DT affects positively in different innovation practices but due to the ambiguity around the concept, it cannot be seen as the only solution for successful innovation.

First, before DT became a popular buzzword among both academia and practice, Veryzer and De Mozota (2005) studied as user-oriented design. User-oriented design (UOD) focuses on the deep understanding of the customer or user, which transforms this understanding into a functional product or service (Veryzer and De Mozota, 2005). Once there is a great emphasis on UOD in the innovation process, it will induce more collaborative NPD effort and this will also generate more ideas and thus more superior products or services are created (Veryzer and De Mozota, 2005). Furthermore, according to Veryzer and De Mozota (2005) users more readily adapt these new ideas, products and services created through UOD. Veryzer and De Mozota (2005) include phases, such as idea exploration, idea generation and

testing and validation in the process of UOD. These phases are very similar to Brown's (2008) DT phases. The results of the Veryzer and De Mozota (2005) study indicate that UOD can provide better realities of the application as well as better realities of the markets addressed. UOD can also be crucial for achieving strategic goals in firms (Veryzer and De Mozota, 2005). There can be seen a relation between strategy and design due to design's ability to serve as a primary mean for executing given strategy (Veryzer and De Mozota, 2005). This study can be seen as a base and first draft of DT that suggests that UOD has to be put in the forefront of senior management thinking.

Furthermore, Furue and Washida (2017) point out the importance of innovation management in today's world as many different organizations, for example companies and research institutes aim to capture customer's needs and develop new products for these changing needs of customers. DT is explored as an alternative way for scanning, which provides companies a clear vision of the environment in terms of market situation (Furue and Washida, 2017). According to Futrue and Washida (2017) scanning takes into account information from multiple factors including the most unusual factors as well. DT's connection to new product development is seen as a way to serve the current hidden needs of the customers (Furue and Washida, 2017). The connection to innovation management is positive but it is highlighted that DT alone cannot succeed (Furue and Washida, 2017). In addition, successful IM needs scanning in order to understand the future hidden needs of customers (Furue and Washida, 2017). This study defined and understood DT as a way of thinking that only takes into account the current needs of the customers.

Carlgren et al. (2014) explored the use of DT in large organizations through four themes: perception of the concept, how it is used, integration of DT with existing product development and who is using it. In the study Carlgren et al. (2014) study, there were in total 16 firms and 31 interviews and these were chosen based on their use of DT. The results of the study indicate that many perceive DT as a mindset or culture instead of a process or a tool (Carlgren et al. 2014). There was also clear results stating that not everyone is able to define DT as a concept even though they were using it in their organization in a wide scale (Carlgren et al. 2014). In addition, the results from the Carlgren et al. (2014) study indicate that it is rather unclear whether DT is a new way to design or organize different activities or whether it brings something new to other user centered approaches to innovation. It was

unclear if DT is seen as a new management concept and how it can be implemented into companies, how it influences existing organizational settings and innovation practices (Carlgren et al. 2014). DT was used in these large organizations by various people and in different roles (Carlgren et al. 2014). Carlgren et al. (2014) pointed out that professional designers within organizations were seen as the users of DT but the question whether or not anyone can become a design thinker, was still unclear and in need for further research. This study raised many good research agendas for this field of study and requested more empirical research on the matter.

Liedtka (2015) linked DT with innovation outcomes and raised same concerns about the manifold nature of DT and the lack of empirical research as Carlgren et al. (2014) also pointed out. Liedtka (2015) suggests that DT has a mitigating effect on the projection, focusing and hot or cold biases when relying on customer insights and perspectives and when improving decision maker's ability to better imagine the experiences of others. In addition, DT supports IM when innovation tasks are carried out by diverse and multifunctional teams (Liedtka, 2015). Prototyping and other qualitative methods that DT uses improves customer's ability to identify and assess their own needs as well as teaches decision-makers to be better hypotheses testers (Liedtka, 2015). This study by Liedtka (2015) suggests that in general DT reduces the amount of cognitive biases and other forms of thinking that might lead to wrong decision making. This means that DT practices have potential for improving innovation outcomes when mitigating well known cognitive flaws.

Davis et al. (2016) study suggests that DT helps in knowledge creation by providing a structured and nurturing framework that facilitated respectful interaction and by assisting different individuals to commit to shared values and idea generation. In addition, DT utilized technology to facilitate shared information, practices and resources in the organization (Davis et al., 2016). This knowledge creation that DT generates, leads to innovation when these new ideas are implemented (Davis et al., 2016).

DT has a positive impact on project management in an innovation perspective (Mahmoud-Jouini et al., 2016). According to Mahmoud-Jouini et al. (2016) problems in project management relate to high uncertainty and wicked problems in which DT is useful. Due to DT's focus on continuous learning, hypotheses identification, problem identification,

exploration and prototyping DT can contribute to the exploratory dimension of projects as well as help in decision making and choosing the most suitable options (Mahmoud-Jouini et al., 2016). In addition, stakeholder management is also improved due to the user-centered take of DT (Mahmoud-Jouini et al., 2016). According to Mahmoud-Jouini et al. (2016) DT enhances stakeholder involvement in innovation projects when enabling rich and multiple interactions with users and user empathy. By starting with a problem definition, DT contributes to the articulation of the projects strategy (Mahmoud-Jouini et al., 2016). DT also ensures that multiple options will be considered and tested and thus represents an effective approach for defining the project strategy (Mahmoud-Jouini et al., 2016). Through DT, the reuse of knowledge from one project to another one is possible, according to Mahmoud-Jouini et al. (2016). Lastly, DT complements traditional project management by emphasizing the meaning of the innovative project thus making an important contribution to strategy orientation and formulation (Mahmoud-Jouini et al., 2016). According to this study, more empirical evidence is needed to give support to the proposed arguments.

Battistella, Biotto, and De Toni (2012) linked DT and design driven innovation strategy and explained how implementing DT does not only help to create new meanings for products or services but also new meaning for other building blocks in a business model. This study suggests that business models can be shaped through a strategy that conveys a deliberate meaning, which can be achieved through design driven innovation. Similarly to Veryzer and De Mozota study of DT in the context of UOD (2005), Battistella et al. (2012) study DT in the context of design driven innovation and do not consider DT as a concept. Still this study provides good insight to how design driven innovation can create new meanings and strategies and thus support innovation management (Battistella et al., 2012). Furthermore, Fraser (2007) makes connections between DT, design and breakthrough strategies. This study suggests that through user understanding and clear concept creation where prototyping and user evaluation is crucial, companies can create strategic business design. According to Fraser (2007), design has highest value when DT is applied to strategy and business modelling because then companies can create breakthrough strategies.

Lastly, Kleinsmann et al. (2017) study indicates that DT has a practical application for innovation. They identified four images of DT that represent these practical applications of DT in different companies (Kleinsmann et al., 2017). These images are value-driven

innovation, experience-driven innovation, purpose-driven innovation and vision-driven innovation (Kleinsmann et al., 2017). According to Kleinsmann et al., (2017) in these different innovations, DT is facilitated and used differently, for example in value-driven innovation prototyping is used mainly for synthesizing the diverse knowledge bases of the different stakeholders, whereas in experience-driven innovation, prototyping is used for collaborative prototyping with users. This study indicates that the context in which designers operate is changing (Kleinsmann et al., 2017). Capturing or measuring the value of DT in different innovation projects is somewhat weak or hard due to the ambiguity of the concept and DT is not alone responsible for good innovation outcomes (Kleinsmann et al., 2017). According to Kleinsmann et al., (2017) these images presented help innovators and scholars to understand DT's different forms and ways of use and thus lower the level of ambiguity around the concept.

This literature review explored DT and IM and opened up these two concepts from different perspectives or approaches that different scholars have presented. As presented above, DT is a complex philosophy that has a lot of ambiguity. There are several studies done, that have opened up DT and have aimed to provide coherence to the field of study. DT's connection to IM has also been studied and these studies indicate that DT has a positive connection to IM. This connection however needs further empirical evidence. Thus, this study aims to provide more empirical evidence on the matter through a qualitative research.

DT needs to be studied from the different viewpoints and it cannot be studied as a clear concept but instead one must identify the different embodiments of DT through which it can be studied. In addition, IM needs to be understood as a broad concept that has one main goal: enabling better innovation success. Thus IM does not need to include controlled tasks or actions, but can instead be included in the company culture. These are the main contributions from the literature review to the empirical analysis that need to be taken into account when conducting the research. In order to proceed with the empirical analysis, the methodological choices for this research will be presented next.

### **3 RESEARCH DESIGN AND METHOD**

The empirical research conducted in this study aims to find answers to how DT has been used in companies and show is it associated with IM. As the literature review indicates, the concept itself is rather differently understood in both academia and practice and thus it is important to take into account the complexity of the concept itself. As the research framework indicates, the empirical research regarding the inferences between DT and IM is studied at project level within companies but also at the organizational level to see how different companies understand DT. Following the approach used in many qualitative studies, this approach for the study is inductive research approach, meaning that the arguments and reasoning are done in a certain context and generalizations have to be made cautiously. Inductive approach or reasoning starts from the observation of the phenomenon, searching for patterns from observation, building explanations and conceptualization, and therefore develop theory. As a result, it might be that theory is proposed at the end of the research process based on the observations. Inductive reasoning aims to develop meanings by analyzing the data without taking into account previous theory. It is based on developing research questions to be explored, following learning from research experience. Researchers aim to find patterns, commonalities and regularities based on data. In this research, the aim is to develop empirical generalizations from the data analysis, aiming to find preliminary relationships. Inductive reasoning does not start form hypotheses at the initial stages.

The strategic approach in this thesis is a case study and the aim is to figure out how DT truly associates with IM. However, when there is no grounded theory around this phenomenon that itself explains it, this case study contributes some valuable insight to the theoretical side as well. Figure 9 shows the research design choices made for this study. Although qualitative studies are usually not meant for generalizing (Saunders, Lewis and Thornhill, 2009), some careful generalization could be made from this study.

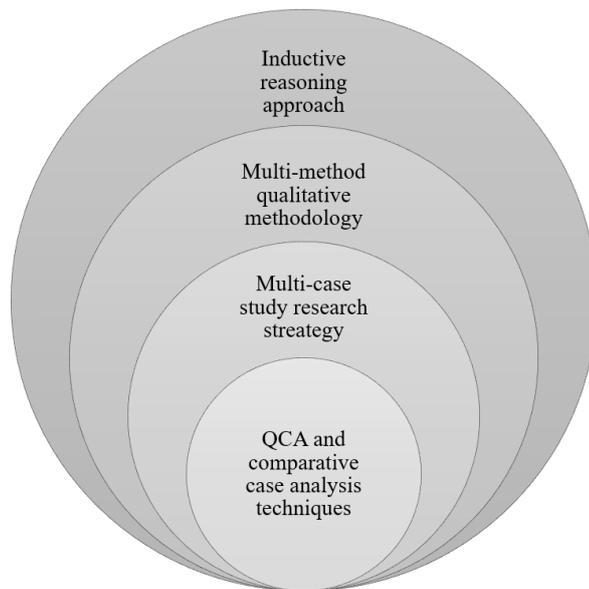


Figure 9. Research design and methodology selections for the study

The aim of this study is to look into the concept of DT and IM and see how these concepts are linked, and for this aim, qualitative approach is most suitable. The research design for the empirical analysis includes the inductive reasoning approach as the selected study approach. The methodological choice in this study is to conduct a multi-method qualitative study which includes a multi-case study as the research strategy. Two different qualitative analysis methods, the comparative case analysis and QCA were chosen as the methodologies in this study.

In order to answer the research questions, relevant data needs to be discovered regarding the phenomena. As previous studies (e.g. Liedtka, 2015) indicate, more empirical studies on DT are needed in order to provide evidence to DT's positive associations with IM. This requires organization and project specific information from which forms DT takes in projects and in organizations and how it has been used and what have been the outcomes of using it in these projects.

### 3.1 Research method

The method adopted for this study is a multi-method qualitative study. This includes the comparative case study and qualitative comparative analysis (QCA). Thomas (2006) identifies different qualitative analysis approaches from which one is the so-called general

inductive approach. This analysis approach is suitable for when analyzing different themes or categories identified in the study. Here the descriptive data analysis plays a key role when the aim of the analysis is to provide answers to the second and third research questions, which in turn support and complement the first research question. The data analysis for this study was done by using two qualitative data analysis methods, the QCA and descriptive data analysis.

The strategy in this study is to conduct a comparative case study, which means that the same issue is studied in several cases instead of just one particular case (Creswell, 2007 p. 72-75). Thus, the results from this multi-case study indicate wider perspectives for DT and IM and might be in some levels more generalizable than with a single case study. There were in total five case companies included. The information from these cases was conducted through in-depth interviews.

In order to analyze the interviews, the codification method proposed by Gioia, Corley and Hamilton (2013) bringing qualitative rigor into inductive research was used. The idea behind this methodology is to identify and create grounded theories through qualitative approach (Gioia et al., 2013). The research design and methods in this study adapt this Gioia methodology from Gioia et al., (2013) and thus aim to understand the main research question: DT's association with IM.

### **3.2 Research context and the description of the case companies**

Qualitative data used in this study was collected from five different companies. These companies are all large or medium sized companies with rather varying revenues from approximately 120 billion euros to 77 000 billion euros (90 000 billion dollars). (Company A annual report, 2015; Company B annual report, 2015; Company C annual report 2016; Company D annual report, 2016; Company E annual report, 2016; Eurostat, 2016). All these companies operate in international markets and four of these companies' headquarters are in Finland and one in the United States of America. These companies operate in various industries. The information obtained through these seven interviews is handled anonymously in due to the delicate nature of the company specific information. Only the more general information about the companies' revenues and industries are mentioned in order to better describe the case companies. This information can be seen from table 7.

Table 7. Basic information about the companies used in this study (Company A, B, C and E financial statements, 2016; company D financial statement 2015)

<b>Company</b>	<b>Revenue (EUR or USD, in millions)</b>	<b>Operating environment</b>	<b>Industry</b>
Company A	10 000 €	Northern and Eastern Europe	Retail
Company B	1000 €	Northern Europe and Baltics	Banking and insurance
Company C	158 €	Global	Cyber security
Company D	90 000 \$	Global	Software/hardware
Company E	129 €	Northern Europe	Furniture and interior solutions

Even though all of these companies can be seen as large or medium sized companies in terms of the amount of employees of (50 to higher than 250 employees) their revenues indicate considerable differences about the scale of the business (Eurostat, 2016). This set of case companies was chosen for the analysis because these companies have some similarities regarding their size but also have differences in the industries and markets in which they operate. By including these different kind of companies in the analysis, the case company information is more diverse. As Creswell (2007, p. 74) suggests, it is important that the researcher selects good and representative cases for best generalization and this set of cases chosen has a good representation of larger companies that operate in various industries and in various markets.

The main requirements for the companies chosen for this study were that they needed to be the kind of companies that have realized the benefit of innovation and use DT in one form or another in their organizations. Second requirement was that these companies needed to be larger companies. The main reason for narrowing the size of the company was that IM is seen to be a problem specifically to large companies, due to their established processes and ways of working being usually slower when it comes to adapting new market requirements or creating new offerings. When comparing for example startups and large companies, the

main difference is that a startup culture is built on innovation, whether radical or incremental and due to their size, startups are usually faster in adapting new ways of working. These companies were chosen as case companies as they all use DT and have stated that they realize the need to keep innovating in order to keep up with the changing market environments that are shaped by the different megatrends such as digitalization and climate change. The necessity that needed to be included was that these companies use DT. This was ensured when contacting the different interviewees and by using the public information available from these companies.

In the context of this study it was important to find not just company specific organizational level data but also project level data. Mahmoud-Jouini et al. (2016) have proved that DT has been seen or identified to exist empirically in the project level, which means that the impact to IM should also be studied at the project level in addition to organizational level. This project level data was important to collect in order to more specifically study, how DT is actually used in these companies, what it is, and what are its associations with innovation and IM. Thus, within those five case companies, there were several projects and project level data that was analyzed in this study. There were 20 projects in total that were covered during the seven interviews and out of these 20 projects, 18 were chosen for more specific analysis using the QCA method. Two projects were left out due to their nature and lack of detailed information. The level of information needed from these projects was in-depth knowledge of the project itself and the use of DT in these projects. There were two companies that gave information about one to two projects and three companies that gave information about more than three projects. In order to keep the anonymity, more specific information about how the projects were divided and to which companies, cannot be provided. These factors however are considered when analyzing the results of the study.

### **3.3 Data collection: case studies**

The first method adopted in this research is comparative case study. As Eisenhardt (1989) states, theories can be built from case studies. Case study is an approach that focuses on understanding the dynamics of a certain phenomenon and it is common for case studies to combine data from multiple sources (Eisenhardt, 1989). Eisenhardt (1989) introduces a process for building theories from case studies. This process flows through selecting cases,

collecting the data, analyzing the data, hypothesis shaping, comparing it to existing literature and reaching closure (Eisenhardt, 1989). Similar process is used in this study.

Data collection in case studies is usually rather extensive, including for example interviews, observations and documents (Creswell, 2007, p. 75). In this study, the primary data sources are the interviews collected from these companies. Some secondary data, mainly publicly available information about the case companies and observations were used to support the interview data. As mentioned before, the main sources of data were the seven conducted semi-structured interviews. Denzin and Lincoln (2000, p. 667) highlight the importance of understanding which type of interview technique to use in order to get the desired type of interview data. In order to get the desired data, it was decided that a semi-structured interview with certain pre-decided themes that allowed the conversation to flow somewhat freely was the best way to gather the data for the study. The interviews lasted from one to two and a half hours and six of them were held face to face and one via video call. All the interviews were recorded and notes were taken during the interview. These interview notes were then complemented by going through the interview recordings and writing down all the essential and important information about each interview. There was no need to transcribe the interviews, because the extensive amount of notes already covered all the necessary information. When a direct quotation was used referring to the interviews, it was taken directly from the recordings.

The semi-structured interviews were based on several themes related to this study and these themes were structured in the form of open-end questions so that the interviewee could already before the interview familiarize himself to these themes. However, it was not obligatory or necessary for the interviewee to familiarize himself to the themes beforehand. Appendix 2 shows the interviewee version of the structure of the interview that was sent beforehand. Even though the interview themes were presented to the interviewee in the form of open-ended questions, the interviews were not meant to only provide answers to those specific questions but to provoke conversation around those questions. Thus, the possible reasoning between the questions around the same theme was enabled for the interviewee. The interviews were all carried out in Finnish, even though the themes and questions were beforehand presented in English. This language choice was made due to all interviewees being native Finnish speakers. When a quotation is used in this study, it has been translated

into English by the interviewer. Thus, these quotations are in fact not direct quotations but instead direct translations of these direct quotations.

The interviewees chosen for this study were all working or used to work for these case companies in positions where they were in direct connection to innovation and DT within those companies. It was necessary that the interviewees knew at some level about DT and thus the majority of these interviewees had experience about “using” DT. Due to the complex nature of DT and the surrounding difficulties in defining it, DT’s definition in relation to the context of this study, was presented in the interview questions material together with definitions of innovation and IM. All these definitions have been made in the context of this study. Because the scope of qualitative study can change or be modified during the study, the definitions of the concepts at that time of the study, were the ones presented to the interviewees. These definitions can be seen from the appendix 2. There are many companies in the world, which are DT oriented companies. However, these companies do not all use the term design thinking and this is why it was necessary to make sure that during the interviews, the definition of DT in this study was clear so there were no misunderstanding of the subject at hand. This is why the first theme covered during the interviews was to talk about the definition of DT. The main criteria for how the interviewees were selected was that they needed to understand what DT is and have knowledge of both how it was used at the organizational level and at project level and have understanding of their company’s innovation process and how it is managed.

The secondary data gathering was conducted both before and after the interviews were conducted, in order to make sure the companies chosen for the study met the criteria and to give support to or clarify some information about the interview data. This secondary data was conducted mainly from the company websites or presentations and newspaper articles.

### **3.4 Comparative case study and content analysis**

Taking in the data gathered in comparative case study, the content analysis of the interviews is followed. When it comes to qualitative content analysis, the most important thing after data gathering is to identify different themes or patterns from the data (Miles, Huberman and Saldaña, 1994). The content analysis was done by first codifying the data into different levels, which can be seen as these themes or patterns. The first level codification includes

open codes. The second level codification included setting up main themes that were discussed during the interviews while the third level codification includes aggregated codes. The Gioia Methodology (Gioia et al., 2013) was used to code the data into the wanted themes. There were first some first order concepts or categories identified and after this, these categories were combined into second order themes. The third phase was to link these to the three research questions.

The interview notes were the main source of data and it was sorted into different categories depending on which research question it provided input into. This division is presented in table 8. After sorting the data by each case company into the different categories, cross-case comparison was made. This was done in order to find out the organizational level information, to see the whole research agenda, to identify the consistencies and differences, and to find out the answers to the research questions in the study.

Table 8. The division of the themes used in the analysis by research questions

<b>Research questions</b>	<b>Themes</b>
RQ 1: How is Design thinking associated with Innovation management	DT's usage in different projects, DT's impact in these projects and in innovation management. <i>DT conditions:</i> problem solving and empathy, customer centricity, strategic reason and understanding, testing and validating, opportunity looking and experimenting, multifunctional collaboration, designers involvement in projects, innovation supported and encouraged, DT process/tools/model used, DT included as a philosophy
RQ 2: What is Design thinking	Defining DT, perceptions of DT in the case companies, models of DT, the different dimensions of DT
RQ 3: How is Design thinking implemented into organizations	Innovation and innovation management, innovation management measurement and the implementation of DT into innovation management.

### **3.4.1 Qualitative comparative analysis (QCA)**

The second method used to analyze case studies is QCA and it was done in order to assess how DT is associated with IM in the project level. The QCA was done based on the codification done in the content analysis. QCA is an approach and research tool set that combines the case analysis and cross-case comparison in order to find out different relationships among different causal combinations (Legewie, 2013). It is a way of quantifying qualitative data in order to figure out complex causalities from cases (Legewie, 2013). According to Legewie (2013) QCA's main focus is to explain how some specific outcome is related to certain condition variables. QCA is best applied when there is in-depth case knowledge and when studying a social phenomenon that is of complex causality which can be formulated into different set-theoretic terms such as necessary and sufficient conditions (Legewie, 2013). Furthermore, QCA reveals patterns of associations instead of proving causal relations (Legewie, 2013). Discovering these patterns of associations is the main reason for why QCA was chosen as an analysis method for this study. DT is a social phenomenon that has complex causalities with possible necessary and sufficient conditions and thus discovering different patterns from the cases was an important aspect of the study.

There are two different QCA methods, a crisp-set and a fuzzy-set (Ragin, 2017). The main difference between these two is in the values that can be given to the different conditions and outcomes (Ragin, 2017). In crisp-set, the values given are either 1 or 0, depending on for example if the given value is present or not thus this analysis relies on Boolean logic (Ragin, 2017). In fuzzy-set, the values given to the causal relationships can vary between 1 and 0, thus creating a more complex set of data (Ragin, 2017). In the context of this study, a crisp-set QCA was used because it served the purpose of the study better. Crisp-set QCA is best applied when the case size is between 5-50 cases (Ragin, 2017). In order to make the crisp-set QCA, it was important not to have too similar conditions separately explaining the same embodiment of DT. Thus, when similar conditions were identified, these were combined into one condition. These ten chosen conditions thus include the different DT factors that appeared the same way in the different projects. In appendix 3, these groupings or categories of these different DT conditions or causal relationships can be seen. A similar coding was done in order to find out the organizational level factors of DT which were studied in the comparative case study.

The crisp-set QCA followed a rather clear path that included some trial and error. Bekdik and Thuesen (2015) present a process for QCA research. In this study, this process follows the similar steps as Bekdik and Thuesen (2015) present. In order to understand the QCA process more clearly, the steps of the research can be seen in figure 10.

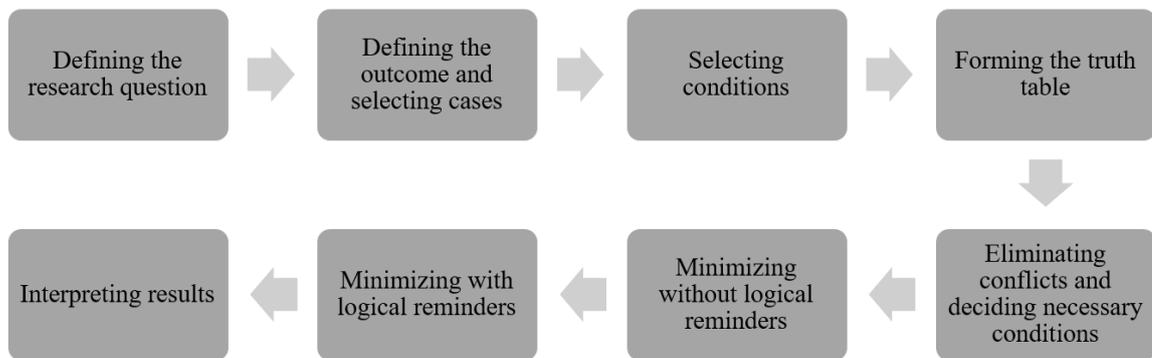


Figure 10. The QCA process (adapted from Bekdik and Thuesen, 2015)

By coding and categorizing the data gathered from the interviews, it was also possible to identify important information related to the different projects. Denzin and Lincoln (2000, p. 515) suggest that through coding the data is easier to define and categorize. As mentioned, there were in total 20 projects from which the project level information about how DT has been used in these case companies in different projects was collected. These projects were all, to some degree, innovation projects aiming at creating new innovations, whether incremental or radical. These projects included different types of innovations, from product and service innovations to process innovations. Table 8 presents the different DT conditions that were discovered during the analysis when combining the data with the existing theoretical knowledge of DT.

These DT conditions were chosen as causal relationship factors of DT when combining the previous knowledge of DT and the interview data. The approach used in this selection of conditions can be classified according to Yamasaki and Rihoux (2009) as a combination of the conjuncture and inductive approach. In the conjuncture approach, the conditions are selected based on joint interactions with different theories and in the inductive approach they are selected based on case knowledge and not precisely on existing theories (Yamasaki and Rihoux, 2009). For example, problem solving and empathy as DT conditions were clearly identified as closely linked to DT in the previous studies and also highlighted during all

interviews, and thus, these were chosen as conditions in QCA. The causal relationships that can be seen above in table 8, were chosen for the analysis by looking at the literature review and identifying the main DT embodiments and then combining this information with the interview data.

In order to perform the crisp-set QCA analysis, the outcome variable, that defines how the causal relationships acts in relation to the outcome, was chosen.. In this analysis, the outcome variable is positive and successful project, then the value of 1 was given to the outcome. If a project was unsuccessful, then the value of 0 was given to the outcome. It can be sometimes difficult to define whether an innovation project has been successful or not. In this study, the criteria for a successful project was that the project achieved the different goals assigned to it and was able to create value for the end user or for the company. It is important to highlight that sometimes innovation projects can be successful even when they do not create anything that can be released or published and this was evaluated case by case in this study in order to evaluate the project success properly.

The values for different DT conditions were given based on the following. If the DT factors were existing in the projects and were seen important, the value given was 1 and if the DT factor was not included in the project and did not associated with the project outcome, it was given a value of 0. By identifying these 1 and 0 for the conditions and outcome in all 18 chosen projects, a truth-table was created. After forming the truth table, necessary conditions were identified. These results show that there are three necessary conditions for successful innovation project: customer centricity, problem solving and empathy and strategic reason and understanding. Often while forming the truth table, contradictions appear and they need to be solved. This is the case when a given value provides an outcome of 0 in some cases but a 1 in other cases. In the case of this study, there were no contradictory rows identified, thus no eliminations were needed.

The minimization process was done in two steps. In the first step, all combinations that had case evidence data, were included in the analysis. The second step of the minimization process contained the inclusion of logical remainders. In comparative research, there is a common challenge that relates to the relatively small number of cases (Ragin, 2017). According to Ragin (2017) it is common to have a situation where a researcher has “more

variables than cases” which is also the case in this study. The first minimization process provided five causal recipes in total. Due to the large number of conditions (10 conditions in total) to be assessed, the possible number of cases was 1024. When studying a social phenomenon, such as DT and IM, the empirical evidence is usually somewhat limited (Ragin, 2017). This is why it is important to consider some logical remainders in the analysis and thus provide counterfactual cases and hypothesis based on theoretical knowledge of some possible combinations. This way a researcher provides a so-called “thought experiment” into the analysis (Ragin, 2017). There were in total seven logical reminders considered in the analysis. These were chosen based on the thought experiment that included theoretical and empirical knowledge. After the minimization process, the results were interpreted.

### **3.5 Reliability and validity**

Golafshani (2003) raises an issue discussed rather widely among scholars about whether or not reliability or validity should even be considered in qualitative studies due to the nature of qualitative study. Stenbacka (2001) highlights the judgement of quality in qualitative research and in an organizational setting and states that reliability in its classical definition comes from the ability to produce the same research method repeatedly. Because the researcher cannot be excluded from the method in qualitative study, it can be very difficult to produce the same exact study and thus the results might also vary (Stenbacka, 2001). This is why the concept of reliability can even be misleading in qualitative research (Stenbacka, 2001). Ensuring reliability in qualitative research requires the examinations of trustworthiness (Golafshani, 2003), which according to Seale (1999) “is always negotiable and open-ended, not being a matter of final proof whereby readers are compelled to accept and account.”

When it comes to validity, Stenbacka (2001) states that the basic definition for validity is “whether the intended object of measurement actually is measured”. This definition again is debatable in qualitative research because qualitative research is not meant for measuring but instead for seeking certain quality that is typical for a phenomenon (Stenbacka, 2001). When assessing the quality of a research, Golafshani (2003) relates it to generalizability of the result, which is done by testing the validity of trustworthiness of the research. This can be done through triangulation, which in its many forms is a way of increasing the

trustworthiness by using different methods, various data sources or analysis technologies when studying a phenomenon (Golafshani, 2003).

In this study, these issues with reliability and validity have been understood and the study aims to provide a data set that is trustworthy and provide results that can be generalized, at least in a certain context. This context is limited to larger companies, which operate in international markets and aim to respond to the changing market environment. This study uses multiple data sources, even though the main data source is the interview data, and provides analysis by using different techniques, the QCA and the descriptive data analysis. This study is a multi-case study which itself is a good proof for reliability, if and when the findings indicate similarities among the cases.

When it comes to generalizability, the coding and evidence for the QCA conditions can be seen in the appendix 5. This supports the transparency of the study. In QCA an important measurement criteria for the goodness of the results is consistency. In this study these consistency numbers are in a good level (close to or higher than 0.75), meaning that the certain combinations of DT conditions provide the wanted outcome. This means that the results are valid. When it comes to reliability, the amount of cases and the conditions are considered to be in good level. A good level in this study comes from the fact that there are five case companies and a lot of variety between the companies operating environment, which means that similar results between cases could be in some levels more generalizable than with fewer cases. Still it should be noted that this is a case study of five firms and thus there are several context dependent factors that might affect the reliability of the QCA.

## 4 RESULTS

In this chapter the empirical findings of the study are presented. First, the findings of the comparative case study, interviews and content analysis are presented. The five company cases in relation to the research questions are presented and then the comparison between cases are made. This part contains the organizational level results, which was one aspect of this study. Second, the results of the QCA are presented thus providing the project level information. Third, the IM metrics are analyzed in order to understand what good IM is and how it is measured in the scope of this study. Finally, all these results will be combined to provide a coherent understanding of the results.

### 4.1 Multiple comparative case analysis: design thinking at an organizational level

This part consists of presenting the results of the multi-case study in an organizational level. The purpose is to present these findings case by case and figure out how DT is seen and perceived in these companies and how these companies have implemented DT. After presenting the case by case findings, the similarities will be presented and generalizations made according to the cross-case comparison. In order to protect the anonymity of these case companies no company or interviewee names will be mentioned. In each of these cases, the structure of presenting the findings follows the themes presented in table 8 above. The focus is first on exploring what DT is in these companies. Second, the focus is in the specific processes or models of DT and thirdly on how DT is related to the dimensions presented in the literature. Lastly, the implementation of DT in these case companies is presented.

#### *Design thinking in company A*

*The nature of DT:* In the case of company A, DT has started to exist in the company's strategy few years ago. It has been publicly stated that company A wants to provide the best possible customer experience and thus being and becoming more customer centered is the key in providing better customer experience (Company A annual report, 2015). DT was seen as a way of thinking and more as a background philosophy that guided the higher management to make strategic decisions regarding customer experience. DT was especially and firstly included in the higher management level as a way of thinking and secondly DT has been used as a tool in different projects. In company A, people still perceive DT rather differently, and due to the many understandings of DT, it is still rather unclear in the

organizational level. For example some perceive DT as service design and the methods used in service design as the DT methods. Some see DT more *“as a definition for acting and thinking where the traditional designing process and its actions and way of thinking is implemented into business and product development in a wider scale”* (Interviewee 1, 2018). DT is also perceived *“as a tool that can really dig out the needs of the customers and their attitudes towards either to the existing or to the future needs that can then be fulfilled with productized service design”* (Interviewee 1, 2018).

*The process of DT:* In company A, there is no stated process of DT or model in use but it can be read between the lines that there are some structures that guide DT within the company. It starts with the problem identification that is stemmed from empathy and customers and then moves on with idea gathering and analyzing these ideas by using service design or other form of designing and from there moves on to testing and validating and creating something new that matches the customer needs. It is said clearly during the interviews that some modeling of DT could be necessary in order to really bring the customer centricity in and in order to make customer experience the real competitive advantage. *“In order for this to be possible, there should be a mode of operation, the tools and the model”* (Interviewee 1, 2018).

*The dimensions of DT:* DT’s linkages with its identified dimensions were seen rather clearly in company A. Especially customer centeredness, multifunctional collaboration and experimenting were dimensions of DT that were very much in use in this company in projects and in organizational level as well. The connections between problem solving, strategy and innovation were also highlighted to be very important and keen parts of DT. The strategy linkage in different projects was seen as an important factor for DT. It was stated that without a strategic higher management support, many new product development projects would not have been executed. Interestingly, in the case of company A, there were several interviews conducted in order to get the project level in-depth info for the QCA. When going through the dimensions of DT with the different interviewees, the connections were seen somewhat differently. The key reason for this was that these dimensions were looked at different levels. It was clear that DT is existing in this company but it is existing differently in different levels. In order for DT to fully exist in an organizational level, it needs to exist in all projects and operations in the company. This is something that company A is

constantly improving on and interviewee 1 stated that there should be some sort of a “design maturity model” in use in order to measure the level of DT within the company. Overall, the dimensions of DT were seen very clearly and were accepted to be connected as key parts of DT.

*Implementing process:* When it comes to implementing DT into the organization, company A started with using external resources but the key element from the start was that the higher management understood the concept of DT and realized its benefits. Interviewee 1 (2018) states that *“it is important that in different levels, both in the execution and in the higher management level, understanding customers and having empathy, which is the core of DT, is everyone’s responsibility. Customer centeredness and finding solutions to customers’ problems are actually the core factors in innovation and business development, not a thing one can glue on top”* (Interviewee 1, 2018). In the case of company A, the right competencies, design tools and customer-centered way of thinking should be bounded into the processes and this way DT is implemented into the whole company. Regarding whether it is actually necessary to implement DT and plan the implementation, in company A it is important but even more important is to get to know and understand the innovation and development processes in the spirit of DT and together realize and see how it all works. In addition, it was highlighted that it is important to educate employees to work in the DT mindset and clearly message, what DT truly is in the company.

In conclusion, company A is using DT as a philosophy that guides the development and innovation towards a more customer centric direction in order to provide better customer experience and in order to answer to the changing needs of customers. Company A clearly sees the dimensions of DT as key part of DT and has implemented DT into the company by including it in the minds of the people in both the operative level and in the higher management level. The different models for example presented by Brown (2008) were familiar within the company and the idea of having or using some level of process of DT was generally accepted. It can provide the much-needed tools and ways of working into the innovation and development processes within the company and thus lead to better customer experience.

### *Design thinking in company B*

*The nature of DT:* Company B has made a rather significant move in responding to changing markets by exploring new business opportunities and by stating to invest in customer experience (Company B annual report, 2015). Together with DT the emphasis has also been in managing innovation and realizing the potential that comes from being innovative and from responding to changing customer needs that are shaped by different megatrends (Company B annual report, 2015). The term DT is used in the company by different developers and designers but it is perceived throughout the company and the major shift has happened through company cultural change when there was a desire to become more agile, open and customer centric. There has been a need for both a mind shift and changes in the working habits in order for customer centricity to become a big thing and reality within company B. DT has been more of a way of thinking not a tool and it has been some sort of a background headline, which covers concepts such as service design, agile development, customer centeredness and agile decision making models. DT as a term is seen more abstract within company B and thus only designers talk in terms of DT.

*The models and process of DT:* Concrete modelling of DT has been considered in company B and the more general DT processes and models have been identified within the company. Interviewee 4 (2018) stated that “*we wondered for a long time whether or not we should draw our own design process model but came to the conclusion that our DT process follows the more generic 4-5 phased model*”. The diamond model was presented and used by company B. It was highlighted that in order to have a successful DT process, it is important that the company does not operate in the so-called waterfall model, and this was one of the things that was changed in company B during the larger cultural change. Identifying customers’ needs and problems through empathy, is usually in the beginning of DT process in company B and this is also usually one of the most important phase in the innovation process. In the more traditional waterfall model, this phase is usually counted as wasted costs and thus when DT was given attention in the company, it was necessary to also change the way innovation projects are done.

*The dimensions of DT:* Dimensions of DT are clearly seen in Company B. Design itself is seen as a helper and ways giving force for companies to be customer centered whether it is in the level of thinking or doing. “*DT and service design is in a way the tool to how customer*

*centricity can be implemented”* (Interviewee 4). DT gives ways to solve the right problems. Especially when problem defining is difficult, there is a direct link to DT in company B. When it comes to strategy, in company B it is the company strategy that gives the mandate to operate according to DT. It was highlighted that DT is a good way to also predict the future and thus helps in strategy creations itself. Innovation in company B is about seeing what everyone else sees and connecting it in a new way and what DT gives to innovation is the way to see things in a new way through identifying the right problems. In company B, designers were always involved in innovation projects but in order for those projects to succeed it required multifunctional collaboration from different business areas and functions. It was noticed that DT also brings these different business areas and functions together and thus minimizes the risk of doing marginal things that bring very little value when the company could provide great customer centered solutions through multifunctional collaboration and DT. *“The bigger the company, the greater the possibilities to make very cool stuff but the greater risk to do very marginal things when collaboration is missing”* (Interviewee 4). Experimenting as DT’s dimension is very important in company B. It was said that in the traditional development model this was a phase that was usually skipped and the results always indicated that through validation and testing and little improvements these results could have provided better results and value to the customer but also saved a lot of money.

*The implementation process:* Regarding the implementation of DT in company B there was a conscious decision made in the higher management to start implementing DT into the company in order to boost innovation. There were investments made to build an innovation unit, investments in designers and projects that could generate new business opportunities. There was a coherent understanding that things needed to be done differently in order to genuinely be customer centered. It was important to have trust in DT and that through DT, value can be generated. The higher management also lowered the decision making model and in doing so, gave the mandate that decisions regarding new innovation can be made. This way in company B, there were actually two different ways to manage innovation through DT. First, an innovation unit explored new business opportunities and focused on experimenting. Second, the more incremental innovation was developed through DT when multifunctional collaboration, experimenting, customer centeredness was brought into the everyday development of products and services. In the case of company B, the critical thing

in implementing DT was the realization of sense of urgency and that bigger corporations must be brave enough to admit that the world is changing and the company must change with it.

In conclusion, company B is a very DT oriented company, in where the value of DT has been understood throughout the company and has been successfully implemented into company B's IM. Company B sees DT as both a philosophy and a process or a tool through which customer centeredness is brought to IM in both new product and service innovations and in more incremental innovations. DT's dimensions have clearly been noticed to be linked in DT. The key in implementing DT was that the higher management sees the implementation necessary and believes in it and invests in it.

#### *Design thinking in company C*

*The nature of DT:* Company C is a company that has been focusing on putting the customer to the center focus in product development for several years (Company C annual report, 2016). DT as a term is not widely spoken of in company C but the philosophy of DT has been implemented into the company. Customer centricity and the desire to make excellent products and services for customers is the main focus in company C. Company C wants to understand and care about its customers and bring solutions to customer's problems. DT is defined in company C as "*creative problem solving in a business environment where multifunctional skills are combined with customer empathy and technological opportunities*" (Interviewee 5, 2018). The intention in company C is to solve customer's problems and in the case of company C, these customers are both business-to-business customers and business-to-consumers customers. DT is a philosophy that guides the company to collect customer understanding and understanding of new technologies and other opportunities from the global markets. Customer centricity has been highlighted as an important concept and way of operating which prioritizes the actions of the company in company C's strategy. The term DT has not been brought to the company and is not seen as something that needs to be brought in but instead it is important to operate in the DT philosophy.

*The models and process of DT:* Concrete process of DT can be seen in company C. It starts with a divergent phase where the problem identification plays a crucial role. After this, the

concept development starts by creating different solutions to a problem or to an area of problems. In an ideal situation, there would be time to create and validate several different solutions and from there identify the best ones through customer understanding. After this, the process moves on to convergent phase where there will be more validating and testing and iterations made through lean design. At some point, this new product or service will be launched and the iteration process continues by constantly listening customer needs and opinions. When these innovation processes are big investments, this kind of process of DT is used rather specifically. It was seen in company C that this type of modelling of DT into a process is good and it does clearly exist in this company.

*The dimensions of DT:* Dimensions of DT were also understood and seen in company C as very much related to DT. Especially customer centricity was seen is the actual embodiment of DT in both strategic level and in the more concrete level of doing. Problem solving also has a clear connection to DT. Interviewee 5 (2018) states that many mislead design as some level of art, when designers are actually problem solvers with titles such as service designer or product designer. Problem solving in company C is the one thing they are constantly doing, whether it is solving bugs or developing massive new solutions for customers. Strategy linkage in company C is seen through customer centeredness and thus not as a direct linkage from DT. Still it is understood in company C, that in order to have DT in a company, it needs to be taken into account in the company strategy. Multifunctional collaboration and experimenting is seen very clearly as part of DT and are keen part of innovation and development projects. Innovation itself is also seen to be part of DT very closely.

*The implementation process:* Implementation of DT has been done through taking it in to existing structures. This means that it has become a part of the company culture and philosophy when there has been a need for it in projects. There should be the support from organization and higher management for innovating and developing new products and services in the DT mindset. DT can be implemented in smaller parts but it requires a management that spreads the philosophy forward within the organization. It has not been necessary to have a strategy of implementing DT through a structured process but instead it has been very successful to have it sprinkled as methods and elements to wherever it seems needed and fit. In order for a firm to successfully implement DT, the most critical thing

highlighted in company C is to become customer centered and think about the customer in everything.

In conclusion, company C has developed innovation and development processes that successfully answer to customers' needs and problems. DT as a term is not used but it can be clearly seen that company C uses DT as a philosophy in everything it innovates. The dimensions of DT are all seen somewhat clearly and the company has successfully implemented DT through including these dimensions of DT into different projects and operations incrementally.

#### *Design thinking in company D*

*The nature of DT:* Company D sees DT as a guiding philosophy in everything the company does. Company D has a culture that embraces collaboration and creativity and encourages the iteration of ideas when addressing challenges (Company D annual report, 2015). DT has been a keen part of company D right from the start and is a collective understanding that guides the innovation within the company. DT is an iterative process that starts from discovering the problem and through analyzing and studying the problem it defines the problem and then moves on to inventing different solutions to it (Interviewee 6, 2018).

*The models and process of DT:* DT's processes and models are adapted in company D but it has not been stated anywhere in the company that this is the way to create innovation. The innovation process follows approximately seven steps: defining, studying, idea creation, prototyping, discovering the right solution, implementing and learning. It was highlighted that it is important to understand the background philosophy and have a culture that supports experimenting and accepts failing. DT as a term was understood differently in company D and thus it is crucial to understand the philosophy behind it.

*The dimensions of DT:* Dimensions of DT were seen clearly and used in company D. Customer centricity was highlighted together with problem solving, which is the starting point of innovation in the company. In rare cases the problem can be something else than customer centered. Problem definition is the most crucial part of innovation and thus much time needs to be spent on this. There are two ways in company D to study a problem. First, there is the so-called reactive study where there is an understanding that something needs to

be done and already know something about the problem. The second approach is proactive and it means that the researchers constantly keep their eyes open for new ideas. Whether or not it is foresight or insight in problem solving the key to solving the problem is to first understand it. DT's linkage to strategy is seen a little weaker in company D. DT in product development is a little less strategic because the strategy evolves in the everyday development process. In the organizational level, the strategy linkage is seen more clearly. The link to multifunctional collaboration is seen in the fact that DT's philosophy is seen in everyone else's minds than just in designers' mind. In company D there is such a strong understanding of DT's philosophy, which includes the culture of experimenting, that everyone can solve problems in the company. Multifunctional collaboration was seen as part of DT together with experimenting.

*The implementation process:* DT has existed in IM in company D from the very beginning. IM in company D is understood in the way that everyone in the company innovates and there is no specific innovation management process and thus there is no clear IM in company D. Still it can be seen that the company culture itself is built on continuous innovation and that there are specific innovation units within the company. The purpose of those innovation units is to keep innovating and provide new technologies and ideas that the company can then offer to its customers. Implementing DT has required a certain mindset of accepting failing and continuous learning and experimenting. Successful implementation of DT also requires skillful employees and thus educating the employees is critical. It is necessary that DT is at some level an acknowledged philosophy but even more important is to understand the philosophy the same way and identify the best ways to implement it.

In conclusion, company D is very advanced in its IM and has successfully implemented DT into the company right from the start. It clearly uses and sees all the dimensions of DT as important factors and highlights experimenting and problem solving as the key parts of innovation. It is a company that sees DT as a guiding philosophy that can as well provide different tools to creating innovation. Company D considers some factors of its IM as its competitive advantage and thus is not capable to open up every single aspect of their innovation, even anonymously.

### *Design thinking in company E*

*The nature of DT:* Company E has a rather clear view of DT as a customer centered philosophy through which the so-called wicked problems can be solved. DT is about being empathic and human centered in company E. DT's and service design's methods are seen as part of DT. In company E, DT has been understood in the higher management as an important method that can tackle bigger problems with a user-centered take on the problems.

*The models and process of DT:* There can be seen a process of DT that includes the discovery phase, studying and defining the problem, creating various solutions and then deciding the solutions through validation. Interviewee 7 (2018) sees that there are several similar processes modelled and branded and that all those models follow the same steps or have the same basic idea.

*The dimensions of DT:* Dimensions of DT are clearly seen in company E. DT brings the tools to understand customers deeply and for example empathy as a word is well known in company E. DT also brings the tools to understand the future needs of customers and this is seen as the missing piece that DT brings to understanding customer needs. In problem solving, the linkage to DT is in the fact that by bringing the customer or user to the center of the problem, these problems can be solved with much better outcomes. Strategy is an important dimension of DT and in company E it has been used as the guiding force for DT. In company E, strategy enhanced also the company culture, in which DT was the center focus. Innovation and DT have a very close linkage in company E. DT supports innovation as a way to answer to the right problems and develop new innovation in a way they are really fulfilling customers' needs. Multifunctional collaboration is seen as the stabilizing factor that ensures that innovations are created the right way. In addition, experimenting is seen as an extremely important part of DT, especially when organizations support prototyping. This is the way to have the best profits from DT, in the case of company E.

*The implementation process:* Implementation of DT has happened in company E from top down slowly through changing the company culture. When implementing DT into the organization, it is important that the higher management understands the need to become more customer centered and have empathy. The company culture is the most critical force in spreading DT inside the company. In general, it has been important in company E that all

employees have been involved in developing this new culture, and have thus seen the effect of DT in IM themselves.

In conclusion, company E has stable DT processes and the DT philosophy is driving the company to continuously develop and innovate. This is done through the different DT methods. Problem identification and solving together with customer centricity, multifunctional collaboration and experimenting give the base for innovation and this has also been linked in the company strategy. Higher management commitment and cultural change have been the most important factors in the implementation of DT into company E.

#### 4.1.1 Comparative case study results

As mentioned earlier, DT has been used in the case companies chosen for this study and this was one of the most important criteria in this study. In order to make a clearer image of what DT can be in organizations and how it is used, a cross-case comparison must be made. This cross-case comparison is made by using four different comparison points: how DT has been used and what it is, how the process of DT works in these companies, how are DT's dimensions seen and how has DT been implemented in these companies. Table 9 combines the findings that have been presented in the analysis of the literature review on DT. The first column describes how DT has been perceived in these case companies, is it more of a way of thinking and a philosophy or a concrete tool. Second column tells whether or not there is a process of DT used. The third column highlights the most important dimensions of DT seen and used in the company and the last column includes important factors about how the implementation has been done and what actions or changes does the implementation require.

Table 9. Cross case results of design thinking in the organizational level

	<b>DT's perceptions</b>	<b>DT's process</b>	<b>DT's dimensions</b>	<b>DT's implementation</b>
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<p><b>Company A</b></p>	<p>Background way of thinking and philosophy, term is used but not still well known and defined.</p>	<p>No decided process and model but these processes were acknowledged and seen important.</p>	<p>Clear connections to all of the dimensions. Customer centeredness, multifunctional collaboration and experimenting were highlighted.</p>	<p>Requires commitment from both higher management and execution level. Connecting DT into company processes and educating people is seen important.</p>
<p><b>Company B</b></p>	<p>Background way of thinking and philosophy and a “headline” that covers service design and agile development.</p>	<p>DT processes are identified and used. The process highlights the importance of identifying the right problems through customer empathy.</p>	<p>Dimensions are clearly seen. Customer centeredness, problem solving, multifunctional collaboration, experimenting and innovation were highlighted.</p>	<p>Higher management decision and understanding the need for change acted as the main driver for implementation.</p>
<p><b>Company C</b></p>	<p>As a term is not used but is clearly a part of the innovation process and acts as philosophy that guides the</p>	<p>Concrete process and model is used and exists.</p>	<p>Clear understanding and connections to all dimensions. Customer centeredness, problem</p>	<p>Including DT into existing structures and projects when there has been a need for it. The most important change is to really</p>

	innovation process.		solving, multifunctional collaboration and experimenting highlighted.	become customer centered.
<b>Company D</b>	DT is a guiding philosophy in everything. There is a collective understanding of the need to innovate and use DT.	It has not been stated to use a certain process but the model and process of DT is in use.	All dimensions were clearly seen as part of DT. Experimenting, problem solving and innovation were highlighted.	Has been existing in the company from the beginning. Has required mindset that accepts failure, promotes learning and innovation.
<b>Company E</b>	DT is perceived as a customer centered philosophy through what customers' problems can be solved. It is a method understood in higher management that can solve bigger problems.	There is a process or model seen in the company.	Dimensions are clearly seen. Customer centeredness, problem solving, innovation and experimenting were highlighted.	Implementation has required higher managements' understanding and has happened through cultural change of becoming more customer centered.

*Findings regarding DT's nature*

All companies see DT as a guiding philosophy that supports the innovation, new product development and other development projects. When it comes to defining DT is a philosophy

or toolset, these case companies all see DT more as a higher level way of thinking that can be seen more concretely through its dimensions. DT as a term was not familiar in these companies in an organizational level and it was pointed out by all companies that it is not important to implement the term into the company but instead it is important that it be implemented in different processes. This perception of DT was very similar in all of these case companies, which means that DT is seen more as a philosophy and a way of thinking and not as a tool. This still does not mean that the concept cannot include different methods and tools but DT acts more as a higher level philosophy that divides into different actions and dimensions.

#### *Findings regarding DT process*

DT's process was identified in all companies as a necessary and right way to develop new products and services. All the interviewees were familiar with the different processes of DT that have been presented. These processes in use were all adapting the same basic steps of the DT process with some company specific modifications. All companies highlighted the need to start the process by problem identification and definition. There were different kind of ways to identify these problems but a common understanding was that these problems included customer understanding and empathy. In some cases it was seen possible that some problems were identified through something else than customer empathy. Still in general it was the customer empathy that was the center focus in these companies in an organizational level, when it comes to defining the problem. From problem identification and definition the process moved to idea generation, where different solutions and ideas were evaluated and tested through customer insight. The next step of the process in all companies was the actual concept creation and product or service development that was done through an iterative process and then implemented into action. This iterative process includes validation and continuous learning. All of the companies have implemented this kind of a DT process into the organization but it was not clearly stated that this is the actual process and it has to be followed. Instead the processes varied within one company and between companies according to the best fit and need in a specific project.

#### *Findings regarding DT's dimensions*

The dimensions of DT were identified and accepted in all case companies. Especially experimenting, customer centeredness, problem solving and multifunctional collaboration

were highlighted as important dimensions of DT. Innovation and strategy were also seen as dimensions but little differently, compared to other dimensions. When problem solving, experimenting, multifunctional collaboration and customer centeredness were seen as the concrete embodiments of DT, innovation and strategy were seen as outcomes or enablers for DT.

#### *Findings regarding DT's implementation*

Regarding the implementation of DT and how it has happened in these companies, higher management involvement was crucial in four out of five companies. Company D has not seen DT as something that has been separately implemented into the company, but instead it has existed there from the very beginning. This also means that the higher management understanding and support has existed in this company from the very beginning. In the other four companies, it has always been crucial that the higher management level understands the importance of becoming more customer centered and implement DT's philosophy into the organization. DT has become a part of the company culture and it has been implemented into the processes and into the minds of the people. Educating employees and involving them has been crucial in the cultural change towards becoming more DT oriented. All of these companies have also invested into having designers involved in the innovation projects.

On one hand, the main similarities identified within these five case companies were in the perceptions of DT, the process of DT and the dimensions of DT. On the other hand, the main differences came from the implementation of DT but still there were common factors, such as the higher management involvement. Other differences between the case companies came mainly from how DT was actually used in innovation projects. These findings are reported in the following chapter.

#### **4.2 QCA results: project level associations between design thinking and innovation**

Design thinking can be seen at project level as different DT conditions or embodiments and in this project level analysis, the combinations of these conditions are considered as the causal relationships. In this study, these project level DT associations with IM were studied through these DT conditions by using crisp-set QCA method. The different conditions of DT and their effect on IM were presented in table 8 and explained in appendix 3. As mentioned before, the outcome variable in this study was the innovation project success. There were in total 18 projects that were analyzed in the crisp-set QCA and all the values given from each

project to each condition were evaluated based on the data from the interviews. Appendix 4 presents the truth table of QCA and shows the variations between the variables identified in causal relationships for each project.

The truth table indicated that these identified causal relationships were widely used in these different projects. There were some projects with exceptions, which stemmed from contextual factors, such as the character of the innovation. There were also differences in the way the interviewees saw these different conditions in these projects. When DT is seen as a background philosophy, it can be difficult to understand that these conditions are indicators of DT. For example multifunctional collaboration is something that may be used without being DT oriented, but when it is combined together with for example DT philosophy, multifunctional collaboration can act as a causal relationship.

There were three necessary conditions identified for the analysis of the DT conditions. These conditions were customer centeredness, problem solving and strategic interest from higher management. The necessary conditions are also reflected in the interview data: *“Design itself gives the ways to be customer centered and bring customer insights in to the projects”* (Interviewee 4, 2018) and *“First we collect the understanding about what the customer wants and where the world is going. This is the embodiment of DT and that is why it is so important... if we do not solve the problems of the people we are going nowhere”* (Interviewee 5, 2018). As these examples demonstrate, it can be seen that customer centricity and problem solving are very crucial to include within a company and without these, a firm cannot really be DT oriented. Similarly, higher management and strategic understanding of DT was highlighted as follows *“If we really want to have a big impact...it requires that in the higher level...people with decision making power know and understand what this (DT) is about and start to require certain modes of operations...and certain processes and methods.”* (Interviewee 1, 2018). Another reasoning was the following: *“it requires an executive managements’ support, even though one could implement it (DT) in smaller...but when it comes to innovation, there needs to be the support from higher management level.”* (Interviewee 6, 2018).

Customer centeredness is the starting point of DT and as the literature review and organizational level case analysis indicates, it is something that is always included in DT

and innovation. In addition, problem solving and empathy, which are closely linked to customer centricity were highlighted as being necessary for successful innovation project. From the organizational level analysis, it can be seen that DT has to be accepted as a strategic, higher management decision in order to be successfully implemented. In QCA, when a necessary condition receives a coverage value higher than 0.5, it indicates a good coverage (Legewie, 2013). In addition, also the consistency should be higher than 0.9 with necessary conditions. These conditions were all existing in the innovation projects with a coverage value of 0,78 and a consistency value of 1.0 which indicate good coverage and consistency.

Deciding how each causal condition should contribute to the outcome was done before interpreting the results. The decision to include some conditions as present and some as present or absent was justified based on the previous theoretical knowledge gained from the literature review and by combining this knowledge with the interview data. In this study, the decision was to have all the other conditions present when contributing the outcome except for the following: innovation supported and encouraged, designers' involvement, use of DT as a process or tool and DT included as a philosophy. Innovation support and encouragement as a company cultural aspect was seen in the case companies as a supporting factor but it was not seen crucial when it comes to innovation project success. Following the human stream of IM studies (e.g. Adams et al, 2006), it is important to have a culture that supports innovation although innovations can still be created without this acknowledged factor. Thus, this condition was decided to be either present or absent, when contributing for a given outcome.

Brown (2009) highlights that DT stems from the way designers view customers' needs, but this does not mean that designers' involvement acts as a crucial factor when it comes to innovation project success. In addition, the interviewees agreed with this justification. Interviewee 6 (2018) highlights that one does not have to be a professional designers, but instead, anyone can act as a designer, at least in company D. DT's usage as a philosophy and DT's usage as a process or a tool are factors that were also chosen to be either present or absent when these conditions exist in successful innovation projects. Even though some DT models or processes were in use in the case companies, there is no theoretical proof that indicates that these kind of DT models or processes have to be in use in order for innovation project to be successful. As the literature review also indicated, there is considerable ambiguity when it comes to understanding the nature of DT. Thus, there can be no clear theoretical proof stating that DT has to act as a guiding

philosophy in innovation project in order for the project to succeed. In addition, the interviewees highlighted that DT usage as an acknowledged philosophy does not play a crucial role, but instead the other matters, such as customer centricity, problem solving and empathy and experimenting and opportunity looking should be present in order for successful innovation to happen.

#### 4.2.1 The crisp-set QCA results

In crisp-set QCA, there are three different analysis results provided: a complex, parsimonious and intermediate solution (Legewie, 2013). The complex solution does not include any a simplification assumptions. This means that when the amount of conditions is higher, the solution term is hardly reduced and this makes the analysis rather difficult (Legewie, 2013). According to Legewie (2013) the parsimonious solution reduces the causal relationships into a minimum amount of conditions possible and thus the conditions included in this type of solution cannot be left out from any solution to the truth table. The intermediate solution then again consists of selected simplifying assumptions and as such, reduces complexity, but at the same time this type of solution should not include the assumptions that could be inconsistent with empirical knowledge (Legewie, 2013). Thus, intermediate solution indicates the needed results for this research. In this study, this intermediate solution is shows the most important results and was chosen as the focus of the analysis. This intermediate solution of the crisp-set QCA is presented in table 10 below.

Table 10. The intermediate solution of the crisp-set QCA

Condition	Recipe 1	Recipe 2	Recipe 3	Recipe 4	Recipe 5	Recipe 6
Problem solving and empathy	X	X	X	X	X	X
Customer centricity	X	X	X	X	X	X
Strategic reason and understanding	X	X	X	X	X	X
Testing and validating	X	X	X		X	X
Opportunity looking and experimenting	X	X	X	X	X	X

Multifunctional collaboration	X	X	X	X	X	X
Designers involvement in projects	X	X		X	X	
Innovation supported and encouraged		X		X	X	X
DT process/tools/model used			X	X	X	
DT included as a philosophy	X		X	X	X	X
<b>Raw coverage</b>	0.79	0.29	0.14	0.07	0.07	0.29
<b>Unique coverage</b>	0.5	0.0	0.07	0.07	0.07	0
<b>Consistency</b>	0.73	0.67	1	1	1	0.67
<b>Projects explained</b>	4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18	4, 5, 7, 8, 13, 17	2, 13	3	1	4, 5, 7, 8, 13, 17

In table 10 the first column indicates the DT conditions. These conditions form the combinations of conditions that include the different alternative paths to the outcome, which in this study is the successful innovation project. The other columns combine the different recipes of these different combinations by indicating whether the certain condition has been present (X) and thus been contributing positively to the outcome.

The raw coverage in table 10 shows the extent to which each recipe can explain the wanted outcome. According to Legewie (2013) the lower the raw coverage score is the less empirically relevant the causal recipe. This means that the causal relationship is able to explain fewer cases in which the outcome occurred. Unique coverage scores can be used for two observations. First, unique coverage indicates how many projects can a given recipe explain in a way that any other recipe cannot explain the wanted outcome (Legewie, 2013). This means that higher unique coverage recipes have higher relevance because without them,

more cases would be excluded from the model. Second, if there is much overlapping between the different recipes, it is usual for the unique coverage to be quite low, below 0.15 (Legewie, 2013). If the consistency score, which can be seen in the second to last row in table 10, is lower than 0.75, it according to Legewie (2013) indicates a badly specified model in which there are conditions and causal relationships that have not been included in the model and might play crucial role in relation to the outcome.

As can be seen from table 10 the consistency scores for each recipe is higher than 0.75 in half of the recipes and very close to 0.75 in the other half. This indicates good consistency and thus shows that these recipes all explain the given outcome well. In two cases, the consistency was a slightly lower, 0.67. This is due to these cases having more failed innovation projects included in them, which means the wanted outcome is not explained as well as in other cases, which is very logical. The generally good consistency scores mean that when these combinations of DT exist in innovation projects the innovation projects have been successful which may lead to the creation of better innovations. From the 18 projects analyzed, four projects were assessed to be unsuccessful. This amount of failed cases is considered to be enough when the number of the cases is relatively small. As mentioned before, there were 7 logical remainders included in the analysis in order to provide a more coherent understanding of the possible combinations and associations of DT and IM. This inclusion of logical remainders gives good support to the relatively small number of cases.

When looking at the raw coverage, there are some variations between recipes. There are three recipes with higher raw coverage, recipe 1, 2 and 6. The other recipes only explain one or two cases, which is the main reason for the rather low raw coverage number. This means that recipes 1, 2 and 6 have higher empirical relevance and can explained a good amount of cases. Unique coverage is relatively high in only recipe 1. This means that this recipe has a higher relevance and can uniquely explain the wanted outcome. In three cases the unique coverage score is 0.07, which being lower than 0.15 indicates that there is some overlapping between receipt 1 and others. In addition, the remaining two recipes with a score of 0 have very high overlapping with the other receipts. This overlap is natural and was expected to due to the variation between the values of 1 and 0 given when forming the truth table, the receipts were rather similar between cases. The inclusion of logical reminders is also one reason for the overlap between the recipes when some cases are involved in the thought

experiences that were included to bring more variation to the relatively small number of cases. Still there is relevance in the results, when looking at the consistencies and raw coverage especially in recipe 1. Recipes 2, 3 and 6 are overlap with recipe 1, and thus these recipes can be excluded from a deeper analysis.

Recipe 1 includes in total 8 DT conditions. These are problem solving, testing and validating, customer centeredness, experimenting, multifunctional collaboration, designers' involvement, DT philosophy and strategic reason. Out of the ten included DT conditions, only two were left out of this recipe, DT's usage as a model or process and innovation supported and encouraged. These two conditions were classified as the ones that contribute to the wanted outcome, when present or absent, which gives support to this recipe not including them. Recipes 4 and 5 both indicate a causal relationships for only 2 cases. In recipe 5, all the DT conditions are present and in recipe 4, testing and validating was absent. Due to them explaining a relatively small amount of cases, these can be considered to be less relevant.

The evidence for the different DT conditions, from which the recipes are formed can be seen in appendix 5. This evidence is a collective summary of the different projects and provides the main examples of the ways these DT embodiments were seen in these projects. There will be no project specific information explained in the appendix 5 in order to ensure the anonymity of the case companies. This evidence for each DT condition is all based on the interviewee notes, and does not include direct quotations, but instead explains the subject in a simple form in order to provide more clear and understandable evidence.

Customer centricity was seen as following "*...we took customer into the center of everything*". In addition, without people from different parts of the organization coming together with a common goal to solve customers' problems, the innovation project cannot succeed. Combining these conditions with problem solving, "*problem solving was the starting point to everything*", and testing and validating as being the tools to see how the customers feel about the project was crucial for the innovation project success. Furthermore, higher management understanding, described as "*nothing should be let to move forward without this DT understanding*" and experimenting and opportunity looking that was described as "*experimenting is very crucial and helps in picturing what the innovation could*

*be like*” support innovation projects as DT conditions. Lastly, DT’s inclusion as a philosophy and designers involvement from which the evidence says for example the following “... *there are designers used in every project*” and “...*customer is in the center in everything, thus DT was guiding it all*” were both contributing the innovation project outcome positively.

In conclusion, these recipes vary very little from each other. Innovation support and DT’s usage as a process or a model are the embodiments that seem to be both lacking and being irrelevant. Thus, the other embodiments together provide support to successful innovation projects. However, this does not mean that these two DT embodiments should be entirely excluded and forgotten and could not thus be supportive conditions when aiming for successful innovation project. The results from the QCA only indicate that in these cases, their presence or absence does not play a crucial role when aiming for successful innovation project outcomes. This crisp-set QCA proofs that there can be found causal relationships of DT conditions that provide successful innovation projects according to the empirical data.

#### **4.3 Measuring innovation management success**

The final results of this empirical research is to measure IM. In order to figure out how DT has influenced on IM, IM has to be measured properly. This means that these innovation projects have to also be measured so the project success can be measured. In the QCA this outcome variable was the success or failure of the project, and this was decided based on the interview data. The more project specific measurement criteria was not discussed so deeply during the interviews, but instead this measurement criteria was discussed at an organizational level. Still it was stated that these projects included in the QCA were also measured according to the company metrics of innovation. Thus, during these interviews, it was discussed how these companies measure IM success in projects in general. As the literature review indicates, these IM metrics vary depending on the type of innovation and different contextual factors. Table 11 combines the different insights regarding the metrics used in these case companies.

Table 11. Innovation management metrics used in the case companies

	<b>Company A</b>	<b>Company B</b>	<b>Company C</b>	<b>Company D</b>	<b>Company E</b>
<b>The metrics used for measuring Innovation management</b>	Customer satisfaction, different sales and revenue growth numbers, Net Promoter Score (NPS), project schedule, employee expectations fulfilled number of orders.	Customer satisfaction, design maturity, development phase, ROI, number of ideas, business goals, NPS.	Staying on schedule, NPS, project cost, average revenue per order, customer feedback, number of new innovations/products, growth numbers.	Categories of metrics: happiness, engagement, adoption, retention, task success. Freedom in teams to choose the suitable metrics inside the heart framework. NPS, customer satisfaction, sales growth.	Customer centeredness highlighted. Different long-term metrics, not just short-term numbers. ROI, revenue and sales growth, brand value.
<b>How the metrics are used</b>	Metrics could be used more deeply and thought how these indicate the reality	Various metrics used depending on the context.	The company believes that you will receive what you measure, thus the measurement criteria is so crucial.	Heart framework in use. Different and manifold metrics depending on the project	It is highlighted that the metrics vary depending on the context of the project.

All these companies use both qualitative and quantitative metrics and highlighted the importance of having the right metrics in use. Some companies already had the metrics

system that worked for them very well but some companies mentioned that there is still work to be done in order to measure IM properly. As table 11 indicates, there are various metrics in use in these companies.

Some similarities could be found between these companies. For example, customer satisfaction and sales and revenue growth numbers were highlighted in all companies as important key metrics of IM. Also net promoter score (NPS) was very much in use in these companies. Interviewee 1 (2018) stated that it would be very good to have the right kind of metrics in use so misunderstandings would not occur when and if something is measured with wrong metrics. Also interviewee 7 (2018) highlights the importance of having the right metrics: *“measurement is in a big role and...it is very common that there is no patience to use the right metrics...this is why short term metrics are so much in use.”* All the interviewees were given some examples of metrics that were mentioned in the literature review in order to give some perspective on the subject. There was a common understanding between the interviewees that these example metrics are the kind of that are in use and should be in use as well, but the key is to choose the right metrics for the right object.

As a conclusion of all the findings presented above, it can be seen that all these companies use DT in order to have better innovation process. There are several DT factors, the so-called causal relationships that can be seen to have a positive association to innovation success. In addition, these companies see DT rather similarly as a guiding philosophy that helps these companies to be customer centered and create new products and services that are solving customers or users problems. These companies have identified the different dimensions of DT and have successfully implemented DT into the organization through company cultural development or are on their way of doing it. This requires higher management commitment and understanding and sense of urgency. DT can be seen to have a positive connection to IM. IM is measured in different ways in these companies. Some common factors can be identified such as customer satisfaction, NPS and different sales and revenue growth numbers. All the companies highlighted the importance of having the right metrics in use in order to really see and identify the success of IM. Next, these findings presented above will be discussed in relation to the literature.

## **5 DISCUSSION**

The results from this study presented above focused on indicating the main outcomes from the qualitative inductive research conducted for this thesis. These outcomes were focusing on answering the three research questions in this study. The first research question explores the connections and associations that DT has on IM. The second and third research question support the first research question by exploring what the concept of DT actually is and how it has been implemented into organizations. The aim for this research is to find answers to these research questions by combining the empirical evidence and previous knowledge and thus provide new insights to the field of DT and IM, and if possible contribute to theory. In this part, the main contributions from the empirical evidence will be connected to the literature and theory. Through this combination, answers to the research questions are provided. First, the discussion will explore the nature and the concept of DT. Second, the inferences and implementation of DT to IM are discussed.

### **5.1 The nature of design thinking**

As the literature review indicates, there is considerable ambiguity around the concept of DT. Design thinking is widely seen as a user centered philosophy that inspires and creates innovation (Brown, 2008). As the qualitative study indicates, these case firms also see DT in an organizational level as a philosophy that highlights the importance of being customer centric. Design thinking as a term is used in the academic discussion, but it is not well recognized in these case companies. Reasons for this are manifold. First, these case companies emphasize the importance of delivering best possible customer or user experience. This naturally means that in order to provide this customer experience, firms need to be customer centered in their innovation process. This leads to being DT oriented. Thus, companies talk more about being customer centric, when they are actually very DT oriented. The questions remains, whether or not it is necessary to talk about DT as a conceptualized term or is it enough that the idea of DT is put into use in practice.

Johansson-Sköldberg et al. (2013) identified that DT literature has two discourses, design thinking, which is a broader field that emphasizes a wider concept and designerly thinking, which refers to theoretical reflections on how professional designers think. In addition, other scholars have identified the ambiguity around the concept of DT and that it can be seen as a

tool or a methodology and as a philosophy (Brown, 2009; Liedtka, 2015; Carlgren et al., 2014). The findings of this study indicate that DT is seen in practice as a broader concept that goes beyond the context of design and acts or at least should act as a guiding philosophy that highlights the importance of being customer centered. Due to the complex nature of DT, it was important to see what could be the embodiments of this DT philosophy in the study.

### **5.1.1 Design thinking's embodiments and dimensions**

Because DT is seen as a philosophy that enables customer-centered innovation to happen, it must have different embodiments and dimensions. As presented above, DT was studied through different embodiments and these conditions were recognized by combining the interview data and the literature review. In the literature review, there were in total six dimensions of DT identified. When looking at the results of the study, it can be seen that customer centeredness/market orientation, experimenting, collaboration and problem solving where the kind of dimensions that were divided into the different embodiments of DT used in the QCA. Innovation was seen more as an outcome of DT and strategy as an enabler of DT. Liedtka (2015) pointed out that deep understanding of users helps in bringing customer to center of focus, when innovating solutions to problems. In addition, problem identification is done through customer centricity and in this, empathy acts as a critical enabler for identifying the right problems that need solving. This empathy is highly linked to user focus, which Carlgren et al. (2016) identified as one of the themes in DT. Whether the term is user focus or customer centricity, this dimension of DT is clearly the starting point and the core of DT. As the results from the study also indicate, customer centricity is one key factor of DT and it can be seen in many forms, for example in user centeredness and in the focus on providing best possible customer experience.

Problem solving was also identified as one dimension of DT in the literature review. Carlgren et al. (2016) used a term problem framing, which means that the idea is not just that problems need to be solved, but instead it is crucial to find the right problems to be solved. This dimension goes hand in hand with customer centricity. By being customer centered in problem solving, one ensures that the problems that are solved are the right ones. The findings also provided support to this dimension and all the case companies highlighted the importance of solving the right problems. Collaboration and especially multifunctional collaboration as DT's dimension was also recognized both in the study and the literature

review. Davis et al. (2016) stated that DT is an iterative, human centered and co-creative way to give support to innovation. By co-creation, Davis et al. (2016) mean that innovations cannot be created alone, but that they require expertise of many individuals from inside and outside the company. Multifunctional collaboration ensures that there are the right people involved in the innovation process. The case companies also highlighted that multifunctional collaboration is crucial in order to have all perspectives and inputs considered.

Experimenting, as a dimension of DT included the need to test and validate new ideas. Experimenting can also be linked to a wider perspective that sees experimenting as a company cultural factor that highlights the importance of looking for new opportunities and predicting the future. Due to this dual nature of experimenting, this dimension was divided into two different DT embodiments when conducting the study. Testing and validating highlighted the importance of asking what the potential user thinks about the new innovation, while opportunity looking was more about being open to new ideas and constantly trying new things even though they might fail. Both of these DT embodiments were seen important in different projects in these case companies. Especially testing and validating were seen as important part of DT. The different DT scholars have also identified this as a theme or a tool of DT (e.g. Liedtka, 2015; Carlgren et al. 2016; Brown, 2008).

The other DT embodiments used in the study, were higher management understanding and strategic importance to be DT oriented. Furthermore, innovation support was seen as an embodiment of DT. These two factors are more closely linked to enabling DT to happen through these other embodiments and result in successful innovation. This strategy linkage with DT has not been as widely studied as other dimensions, but the findings above indicate that it is crucial that DT is included and implemented as strategic decision that relates to providing the best possible customer experience.

Also strategic interests towards different innovation projects is crucial or at least innovation creation should be supported and encouraged one way or another in these companies, if and when the goal is to succeed in different innovation projects. Even though the crisp-set QCA suggested a causal relationship that did not consider innovation support and encouragement as a crucial connection, it does not mean that it should not exist in companies. As the interviewees mentioned, cultural change is one key factor, if firms want to become more DT

oriented. When looking at figure 6 presented in the literature review, it can be seen that this framework for organizational learning gives good support to the interviewees' statements. Higher management involvement and understanding and most importantly transformational leadership was identified to have a positive impact on innovation (Prajogo and Ahmed, 2006; Elenkov and Maney, 2005; Jung et al., 2003). The findings give very clear support to this as well, when identifying higher management understanding and strategic importance of DT as one crucial enabler of DT.

The other embodiments that were not included in the literature review as dimensions of DT were DT's process, designers' involvement and DT's inclusion as a philosophy. These three causal relationships are broader and intangible and as such indicate how DT is perceived in these different projects. According to the results, there were several different so-called recipes of these DT embodiments and these recipes include also these three broader causal relationships. These causal relationships were not evaluated to be among the most crucial DT conditions in the crisp-set QCA, meaning that these conditions could be either present or absent when contributing to successful innovation project.

DT's usage as a model and process in these recipes means that DT has a certain process that it follows in the innovation process within these case companies. In the study, it was discovered how this DT process or model might influence the project outcome. When seeing DT as a process, it is natural that at the same time it acts as a more concrete tool that provides a certain outcome. These findings are not in line with the existing literature. Furthermore, the literature has not found common ground when it comes to this matter. The reason for this again lies in the ambiguousness that surrounds the concept. Liedtka (2015) identified DT to include seven different tools, such as visualization, prototyping and field experiments. When considering the model of DT, Brown's (2008) model can be seen in many of these case companies. This model presents the process of DT that moves between problem definition, idea creation and testing and implementing. When combining these observations regarding the nature of DT as a tool or a process or a model, one can see that it lacks coherence. When looking at the results of the study, it can be seen that DT in practice includes this process and tools more as an embodiment itself, which also has linkages to other embodiments or can be seen through these embodiments. However, when considering the results, this process-like character of DT was highlighted and thus it needs to be looked at case by case.

In conclusion, the process of DT as an embodiment of DT together with the other embodiments has to be examined separately but at the same time through other embodiments. When opening up the process of DT (Brown, 2009) in more detail, it can be seen that many of these DT embodiments happen through this above described process.

DT's nature as a philosophy was already discussed above and it was concluded that DT is seen more as a philosophy that guides the process of innovation both in the literature and in the results. As an embodiment of DT, this philosophic nature of DT was seen very important but at the same time not as crucial as some other conditions. DT as a philosophy has the similar nature that it has as a process. It needed to be included in the QCA as an independent causal relationship but it actually exists through these other embodiments of DT. This was also one of the reasons why it was included in the crisp-set QCA, this condition was considered to contribute the outcome when either present or absent.

The last causal relationship of DT included in the crisp-set QCA was designer's involvement. Many scholars have pointed out that DT has stemmed from the way designers view customer needs and solve problems and thus professional designers possess the talent to be very DT oriented (e.g. Brown, 2008; Meyer, 2015). In the study, this designers' involvement was taken as one of the causal relationships in order to see how their involvement is linked to the project success. The existing literature does not consider it as a necessity that needs to exist in innovation process, but it does no harm that there are designers involved in those projects. The results from the research indicate that in the recipes of successful innovation projects, there has been a designer involved. This does not yet give proof that this condition needs to exist in the innovation projects, but at least within this context, it seems to contribute positively to the innovation project outcome. Figure 11 combines the discussion about DT's different dimensions and embodiments and provides a description of DT that takes into account these different embodiments, dimensions and natures of DT and brings coherence to the ambiguousness that surrounds the concept. This figure 11 explains how these different causal relationships chosen for the crisp-set QCA and these dimensions and tools presented in the literature review are seen according to the findings of the study.

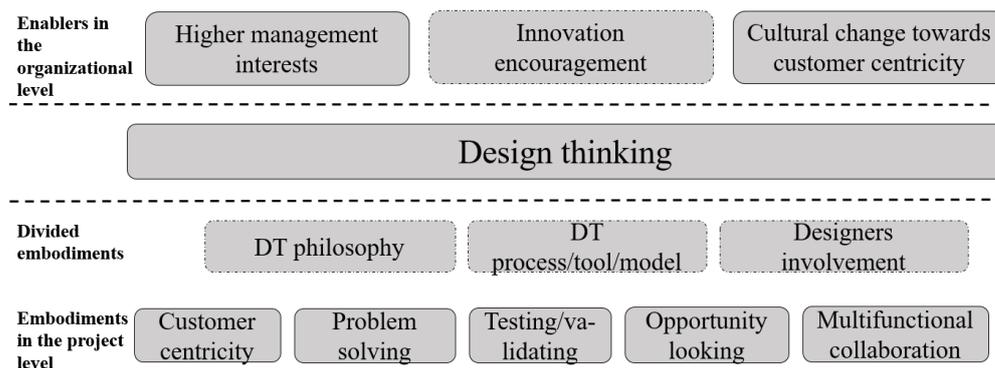


Figure 11. Design thinking explained through its different enablers and embodiments

Hence, this master thesis aims to theorize about DT and innovation, following the importance of real cultural changes and customer or user behavior and challenges. DT brings the analysis of cultural and individual behavior into innovation management, bringing the analysis of individual and collective behavior to strategy and connecting the company to real experiences of customers and end users. Thus, DT builds a new type of value creation for companies based on real societal problems, and the connection between business and society. DT makes products and services more useful for society. This includes the five main dimensions of DT value creation: customer centricity, problem solving, experimenting, opportunity looking and multifunctional collaboration.

## 5.2 The inferences of design thinking and innovation management

As presented in the results, DT inferences with IM through its different conditions. These embodiments and the nature of DT was discussed in the previous chapter, but it remains somewhat unclear, what kind of connection does these embodiments have on IM. The findings from the crisp-set QCA and the comparative case study analysis provided general support to the fact that DT enhances innovation. This is in line with previous studies' results as well, which have required more empirical evidence regarding DT's connection to innovation outcomes (e.g. Liedtka, 2015; Carlgren et al., 2014). This finding means that when being more DT oriented and thus having these different enablers and embodiments included in the innovation process, there will be more successful innovation projects. This means that DT supports IM positively.

There were in total six important recipes provided through the crisp-set QCA. These recipes varied only little and included many identical conditions.

Ragin (2017) suggests that combining a so-called superset of the different recipes can provide a more coherent understanding of the QCA. This is done by looking at the presence of different conditions in different recipes and identifying those conditions that are present in the different recipes. This superset can be identified from the QCA results, including the following conditions: problem solving and empathy, customer centricity, strategic reason and understanding, opportunity looking and experimenting and multifunctional collaboration. This superset recipe indicates that these present conditions of DT can be considered important conditions in innovation projects.

Even though the QCA did not provide many clear causalities in this analysis, it can still be seen that at least in these cases, there has been positive connection between these causal relationships and the innovation project outcome. As the findings indicate, from these causal relationships, problem solving, customer centeredness, opportunity looking and experimenting and higher management interests were seen in every project included in the QCA as a superset. These factors have been highlighted by many researchers as well and it is quite clear that these DT's dimensions are very crucial parts of DT and IM. In order to create successful innovations, one must be customer centered, solve problems in a right way, have higher managements' strategic understanding and support for the projects and look for new opportunities continuously.

Other causal relationships that have also been much in use were designer's involvement, testing and validating, DT's inclusion in the organization as a guiding philosophy and multifunctional collaboration. As mentioned already, DT scholars have also identified these embodiments and their importance to innovation. As already explained, designers' involvement and DT philosophy and their relationship with the innovation project outcome can be considered differently. In addition, the last two conditions, innovation support and encouragement and DT's usage as a tool or a process, were used rather much in these projects but were the ones that according to the crisp-set QCA were not contributing to the innovation project outcome as much as the other conditions in these cases.

These results indicate that there is rather good evidence that DT has a positive impact on IM in the project level. This means that by including these different causal relationships into innovation projects, the project outcome is more likely to be successful than without these

inputs. What then makes these DT factors a part of IM process? What are the differences between DT process and innovation process and how can these processes be combined in a way that there is a theoretical base for this connection? By combining the empirical evidence from the study with the IM theories, these questions can be answered.

### **5.2.1 Design thinking transforming innovation management**

As stated above, there is a philosophical nature in DT. If DT is a philosophy, how have different scholars and companies managed to model their so-called DT process. And if and when there is a process of DT, how can this process be linked to innovation process? As Berkhout et al. (2010) have stated, innovation management is a cyclic process that depending on the context goes through product creation, market transitions, scientific explorations and technological research. Some argue that innovation cannot be managed and employees can by themselves innovate through this cyclic process. This can be the case in some companies meaning that the company has usually decided and understood from the very beginning that innovation needs to happen and has developed a structure that enhances continuous unmanaged innovation to flow through the company. This was the case in one of the case companies as well. Still, the case companies all followed a rather similar process of DT, which can be very easily linked to the models of DT presented in the literature review.

The cyclic innovation model is a model that considers innovation creation to be a cycle that flows through scientific explorations, technological research, product creation and market transitions. This model considers the changes in the market environment and customer needs and connects it with the technological capabilities. (Berkhout et al., 2010) As discussed above, DT is a customer-centered philosophy. According to the findings, DT shapes this cyclic innovation model by bringing customer centricity into the model more strongly. While technology is important, the new products and services that new technologies enable, need to be designed according to customer needs. Berkhout et al. (2010) stated, that this model can be used in real innovative environments. While there is no arguing that this cyclic innovation model does not model the process of innovation in an ideal environment, it does seem that this model could be more customer-centered, because this is the key difference that DT brings to innovation. In this cyclic innovation model that is shown in figure 7, DT is mostly included in the product creation phase. This model explains how innovations are created in the markets through this cyclic process and how innovations are created by

considering both the technological research and market research. This is where DT plays a crucial role. DT with its embodiments helps in having customer understanding and creating the kind of products or services that the customers want. When Berkhout et al. (2010) explained that their cyclic innovation model combines the two viewpoints, technical and market oriented, DT acts as the philosophy that makes this connection happen in the project level.

In addition, the open innovation model presented by Chesbrough (2012), is very much related to technology and takes a viewpoint that explains the creation of innovations from a technology point of view. In the case of open innovation, DT plays a crucial role in making these innovations the kind of the customers want. DT's customer centric nature could bring the right kind of viewpoint so these new technologies serve the customers and thus really become successful innovations that improve firms' performance. When looking at the model of open innovation in figure 7, DT should be placed inside the funnel and act as a philosophy that turns these new ideas and technologies into products, services or processes that either serve the current markets or create new markets. One should consider, whether this model of open innovation really explains how innovation is created, or whether it is just a model presenting how different technological innovations can be managed within companies. When it is considered as the latter one, it better serves its purpose than when it aims to explain the whole IM process.

The results indicate that DT has a positive impact on innovation at a project level, changing IM towards a customer-centered orientation serving for co-creating value. The process of DT in project level indicates a very customer centered model that focuses on creating or developing new innovations through careful problem identification, idea generation and implementation. DT's philosophy brings the much-needed customer-centricity into innovation and should be included in the innovation process, solving real problems in society. The models of innovation management presented in the literature review describe the theoretical base for innovation. DT should be implemented into these models as a guiding philosophy, as the results indicate. The process of DT is included in the philosophy and can be seen in the project level, in innovation projects. The innovation management models presented in the literature review, describe the IM process in the organizational level, which means that DT should be included in these models more as a guiding philosophy. These

models might not even need changing, and can include DT already. DT and its changes are happening in the project level, where the innovation creation happens. When looking at DT's role in a bigger picture, one must consider more deeply how it is implemented into IM. The implementation of DT into IM is discussed next.

### **5.2.2 Implementing design thinking into innovation management**

The results of the analysis indicate that DT is a customer centric philosophy that affects IM positively. The third research question of this study focuses on figuring out, how DT is implemented into IM. Hurley and Hult (1998) and Slater and Narver (1995) studied how different organizational learning happens through culture and climate. As the results indicate, the case companies highlighted that it is extremely important to have a company culture that supports DT. This means that in order to implement DT into IM, companies must have a culture that enhances DT. This cultural shift does not happen itself, but it requires higher management commitment and understanding of the needs to become more DT oriented.

As the framework presented in figure 6 indicates, there are several cultural and climate related things affecting the organizational learning process and innovation. This framework suggests that through organizational learning and innovation, companies have better customer satisfaction and new product success that leads to better profitability, capacity to innovate and competitive advantage, which again affects the company culture. When adding DT into this framework as a part of company culture and climate this framework would very well explain how DT shapes IM and how DT should be implemented into it. When considering these findings and the literature review, a framework for DT can be created. This framework presented in figure 12 considers DT is a philosophy in the organizational level that guides the IM process to create innovations that serve their users. When adding DT with all its embodiments into innovation projects, it will lead to better customer satisfaction and sales growth, which are good indicators of company performance as has been highlighted in this study as well.



Figure 12. The customer-centric role of design thinking in innovation management

This very simplified framework that can be seen in figure 12 combines the results of the study with the literature review. It suggests that the changing market environment pushes higher management to consider their business from a more customer-centered perspective and this requires cultural change towards being more customer centered. This customer-centered philosophy that is named as DT supports the innovation projects through its embodiments, such as customer-centeredness, problem solving and empathy, testing and validating, multifunctional collaboration and opportunity looking. This again leads to more successful innovation projects which leads to better company performance.

In conclusion, DT is by nature a philosophy that guides the innovation process through customer centricity, validating and testing, opportunity looking, multifunctional collaboration and problem solving. DT has a certain process and stems from the way designers view customers' needs and problems. This provides an answer to the second research question. DT is implemented into the organization through a cultural change to become more customer centered and the key enablers in this are higher managements' strategic commitment to DT and innovation encouragement. This provides answers to the third research question. When answering the first research question of this study it seems that DT has a positive connection with IM. This means that by including DT into innovation

projects and implementing it into the organization in general, companies have more successful innovation projects and IM. In addition, successful IM should be measured with both qualitative and quantitative metrics, among them the most important metrics identified in the study, such as customer satisfaction and happiness, promoter scores and long-term sales and growth numbers.

## 6 CONCLUSIONS

DT is a concept that has gained quite a lot of attention during the past decade in the managerial discussion. Companies have implemented DT into their organizations more visibly and DT is highlighted to be an important factor in innovation. In general, service design and designers use in innovation projects has become more important. The capability to innovate and keep up with the changing market environment is becoming more crucial for companies, who want to stay in the competition. This means that innovation is nowadays one of the most critical success factors in companies. This thesis studied DT and its associations with IM and aimed to provide answers to how IM can be more successful through DT.

### 6.1 Theoretical contributions

Many scholars (e.g. Brown, 2008; Liedtka, 2015; Carlgren, 2016) have studied DT and provided support to the argument that DT has a positive impact in innovation. These studies however suggest that further empirical evidence is needed in order to prove this phenomenon. Previous studies have provided a good base for studying DT and innovation, but the field of study has still lacked coherence and there has been a lot of ambiguity around the concept of DT. This thesis provided support and answers to these needs by presenting a qualitative study that looked into the context of DT within five large or medium sized case companies. The results indicate several contributions for academia that can be seen in table 12.

Table 12. The main theoretical contributions

Contribution 1	DT can be studied and is acting as a concrete philosophy that guides organizations towards being more customer-centered.
Contribution 3	DT has different embodiments that can be placed to exist in the context of DT. This can be empirically studied.
Contribution 3	There is this so-called DT process and it can be seen in different innovation projects where DT has been in use.
Contribution 4	There seems to be a positive inference between DT and innovation management.

Contribution 5	Higher management understanding and commitment to use DT and organizational structure that enhances innovation and cultural shift to become more customer centered play a crucial role of innovation management change when implementing DT.
Contribution 6	DT changes innovation management by focusing on co-creating value with customers embedded needs and value creation.
Contribution 7	DT builds a new theory of value creation to society by connecting the company to customer and end user needs.

First, a question about DT's concept like nature can be debated. DT can be identified as a buzzword, which has caught a lot of attention in the managerial discussion, but academic discussion has not been among the most prominent ones. One reason for this surely lies in the lack of coherence that surrounds DT. One can even debate whether DT is really a concept that needs studying or whether it is more of a buzzword that connects different ways of thinking into two unclear words. Brown (2009) certainly did not think that DT is just a buzzword, but a philosophy. He created an exciting concept of DT, which connects with innovation through design (Brown, 2009). Other scholars have as well studied DT as a concept and have stated that designs' nature is complex due to the inherently complex human activity (Shearer, 2015). This is why it is so difficult to conceptualize DT. Still the results of this study indicate that DT is a concept that can be empirically studied. It does not require complete coherence to study DT, but instead it is important to understand that the nature of DT is manifold. There is no one correct definition of DT, but the results of this study suggest that DT is acting more as a philosophy that guides and supports the innovation process to be more customer-centered. This research provides evidence of this philosophical approach of DT that enhances innovation towards real customer, social and market needs framing new value-based methods and tools of customer, society and market-trends.

Second, the embodiments of DT used in this study can be seen as more concrete and familiar tools or themes of DT. One could argue whether these embodiments need to be placed under the concept of DT or whether these embodiments could just act on their own and produce the same positive connection to innovation project outcome. This might be true in some cases for sure but the results indicate that only the certain recipes of these DT conditions provide the wanted outcome. This means that these embodiments together are stronger than

when acting alone. It also means that it is not for example enough that innovation projects are just customer-centered, but it is also very important to have the right kind of problem solving and multifunctional collaboration involved. This finding is rather significant and gives proof that these embodiment are a part of a bigger context, which in this study is defined as DT.

Thirdly, when it is clear that DT is a concept that can be empirically studied, it is important to provide the ways to do this. This study suggests that DT's connection with innovation is studied in the project level through the different embodiments of DT. These embodiments have been recognized in previous research as being part of DT and the results indicate that these embodiments are also important in practice within these case companies. Because DT is in particular a philosophy, that includes different tools (Liedtka, 2015) and themes (Carlgren et al. 2016), it is important to find common ground on which tools or themes or as in this thesis these were called dimensions, conditions or embodiments, belong to DT. This study explained how these different dimensions of DT can be located within the concept of DT as figure 11 concludes. Even though DT is primarily a philosophy, DT still has a process as many DT scholars (e.g. Brown, 2008; Liedtka, 2015) have proven already. This study gives empirical support that there is this so-called DT process and that it can be seen in different innovation projects where DT has been in use.

Fourth contribution to academia is that, this study suggests that there is a positive inference between DT and innovation management. This evidence comes from the project level QCA and provides the requested empirical evidence of the connection that DT has on innovation. In the organizational level it is understood that DT acts as a guiding philosophy that supports innovation management to be customer-centered and use DT's tools in innovation creation. In the project level, DT is seen through its embodiments and these embodiments are seen to have positive connection to the innovation project outcome. This means that while previous studies have provided some support to the argument that DT supports innovation, this study provides clear case evidence of this matter. By studying different larger companies from various industries, this study gives evidence that DT is perceived as a positive force for organizations and customer change, which provides good innovation outcomes. This discovery brings the much-needed coherence and empirical evidence that DT can act as a very critical success factor among bigger innovative companies.

Fifth, it is important to highlight that this study also opened up the organizational learning theories and their connection in the implementation of DT. This is the fifth contribution for academia from this study. This thesis provided a starting point for looking into how DT is implemented into organizations, and pointed out a few important enablers of DT, connecting innovation and society, building new end-user and societal value creation. Higher management understanding and commitment to use DT, organizational structure that enhances innovation and cultural shift to become more customer centered were these enablers of DT that play crucial role in the implementation of DT into innovation management. As some organizational learning scholars (e.g. Hurley and Hult, 1998; Slater and Narver, 1995) have already presented, organizational culture and climate have impact on how organization learns and enhances innovation. When DT is added into this as a guiding philosophy that takes place in the culture, innovation capabilities might increase inside the company.

Sixth, while innovation management has been studied by many (e.g. Chesbrough, 2012) and there is a rather stable understanding of how innovation process within companies should flow through a cyclic innovation model (Berkhout et al., 2010), this field has mainly focused on the technological side of innovation. By bringing DT into the field of innovation studies, it provides the much-needed market oriented viewpoint and more importantly the customer-centered viewpoint to the innovation research. This thesis proved that these concepts, innovation management and DT, are very much connected in the organizational and project level. This study provides proof of this connection and hopefully contributes this new insight to the field of study. Therefore, future research should build a theory of design thinking and value creation including co-creation with end-users and customer, society and large stakeholders.

Seventh, in relation to the development of society, this study brings new insight on how new value is created in society. DT builds a new theory of value creation to society that connects companies to real people. As mentioned earlier, DT supports innovation through its different embodiments, such as customer-centricity and deeper knowledge of customer or end user needs. Hence, through deeper understanding of customer or end user needs, these individual needs can become collective needs of the society. By implementing DT to innovation

management, companies can develop new products and services that support the needs of customers and end-users and thus new value is created in the society.

This research used QCA as a research method and by doing this, it provided evidence that this method can be used in DT studies. QCA is a new methodology for management studies and this thesis provides good evidence that this methodology can be used in this type of qualitative studies that aim to look for causalities and associations between different concepts.

## **6.2 Managerial implications**

There are several implications for practice as well from this thesis. The first and most obvious implication for practice is that DT should be implemented into companies because there is a positive connection seen between DT and innovation management. This study provided rather clear case evidence from companies operating in different markets, that DT is a good philosophy that supports innovation and thus should be used in companies who believe to achieve better firm performance through innovation.

Second, because DT is a philosophy that enhances innovation, higher management should first understand that DT is important in order to have successful innovation, and thus innovation management should consider DT as a critical success factor. The results clearly indicated that higher management commitment in the implementation of DT is extremely important especially in bigger companies. This is why this study suggests that DT is taken seriously in the managerial discursion. When DT is taken seriously within the higher management level and more importantly, understood correctly, it is important to start implementing DT through company cultural change. It is not necessarily important to talk with the term design thinking, if it sounds unnatural, but companies should decide what the most important messages to send in the cultural change process are.

Third implication for practice is linked to the terms' usage when implementing DT. Many companies talk about customer-centricity. This alone might not be enough, especially when the results of this study indicated that there are several DT embodiments that need to be included in innovation projects in order to have successful innovation project outcome. This is why some roof level concept is needed in order to understand what this cultural change is

about. Here the term design thinking might come handy. Still one result of the study was that there is no need to use the actual term, as long as there is a thorough and common understanding of the principles and the philosophy of DT.

Fourth, this DT orientation should happen through changes in the company culture. This means that if and when companies that do not have DT want to implement DT into the organization, it does not happen in a flash but it requires company cultural change towards a more customer-centered way. The results signal that there has been different levels of cultural change happening within these case companies and that there is no one answer fits all solution available when it comes to implementing DT. This is very context dependent and thus this study cannot provide any specific solution to how the implementation should be done. However, this study provides a clear theoretical framework for how DT is positioned within IM, and this framework can act as a guidance for managers when deciding how to explain the cultural shift.

The last clear implication for practice from this study is that while it is clear that DT supports IM in the organizational level, it also affects directly in the project level in innovation projects. This is why companies should include these different DT embodiments into different innovation projects. As mentioned in the literature review, these innovation projects can be varying from process innovations to product and service innovations. What is important here is to understand that by being customer-centered throughout the whole project, by spending time to identify the right problems to be solved, and by multifunctional collaboration, testing, validating and experimenting, these innovation projects are to succeed more likely than without these DT embodiments. By recognizing these results as important factors that need to be included in every innovation project in the company, firms might easily implement DT in the project level and achieve more successful innovation projects.

IM measurement was also one focus area in this thesis, because without the right metrics for innovation success, it makes no sense to study it. There was a rather common understanding between the case companies that it is crucial to have the right metrics in use in these innovation projects and these metrics can and should be decided project by project. There are some metrics, such as customer satisfaction and different sales and revenue growth numbers that should be followed but even more importantly it was highlighted in the results

as well as in the literature review that it is important to really think about the metrics and the time period in which these metrics are looked at. Even though this is not new information, this study provides some additional evidence regarding this matter.

### **6.3 Limitations and future directions**

Regarding limitations, there are few very important things in this study that need to be expressed. First, this study was a qualitative multi-method study, which means that the generalizations need to be addressed carefully. Qualitative studies in their nature usually aim to explain a certain phenomenon in a certain context and thus do not aim to explain things universally. However, this study used multiple cases in order to have better generalizability and give support to the argument that the same phenomenon can happen in different contexts. The companies used in this study are operating in different industries and in different market environments. It still needs to be pointed out that four out of five of these companies are based in Finland. Even though there was one company based elsewhere, this might still act as a contextual factor, which can affect the findings generalizability. Thus, including cases from different countries might have improved the generalizability.

There were in total five case companies, of which in total 18 innovation projects were studied more closely. This amount of cases is considered a rather good amount for QCA. However, out of these 18 cases, four cases were evaluated to be unsuccessful, meaning that true causalities from the QCA can still be difficult to identify. Still there can be some generalizations made out of these findings regarding the connection between DT and innovation project outcome. At least in these cases, this relationship was seen positive. Including more cases that vary in their nature might help in providing results that are even more reliable. Furthermore, including different sized companies in and comparing small and medium sized companies and larger companies could provide deeper understanding of the nature of DT. Because startups are usually by nature very DT oriented, it would be interesting to see what are the differences between different sized companies in their DT behavior. In addition, reviewing the different DT conditions and adding some other conditions that are identified to be involved in innovation projects, could provide deeper understanding and results. For example including some conditions which absence itself has theoretically a positive connection to innovation project outcome, could have improved the depth of the analysis.

There were two different research methods used in this study, comparative case analysis based on descriptive data analysis and crisp-set QCA. These methods support each other by looking into the same phenomenon from two different levels, organizational and project level. Thus, there is no limitation regarding the methodological choices but the limitation comes from the amount of total cases and the amount of data received from each case. Even though five cases is considered rather good in qualitative study, the amount of information from the cases could have divided more equally. From some companies, the amount of information in use was wider than in others. Still this amount of data was in a good level for doing the analysis and this study gives proof that this method is suitable when studying the inferences between DT and IM.

This thesis provided new insights for studying DT and empirical evidence to the connection of DT and IM. As mentioned earlier, DT is a common buzzword that has received attention in the managerial discussion but is still lacking coherence in the academic discussion. DT and IM have been studied before, but due to the ambiguous nature of DT, the field has lacked and requested for empirical evidence. This study provided some much-needed evidence of the connection between DT and IM through qualitative methods. Further studies could consider looking into this relationship with different cases that include more various innovation projects. Furthermore, as mentioned, the addition of other conditions affecting the innovation project outcome could provide new insights to this relationship. The scope in this study was in looking purely at DT embodiments and their impact, but identifying other causal relationships that influence the innovation project outcome might be in place. QCA was proven to be a good method for studying DT, but this study looked at the phenomenon from a very simple viewpoint. By adding causalities and perhaps conducting a fuzzy-set QCA analysis, these causalities could be explained in more detail.

Further research is needed to also provide clarity to the innovation outcome. While this study highlighted the most important IM metrics and their importance for IM, it would be interesting to see how different metrics indicate the innovation project success in the context of DT. Could it be that different metrics indicate different results regarding DT's impact on the innovation project success? While it is rather clear that innovation project success leads to increased capability to innovate which leads to better products and services, better

customer experience and thus better firm performance, these effects should still be empirically proved. Future research could focus on studying these effects more closely and link them to DT. This would provide more solid proof for the positive effects that DT has in organizations.

This study placed DT into the field of innovation studies by placing it inside the innovation process as a philosophy that guides the innovation creation towards a more market oriented and customer centered direction. Connecting DT into the models of IM still requires further studies regarding the nature and character of DT. This study provided the much-needed coherence to clarify what DT in fact is, but mapping it into different innovation management theories still needs further evidence and clarifications. While this study indicates that DT is or should be a keen part of IM within companies, it still needs deeper studies that look into the process of innovation and merge these theories of DT and innovation together.

Regarding the implementation of DT into organizations, it is unlikely that there could be a one size fits all solution to be found. This study provided some insights into what factors act as the enablers of DT but a more detailed description of the implementation process could be in place. This would especially help the practitioners when a need to be more DT oriented is in question.

While customer centeredness plays a key role in DT, it is likely that in the future companies need to go even deeper into behavioral sciences in order to really understand customers' behavior and provide them the products and services they want. Future studies should take this factor into account and provide tools and theories regarding the importance of using behavioral sciences in the innovation process. In addition, while DT was seen to be a good philosophy through which future and hidden needs of customers can be found, this factor needs further proof and behavioral sciences might be the missing link that explains how this is actually done.

Even though DT is a common buzzword, it has achieved a rather stable position as a concept. Other design related buzzwords have also arisen from these DT and innovation related discussion. One of these buzzwords is venture design. The key idea behind venture design is to combine DT with the startup culture, and thus offer larger companies the opportunity

to innovate by cooperating with startups or by creating startups inside the company. By looking deeper into venture design in the context of DT, further studies could provide proof and new theories on how innovation is created in the changing world.

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Interviewer: Kinnunen, S. Date: 18 January 2018.

## APPENDICES

### Appendix 1. The key words used in the key word search for the study

<b>The concept that was searched</b>	<b>The key word used</b>
Design thinking	Design thinking, Design, Industrial design, Web design, Designerly thinking, Total Quality Management, Service design
Innovation management	Innovation management, Innovation, Managing innovation, New Product Development, Open innovation, Radical innovation, Breakthrough innovation, Incremental innovation, Innovation tools, Innovation management measurement, Measuring R&D,
Organizational learning	Organizational learning, learning organization, market orientation, cultural change

## **Appendix 2. The structure of the interview in the form of the interview questions**

The interview will be semi-structured and the interviewer will record the interviews for her own research use only. Interview notes will be taken during the interview by the interviewer. Questions below can and will be clarified in the interview if needed by the interviewer and additional and more specific follow-up questions can be asked. The interviewee can get familiar with the questions beforehand but it is not obligatory or necessary.

Interview topics/questions:

1. How would you define DT?
2. What is DT for this company, how is it perceived?
3. There are several models of DT processes described in the academia, how do you see your company's process of DT/model of DT.
4. DT has many linkages and dimensions. Do you see that these dimensions are linked to DT in your company or the other way around?
  - a. Customer centeredness/market orientation
  - b. Problem solving
  - c. Strategy
  - d. Innovation
  - e. Multifunctional collaboration
  - f. Experimenting
5. The concept of Innovation management is understood differently. What is Innovation management in your company? What does innovation mean in your company?
6. What kind of innovation projects whether new or incremental product development processes have been done in your company? Give background of the project (size/scale, budget, importance, new or incremental development, what was the result/outcome)
7. How has DT been used in these projects? Describe this project by project.
8. How is DT affecting the innovation process in these projects? Describe this project by project.
9. How do you measure Innovation management/project success in these projects?
10. How have you implemented DT into Innovation management?

In the context of the study/Master's Thesis the following concepts are defined as followed:

*Design thinking*: customer/user centric methodology that highlights the importance of having customer insight, testing and prototyping and continuous learning in the process of innovation. Design thinking is influenced by the way designers view customer needs and thus contributes to decision making when understanding what customer values.

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*Innovation*: successful exploitation of ideas that bring value to the users and require skills in making new connections and challenging continuously the existing status.

*Innovation management*: Enabling the exploitation of new ideas and the value creation process that can be called innovation.

**Appendix 3. The design thinking condition explanations for QCA**

Problem solving and empathy	Testing and validating	Customer /user centricity	Opportunity looking	Multifunctional collaboration	Designers involvement	Innovation supported	DT process	DT included as philosophy	Higher management interest
Problem solving	Testing	Customer centeredness	Experimenting	Multifunctional teams	Service designers used from firms own resources	Innovation unit in the company	DT used as a tool	DT included in the minds of people	Strategic interest towards DT
Customer empathy	Validating	User centeredness	Looking for new opportunities	Idea creation in different parts of the organization	Service designers bought outside the company as a service	Innovation supported in the company	DT's process identified and in use	DT used as a background way of thinking	Strategic interest towards being more customer centered
Customer insights included in the process	Iterative development	Focus on customer experience	Predicting the future needs of customers	Communication between business units	Service designers leading the innovation projects	Innovation encouraged and highlighted as everyone's task	DT's model in use and identified	DT used as a guiding philosophy	Higher management commitment in innovation projects
Problem framing	Customer interviews					Cooperation with startups			Sense of urgency from higher management

**Appendix 4. The truth table of the crisp-set QCA**

Causal relationships, "DT factors or embodiment"	Problem solving, empathy	Testing/validating	Customer centeredness/User centeredness	Looking for new opportunities/predicting the	Multifunctional collaboration	Designers involved in projects	Innovation supported and encouraged	Design thinking model/process	Design thinking included as philosophy	Higher management interests	Outcome : successful/unsuccessful project
Project 1	1	1	1	1	0	0	0	0	0	1	1
Project 2	1	1	1	1	1	0	1	0	1	1	1
Project 3	1	0	1	1	1	0	0	0	1	1	1
Project 4	1	1	1	1	1	1	0	1	1	1	0
Project 5	1	1	1	1	1	1	0	1	1	1	1
Project 6	1	1	1	1	1	1	1	1	1	1	0
Project 7	1	1	1	1	1	1	0	1	1	1	1
Project 8	1	1	1	1	1	1	0	1	1	1	1
Project 9	1	1	1	1	1	1	1	1	1	1	1
Project 10	1	1	1	1	1	1	1	1	1	1	1
Project 11	1	1	1	1	1	1	1	1	1	1	1
Project 12	1	1	1	1	1	1	1	1	1	1	1
Project 13	1	1	1	1	1	1	0	0	1	1	1
Project 14	1	1	1	1	1	1	1	1	1	1	1
Project 15	1	1	1	1	1	1	1	1	1	1	0
Project 16	1	1	1	1	1	1	1	1	1	1	0
Project 17	1	1	1	1	1	1	0	1	1	1	1
Project 18	1	1	1	1	1	1	1	1	1	1	1

**Appendix 5. The qualitative evidence of the design thinking conditions in the QCA**

The causal relationship	The main evidence for the causal relationship. (*evidence for not having it)
Problem solving	<p><i>The starting point was that people have a need for this innovation.</i></p> <p><i>Our customers need better business intelligence.</i></p> <p><i>There is a certain growing need, thus we can provide this need while the customer fulfills another need.</i></p> <p><i>We have a lot of customers who want to do this but do not have the skills for it, how about we provide it as a service for them.</i></p> <p><i>We can prioritize different problems and challenge them within the organization.</i></p> <p><i>We solved problems when we asked what kind of problems the customer have in their lives.</i></p>

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	<p><i>We find the right problems to where we provide answers to.</i></p> <p><i>We use empathy to deeply understand customers.</i></p> <p><i>Every project starts with understanding the problem.</i></p> <p><i>Problem solving was the starting point to everything.</i></p>
Testing and validating	<p><i>We build a prototype and see that this actually works.</i></p> <p><i>The innovation process happens through iterations and continuous validations.</i></p> <p><i>We explored, validated and tested the ideas with customers.</i></p> <p><i>There was a design process were we prototyped, validated and iterated the product.</i></p> <p><i>Interviewing customers in a spontaneous situation real life situations</i></p> <p><i>Interviewing people about the functionalities.</i></p> <p><i>Building the actual prototypes of the products and testing it.</i></p> <p><i>There were interviews and hypothesis used.</i></p> <p><i>You follow the customer and prototype and receive feedback and iterate after that.</i></p> <p><i>Collected feedback and discovered the problems.</i></p> <p><i>Interviews with the users and with non users.</i></p> <p><i>Usability tests with customers.</i></p> <p><i>User validation and iterations according to those.</i></p>
Customer/user centricity	<p><i>We collect understanding of what the customer wants and where the world is going.</i></p> <p><i>In every project, there has been a customer centered take on everything.</i></p> <p><i>There is a strong connection to customer centeredness.</i></p> <p><i>We took the customer into the center of everything.</i></p> <p><i>Design itself helps being customer centered.</i></p> <p><i>We think it from the human side, everything else should be dependent on this.</i></p> <p><i>There is either reactive or proactive customer understanding but innovation is almost always very customer centered.</i></p>
Experimenting/ Opportunity looking	<p><i>There is these enablers that help look new opportunities.</i></p> <p><i>How can we create new value in a new way to our customers.</i></p> <p><i>Many new innovations have come from just experimenting new things.</i></p>

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	<p><i>Experimenting is very crucial and helps in picturing what the innovation could be like.</i></p> <p><i>DT acts as a translator for the world, what is experimented there and what we should look for.</i></p> <p><i>There is a freedom to fail and experiment. Sometimes it creates innovation, sometimes it fails.</i></p> <p><i>There is a strong connection to experimenting and opportunity looking in all projects.</i></p>
<p>Multifunctional collaboration</p>	<p><i>It is needed to provide something that can help all business units and this is way everyone comes together to create it.</i></p> <p><i>There is a clear need for multifunctional collaboration in innovation projects.</i></p> <p><i>There must be the right people from different functions involved in order to have all the viewpoints and insights.</i></p> <p><i>Teams including people with different skills and knowledge is essential.</i></p> <p><i>It requires everyone to have the same knowledge from different parts of the organization.</i></p> <p><i>It was a project that combined many different functions together and together the innovation was created.</i></p>
<p>Designers' involvement</p>	<p><i>There was service designers bought from outside the company in order to provide design knowledge.</i></p> <p><i>We brought the skills to do design from outside and it provided a good outcome.</i></p> <p><i>There was a service design project bought from outside the company.</i></p> <p><i>We invested into designers highly in order to have the right knowledge within these innovation projects.</i></p> <p><i>In our company, everyone can be a designer if needed, there are designers in every project.</i></p> <p><i>If there is designers in house it is good, they must be involved in the projects.</i></p>
<p>Innovation supported</p>	<p><i>*We don't have a well managed innovation unit or control of the process on how new ideas are managed.</i></p> <p><i>When something new is done, it is supported and seen as innovation.</i></p> <p><i>We see disruptions and realize it pushes us to create a managed innovation system.</i></p> <p><i>When we see something change, we can innovate something to it.</i></p> <p><i>We have different innovation units as well as support for individual innovation creation.</i></p>

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	<p><i>We created a culture for innovation and it was highly emphasized how everyone can innovate.</i></p> <p><i>This innovation was created from innovation team.</i></p>
DT process/model	<p><i>When using service design, there was a certain process of DT.</i></p> <p><i>In this project, DT has provided the toolset that guided the process.</i></p> <p><i>It has been one tool among other tools in the innovation process.</i></p> <p><i>We follow the existing models and processes of DT and modify those into our context when needed.</i></p> <p><i>We do not have a need to create our own model and processes because the existing ones fit very well.</i></p> <p><i>Simon Herbert's 7 step model is very well fitted to our company.</i></p> <p><i>There are elements that can be mapped into Brown's model.</i></p>
DT included as philosophy	<p><i>DT has been "a thing in the background".</i></p> <p><i>It has created a base where we can potentially build business on and it has worked well.</i></p> <p><i>*It has been still an inside out approach and not a guiding philosophy.</i></p> <p><i>This innovation project is a good example of an acknowledged DT that has guided the process.</i></p> <p><i>We highlighted from the very beginning how customer is in the center in everything, thus DT was guiding it all.</i></p> <p><i>We had a massive shift in the way of thinking towards customer centeredness and it became the reality that DT included as a philosophy.</i></p> <p><i>The strategy process is affected by DT as human centered way of thinking when translating what these trends and ideas mean for the company.</i></p> <p><i>A philosophy where we do the traditional work to get customer understanding and solve problems.</i></p> <p><i>It has been more of a way of thinking.</i></p> <p><i>DT was there at the beginning and represented the way of thinking from the customer point of view.</i></p>
Higher management interests	<p><i>In order to have a big influence, it is crucial to have influencers from higher management level so people understand and start to require certain mindset, processes and operations.</i></p>

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*There needs to be this strategy that leads to innovating certain service with a certain customer centricity.*

*Nothing should be let to move forward without this DT understanding.*

*These projects are examples of DT where strategy stated that these needed to be implemented.*

*The higher management must be the drivers for change because they are so connected with the company strategy.*

*There needs to be a certain sense of urgency involved from the higher management.*

*When talking about bigger companies, there needs to be an understanding of the fact that the old things don't work anymore and courage to do something new has to replace these old habits.*

*The final decisions are made by the higher management and thus it provides efficiency and clarity.*

*It requires a higher management sponsor so DT can be used.in innovation.*

*It needs a higher management support to innovation.*