UHASSELT

Faculty of Business Economics

Master of Management

Master's thesis

The Exploration of Design Thinking in European firms

Elias Ibrahim
Thesis presented in fulfillment of the requirements for the degree of Master of Management, specialization Strategy and Innovation Management

SUPERVISOR :

Prof. dr. Bart LETEN

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EXECUTIVE SUMMARY

Innovation has become a source of significant importance for organizations to stay relevant and survive in the current fast-changing business environment. Business incumbents are getting disrupted by the innovative solutions that are being introduced on the market by nascent companies. In order for an established firm to compete and survive on the market, new innovation tools are in need in order to activate their corporate innovation processes and convert novel ideas into successful solutions. As a way to overcome these challenges, "Design Thinking" is a non-linear principle that aims at perceiving the user's needs, challenge assumptions and restructure difficulties in an effort to uncover various approaches and answers that were not obvious at the previous level of consideration. Simultaneously, DT is a solution-seeking principle that manages complex problems. DT is a reasoning and functional method in addition to being a set of direct application tools. Until today, no exact definition exists yet in the current literature on DT. The ongoing discussion in the literature focuses on the aim of implementing DT rather than the challenges that are derived from implementation.

Over the past few years, the principle of DT has developed into becoming a hot topic and is gaining popularity in the business discourse although, there remains an inevitable confusion in the literature on the effectiveness of DT. Therefore, this research will elaborate on the drivers behind the theory of effectiveness while simultaneously examining whether or not DT is prone to be considered a successful innovation tool for improving organizational processes.

The DT principle instantly facilitates the diversity in decision making between options and limitations; the principle fits best where decision-making settings are highly ambiguous and uncertain. The Empathy Factor, which is considered an important principle and the first building block of DT, is a significant source of knowledge for users' feelings and experiences. Designers should concentrate on their empathy skills to better understand users' thoughts, emotions and visions. Also, to enable improved prediction of users' reactions when encountering products and services. The process of learning based on increasing knowledge through prototyping and experimenting is a fundamental task in DT. Ethnography is an essential search method for the DT process, and the main idea behind the methodology is to understand the user's perception. The potential benefit of brainstorming is related to the ability to use an organized setting as a means to build on top of the team member's ideas.

The research explored the current literature on DT in order to elaborate both existing interpretations of the topic which are process and mindset defined by researchers and practitioners. Six semi-structured interviews were conducted with European firms in order to identify how DT is perceived in today's organizational context and to clear the myriad on the definition of DT. In total, all the interviewees state that DT is considered to be a mindset rather than a process. The DT principle is a mindset that can be taught to people and should be embedded in the project teams' attitudes, skills, and know-how. However, when DT is recently introduced to an organization as an innovation tool, the principle itself is still considered a process. Having a groundwork and a structured process to follow will help in better

training people on the actual use and in order to efficiently implement DT. When project teams start adopting the principle on a daily basis, the latter becomes part of the project team's daily routine and will be efficiently embedded in the organizational processes.

The DT principle is considered to be an effective innovational tool for organizations that are looking to becomes more user-centric, improve their innovation capabilities and achieve adaptability and agility. However, every innovation tool carries significant challenges. The research tests the current related challenges with implementing DT. The interview findings confirmed the seven identified challenges from the case of (Carlgren et al., 2016). Besides, two additional organizational challenges were recognized: firstly, people trying to sell their ideas at a DT workshop, and secondly, when a significant number of people engage in a workshop, the tasks become challenging to manage. Various actions by the interviewee were mentioned to overcome these challenges like, for example, having an excellent facilitator at DT workshops, or the use of some rewards and training, that will eventually lead to effective diffusion. In addition, including the users or stakeholders on the DT workshop plays a significant role in applying new ideas and concepts.

Finally, the four contexts were discussed on the effectiveness and the related outcomes that result from implementing DT. The four primary areas of effectiveness that were identified focus on how DT improves the quality of generated ideas, reduce risk and failure, enables successful project implementation, and improves project selection. The user-centricity perspective is primarily being sought by organizations as a strategic advantage. DT is a solution generation method, and when users have an idea that requires further development, DT can be the tool used to de-risk the concept and successfully implement it.

ACKNOWLEDGMENT

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GLOSSARY

Design Thinking or DT: a user-centered approach for problem-solving and an innovation tool. The principle is a method used by the organization to find a solution or generate a specific outcome. The principle starts with emphasizing the problem, defining it, moving to ideation, prototyping, and later testing the generated outcomes.

Human-centered: the term is mostly used in the design and management context where the solution to problems is developed by including the human standpoint or factor in every step along with the solution development procedure.

KPI: Key performance index is a measuring tool to evaluate how effectively organizations are reaching their business objectives. The measuring index assesses the success of a company or a particular activity that they participate in.

Organizational context: the organization size, centralization degree, managerial structure, and the level of formalization. In this thesis, the organizational context is used for the referral to a particular impact on the factors mentioned above.

Innovation: the current terminology refers to a novel idea, a creative concept, a novel principle in the form of product or services. The principle can also be used in the context of new answers that meet the user needs or new requirements.

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1. INTRODUCTION

1.1 Problem Statement

Organizations worldwide are excelling by implementing innovation into their core competencies. Companies like Alphabet, Apple, Amazon, Alibaba, and JPMorgan chase were able to outshine the rest of the competition. A vast majority of nations like the United States, China, Japan, Hongkong, Singapore, South Korea, and the UAE highlight the importance of innovation and encourage learning institutions to start diffusing it across their systems partly by updating their design institutes or by implementing innovation classes within their programs. Design universities, Business and engineering faculties worldwide are increasing their ability to instruct students on the importance of innovation, usually by enrolling them in collaborative sessions that offer a sense of involvement in the innovation cycle. The benefits of innovation in the design industry has been cited by many academics (Perks, Cooper, & Jones, 2005). A rising number of published articles describe how both hardware and software have advanced tremendously within the past couple of years with the use of innovation, and recent publications are focusing more on innovation in design. Innovation is a term that is very well known as a survival tool in today's day and age. (Tushman & O'Reilly, 1996). Stage gate processes are applied to reduce time, but studies have proven that these processes may be damaging to the innovation process (McDermott & O'Connor, 2002). Innovation fundamentally relies on mystery, complications, and ambiguity according to O'Connor (2008), the primary purpose of what the stage-gate processes are supposed to handle.

Regardless of the incentives that are derived from innovation, organizational routines barely change. Innovation is perceived with a high level of uncertainty. Firms in their daily routines try to reduce uncertainty, and try to turn novelty into certainty. People start looking for the resemblance that exists between old and new. This will result in people holding on to their existing rules and behaviors while engaging in new projects (Lin, Chen and Su, 2017). The New Product Development (NPD) is a playground for significant uncertainty, especially when it comes to the level of innovativeness as well as the specifications and goals. Organizations are obliged to efficiently handle their innovation capabilities, which in some cases, clashes with the already established processes (Stockstrom, C. and Herstatt, C. 2008). Most studies today are focusing on interpreting the specified activities and methods related to design, highlighted as important distinctive functions within the entire innovation process (Perks, Cooper, & Jones, 2005).

New studies indicate that researchers in the innovation field are moving toward finding the link that exists between innovation and design. Surely applying any innovative ideas, techniques, or notions causes immense complications, especially when practitioners lack knowledge in applying the right tools at the right time (De Waal & Knott, 2013). Significant complications and challenges occur when it comes to an established organization having to undergo radical innovation (O'Connor, 2008). Looking for multiple ways to implement innovation, Design Thinking was considered the critical link from a

theoretical and practical perspective that developed to become a "hot topic" among management practitioners (Johansson Sköldberg et al. 2013; Seidel & Fixson, 2013).

In today's discussion, DT is more often referred to as an ambidextrous, human-centered method for innovation, stimulated by the designer's way of ideating and operating (Johansson Sköldberg et al. 2013). The method is, in general, referred to as imaginative, independent, and expressive; it differentiates from the systematic procedures that identify the rest of the major firms (Brown, 2008). The existing literature on the topic is found to be under the form of scholarly articles, journal magazines, entrepreneurship guidance articles, popular business e-magazines, and some organizations have written books on DT framing it as a remedy for organizations. The number of writers interpreting Design Thinking has increased considerably over the past decade (Kelley and Littman, 2005; Brown, 2009; Martin, 2009; Liedtka and Ogilvie, 2011).

Design Thinking supporters claim that organizations benefit from the process as a problem-solving technique, develop innovative ideas, maintain a healthy equilibrium between exploitation and exploration (Martin, 2009) and innovate their business processes (Brown, 2008, 2009; Martin, 2009). However, DT can be applied as a conceptual model and a practitioner tool. Additionally, it is noticed that there is barely any connection associating both the business and design perspective together on DT. It seems as if Tim Brown (2008), who wrote about DT in the management literature and Richard Buchanan, who was a pioneer in the design discourse, both agreed on the name, but they had a different explanation regarding the subject (Johansson Sköldberg et al. 2013). DT supporters recommend it as a tool for achieving fast and outstanding innovation outcomes in firms, but presumably, it does not seem to be a simple "plug and play" method the way it is described.

Hence, after the small introduction on DT, researchers in the innovation field are moving toward finding the link that exists between Design Thinking and innovation. The way researchers and practitioners perceive it is that there is a need to study how Design Thinking is being implemented in the organizational setting, and what are the outcomes resulting from the implementation.

Below are presented the aims and objectives of this research.

1. 1.1   Aim
This research aims to explore how organizations by implementing the Design Thinking principle and using creative tools and processes can increase their innovative capabilities and improve their organizational outcomes.

1. 1.2   General Objective
The research purpose is to contribute to the existing literature and simplify the myriad of relevant reflections and viewpoints. The findings aim to help business owners, managers, and people who are interested in developing their knowledge on the principle to have an in-depth overview on the role of Design Thinking in the organizational setting. The research will also highlight the importance of DT in problem-solving, business advancement, and innovative idea development.

Furthermore, the research has the following specific objectives:

1. 1.3   Specific Objectives

- Identify how Design Thinking is understood in the organizational setting and how it is perceived and defined by users.
- Determine what could be the related challenges with implementing Design Thinking, whether from the perspective of management or related complications in terms of tools, methods, and if there could be any additional challenges not mentioned in the literature.

- Identify the effectiveness and the related outcomes that are derived from implementing the principle and the context where Design Thinking is perceived to be most effective.

1.2 Research Question

How can firms by implementing Design Thinking improve their organizational outcomes?

1.3 Methodology and structure of the thesis

To answer the research question and to understand how Design Thinking is being used to enhance organizational outcomes. The thesis starts with an overview of the reviewed literature on Design Thinking and innovation processes. In order to understand the perception of DT in the organizational context, the primary data was collected in the form of qualitative research for many reasons. Mainly, since there is a consensus among scholars that there is no direct way of measuring innovation and that its perception and understanding differ among researchers. Additionally, considering that DT is a nascent term in the Management Literature, few researchers have interpreted the implementation of DT in the organizational setting.

The first chapter in this research serves as an introduction to the topic, and chapter 2 focuses on defining the term of Design Thinking from various perspectives in addition to a brief history of the concept and the way it represented in the business discourse. Chapter 3 aims at extensively elaborating the methodology of the various building blocks of DT and the transitional steps in moving from one step to the other. Chapter 4 will be dedicated to investigating the challenges that are related to implementing DT in the organizational setting. Chapter 5 will be devoted to the effectiveness and outcomes of the principle with cases discussed from the literature. Chapter 6 will discuss the various related processes to innovation that resemble the outcome of DT. Chapter 7 will be devoted to explaining the methodology used for this research. Consequently, results from the research and interview discussions will be presented with in-depth analysis in chapter 8, accompanied by a proposition designed by using the findings towards a better understanding of DT. Finally, chapter 9 will serve as a discussion and conclusion for the study in which answers to the research question will be provided based on both desk research and fieldwork.

2. DEFINING THE CONCEPT OF DESIGN THINKING

A more familiar description of DT until now is not readily available, and the terminology itself is a topic of discussion between experts, academics, and consultants. The notion behind DT has surfaced as a human-centered method to innovation founded on the idea of how designers operate and reflect on matters (Brown, 2009; Martin, 2009). A slight consistency exists in terms of interpreting the DT principle by practitioners and researchers. DT is still considered an indefinite principle where different definition occurs when being researched. For instance, DT is, in some cases, defined as creativity or promoted as a tool for generating revolutionary ideas (Carlgren et al., 2016). Earlier studies that were conducted highlighted the importance of having expert designers in design and innovation as the primary goal of designers is to generate unique values in a sociological and material world (Kimbell, 2011). In addition to how the designer's expertise can significantly influence innovation (Verganti, 2008).

From the recent existing literature on behavioral processes, the terminology is more suitably accredited to the innovation consultancy enterprise IDEO and its founder David Kelley, and lately, it's chief executive officer Tim Brown (Liedtka, J. 2015). To contradict the previous studies, design company IDEO with Tim Brown, (2008) and the Rotman School of Management with Roger Martin, (2009) emphasize that in any given field, people can innovate and increase their knowledge from the same idea of how designers at work can reflect and work on specific tasks. People can implement DT techniques into their processes, not just for innovation purposes but also when restructuring and making strategic developments (Brown, 2009).

Earlier studies on design and innovation highlight the importance of professionally qualified designers and the influence they carry on innovation. On the contrary, supporters of DT state that in any field, users can take inspiration and learn from the principle of how designers reflect and execute, and implement these principles into their processes. The DT principle is being used to innovate organizational efforts and strategies, new product development (NPD), and organizational restructuring (Carlgren, Rauth, & Elmquist 2016).

Tim Brown's define DT as a principle that implements the designer's sensibility and methods to link the user's requirements with what is technologically achievable and what a feasible business strategy can translate into a user's value and market opportunity (Gobble, 2014). Current claims state that DT improves teamwork and enthusiasm by applying empathy and generate advanced knowledge and cooperative thinking by prototyping. Additionally, DT embraces self-assurance in individual creative skills, DT encourages intuitive learning or 'gut feeling' that supposedly enables improved personal decision making (Carlgren et al., 2014).

IDEO's approach as an innovation consultancy firm interpreted the development of DT. While initially concentrating on product development, the firm has extended its knowledge on the subject to involve servicing designs, strategy development, teaching, and additional social systems (Liedtka, J. 2015). Tim Brown has interpreted DT as procedures, principles, techniques, tools, and bringing designers together

to resolve complex problems (Brown, 2009). Bloch (2011) states that the design principle is still vague in the academic literature, but because the design notion is crucial to business development, the current principle interpretation goes far beyond appearances and styling. Thomas Lockwood, the previous president of the design management institute, has developed a more precise explanation of DT: "a human-centered innovation process that focuses on observation, collaboration, fast learning, visualization of ideas, rapid prototyping, and simultaneous business experimenting" (Liedtka, J. 2015).

DT empowers executives to generate novel ideas as an alternative for various contrasting methods. The principle is defined in different ways and with numerous stages (Carlgren et al., 2014). "Hoerst Rittel" initially draws attention to the "wicked" problems of different design complications. The author claims that these difficulties and complications required decisive preparations, and the results were characterized as highly ambiguous hence, direct analytical methods are likely to be unsuccessful when trying to resolve wicked problems. The author states that the advantage is gained when looking at things from a different perspective while undergoing a trial approach that explores numerous conceivable results (Liedtka, J. 2015). To manage "wicked problems," DT was considered the process that offers the best opportunity. The principle not only assists in searching for the best possible solution or the exact method required, but DT also offers a need that is waiting to be accepted. The principle helps to look at problems from a different angle since other methods are considered a dead-end (von Thienen, Meinel, & Nicolai, 2013). To contradict the conventional management methods, Owen (2007) discusses the importance of how design handles ambiguity as, according to the author, design is considered the main advantage that the principle has to offer. He would later claim that DT, actively circumvents and hold decision making for the longest conceivable time to exploit knowledge as a strategy and to reduce uncertainty and risk.

DT cover more than simply design as most of the people perceive; the principle does not mainly focus on the physical appearances of a product. DT involves an entire range of tools and frameworks, which many of them have been imported from related methodologies, that mirror DT functions with the human experience (Gobble, 2014). Knowledge has always been considered an essential aspect of the purpose of design (Beckman and Barry, 2007). However, exist three significant variations and additions that are worthy of mentioning that indicate the necessary foundations of DT.

Firstly, ethnography is an essential search method for the DT process, and the main idea behind it is to determine the perception of users. According to a paper written by Elliot (2003) on ethnography in strategic research, the author states how decision-makers encounter many complications while trying to discover innovative solutions and decide on users' preferences. The ethnographic research is applied by assigning few researchers to study a population sample. Two types of researchers exist, the "opportunistic" who are more involved in gathering valuable data and the "judgmental" who are considered to have a high area of expertise in a particular field. The ethnographic research emphasizes the patterns that occur every day, which are considered significant and applicable for the generation of concepts, designs, and the development of new products and services (Baskerville & Myers, 2015). To be more precise, ethnographers' main task is to generate extensive explanation and analysis of specific

social conduct (Elliot, 2003). In general, ethnographers encounter a variety of abstract, complicated situations while studying a population sample; the situation can be unfamiliar, unordinary, and ambiguous. The gathered data must be arranged at first in order for them to understand the correct content and then provide an explanation. Due to the difficulty of the process, handling this type of research requires an explored amplified study on users rather than forecasting.

Secondly, brainstorming the way it is stated by Seidel & Fixson (2013) is a teamwork operating method that supports the inquiries for an innovative solution that cannot be achieved by personal ideation. The potential benefit of brainstorming is related to the ability to use an organized setting as a means to add on top of each other's ideas. The advantage of brainstorming is typically attributed to the possibility of using a structured environment to build on other team members' ideas. Instead of only generating ideas, the brainstorming methodology improves internal organizational communication and strengthens the company norms for teamwork and continuous experimentation (Liikkanen, Laakso, & Björklund, 2011). The paper by Seidel & Fixson, (2013) states that recent research on the topic revealed that brainstorming is more efficient than the regular teamwork for finding solutions on mild complex situations that require intake from cross-functionality. Brainstorming can assist organizations in pushing further than ideation like, for example, increasing their set of skills and knowledge for designers. Brainstorming processes enables groups to map gathered information from ethnographic research, while it can also help in retaining judgment, preventing quarrel discussions, or solely focusing on mismatching information that will lead nowhere. The pressure generated under brainstorming promotes a novel group solution, while it is also considered a tool that facilitates the team function for drawing insights from ethnographic data.

Thirdly, in a paper written by Devecchi & Guerrini (2017) on the role of empathy in design, the authors define the term according to The Oxford Dictionary as being the potential to perceive and share the emotions of someone else. Considering that DT is a principle where empathy is being used, the relationship between them both gained popularity in the '90s when organizations began to understand that collected surveys are not a good source for product development. Empathy is a significant source of knowledge for users' feelings and experiences. Designers should concentrate on their empathy skills to better understand users' thoughts, emotions, visions, and to enable improved prediction of users' reactions when encountering products and services. Carlgren, Rauth, & Elmquist, (2016) state that empathy is a major tool for designers and to empathize, various factors should be taken into account. Like for example, having an open mindset, welcoming attitude for people from various environments, and circumventing criticism. Empathy in design is achieved through ethnographic studies and brainstorming processes. The aim here for designers is to get into their users' shoes and associate with the ability to build a qualitative connection with them. The value of the connection built needs to be corresponding to the empathy level, considering that empathy is an essential tool to understand and experience users at a psychological level (Devecchi & Guerrini, 2017). Organizations anticipate generating better-needed solutions that deliver imaginative possibilities that are placed beyond high-end aesthetics experiences and are considered to implicitly fulfill user's needs (Carlgren et al., 2014).

2.1 History of Design Thinking

In the 1970s, the academic institutions started teaching design management, where it was instructed by designers, targeting to instruct management professors and experts for the purpose of understanding the concept behind the design and its importance. The designers selected topics related to design in the administrative field, reviewing design as a symbol (Johansson Sköldberg et al. 2013). The roots of the design principle started in the mid-1970s and early 1980s, determined by the efforts to interpret design as a sperate notion to be thought (Hassi & Laakso, 2011).

The term "Design Thinking" first surfaced in a book written by Peter Rowe in 1987, an urban designer and architect who at the time was a professor at Harvard's School of Design. The author's intention on using the term DT was mainly pointed toward architecture and design and does not seize the present meaning existing in today's business setting (Liedtka, J. 2015). For Rowe, DT was an umbrella term that was encompassing designers in action on a daily basis (Johansson, U. Woodilla, J. 2010). Richard Buchannan in 1992 labeled the principle of DT through the notion of "wicked problems," i.e., highly complicated and multi-faced problems (Liedtka, J. 2015). For Buchannan, DT cannot be explained by placing the principle in a specified category but instead placing DT in different situations. The explanation is determined by the tools of DT and the origin of novel ideas and opportunities when the principle is applied to challenges in real situations (Johansson, U. Woodilla, J. 2010).

Nigel Cross, in 1995, while studying multiple techniques on design methods that are being put to use, states that from what the results of studies show, architects, engineers, and other designers implement a technique to resolve problems founded on creating and experimenting with possible solutions (Liedtka, J. 2015). The connection made around the features of the design process delivers a theoretical groundwork to show how businesses are promoting the relation of DT processes with today's environment. It is a theory-driven procedure that focuses on problems, as well as finding solutions (Liedtka, J. 2015).

The notion of DT developed a new way for design to become a significant part of innovation, and DT allowed innovation to overcome strategic management as an approach to handle complicated situations. The first time Design was acknowledged as a strategic mechanism was in 1984 according to Johansson Sköldberg et al. (2013), although the concept was mentioned earlier, no detailed discussion resurfaced again on the topic until the late 2000's (Brown, 2009). As a fact, 80% of the management journal that states the word Design Thinking exists in their summary after the year 2000 (Ben Mahmoud-Jouini, Midler, & Silberzahn, 2016). The topic gained media attention at the beginning of 2004 and peaked in 2009. The innovation topic in the academic field was intensely focused on engineering and numerical outputs, while the logical truth was that innovation needed more creativity (Johansson Sköldberg et al. 2013).

IDEO, one of the most prominent design firms, began promoting itself as an innovation-focused organization relatively than a design firm. IDEO's in-depth knowledge and experience designated them

as experts, and the collaboration that was made with Stanford University supported their academic recognition (Johansson Sköldberg et al. 2013). IDEO's achievement stories and operating processes regarding product development innovations were narrated by Tom Kelley, the founder, and GM. The presentations made on the organization's effort brought IDEO wider reachability and increased the firm's network (Johansson and Woodilla 2010). Tim Brown (Brown, 2008), CEO of IDEO, named the idea Design Thinking, describing the stages of the method and supplying readers with real-life scenarios for the reader's benefit to support IDEO's methods, especially entrepreneurs, managers, and community innovators.

Companies are implementing DT as a tool to handle uncertainty and an essential skill for managers (Ben Mahmoud-Jouini, Midler, & Silberzahn, 2016). Roger Martin, Dean of the Rotman School of Management, was studying the knowledge process on active managers and their requirement for analytical reasoning. Martin partnered with IDEO to have a more in-depth insight into the notion of DT, user understanding, and teamwork (Dunne & Martin, 2006). The result of the partnership with IDEO led Martin to encourage education on how to implement the notion for management graduates and carried the idea to implement DT in the school of Management. Martin's perception of traditional organizations, the author states that organizations just have to shift into design studios in their methodologies and work processes. On the Rotman school website exists a quote stating that "today's business people don't need to understand designers better, they need to become designers" (Dunne & Martin, 2006).

DT is a continuous loop of idea generation (abduction), forecasting future implications (deduction), examining and generalizing (induction) (Johansson Sköldberg et al. 2013). Martin's theory developed into becoming a technique to handle uncertainty in companies, an essential talent for leaders, and a critical notion in management studies. As a consequence of Martin's extensive discussion on the topic, DT was enhanced to become an effective method in various fields, Policy Making (Mintrom, M., & Luetjens, J. 2016), Federal Government, (Liedtka, Sheikh, Gilmer, Kupetz, & Wilcox, 2018) and various other fields. Additionally, Leidtka & Ogilvie (2011) constructed a Design Thinking practical guide for managers that provides guidance throughout project execution.

2.2 Design Thinking in the business discourse

Regarding the representation of DT in the business discourse. This section below will present a brief overview of DT as a concept, a description of the two versions in the literature and the way the principle has been represented by practitioners and researchers in the innovation field.

The concept of DT is used both in practice and theory. According to scholarly articles, two major perspectives exist in the literature on DT. The most common debate is by how experts define DT, which is considered the most frequent myriad. According to the literature review that was focusing in general on the practice-based literature, the research result was that DT in the management discourse consists of either a set of "practice" or "mindset" (Johansson Sköldberg et al. 2013). Stanford d.school, (2010) states that in order to excel in innovation, users should engage in a design mindset that influences how

people operate, which has no relation to the process that should be used. Thomas Lockwood defined DT as a human-centered innovation process (Liedtka, J. 2015). In a paper written by Seidel & Fixson (2013) on DT in order to study the relationship between formal design methods and the user's behavior in multidisciplinary teams, the authors interpret DT as being a method for innovation. The research by Carlgren, Rauth, & Elmquist (2016) on exploring DT in large organizations resulted in defining DT by being considered a set of methods, processes, and specific mindsets while various research papers still highlight DT as being a method or process to innovation. Carlgren, Rauth, & Elmquist (2016), in an empirical study on framing the concept, the researchers describe DT as being a management method that exists in the form of 5 steps: user focus, problem framing, visualization, experimentation, and diversity. Di Russo, (2016) explains that because DT has increased in popularity and adoptions in the past couple of years, the definition has significantly expanded beyond the formal use, which increased the discussion on where to classify it. Emerging opinions on if DT is considered a mindset, a process or a combination of both is still occurring between both practitioners and researchers.

From a reader perspective as a way to interpret the concept; therefore, it is evident that two literature viewpoints exist on the topic, the practitioner, and the researcher's perspectives. Design Thinking has been gaining popularity lately among field experts, according to Seidel & Fixson (2013), for its supposed capability as an innovation driver. Organization design science is not fully exploited yet, many views; even contradictory opinions have emerged on the topic and the way it is developing. Slight information exists on the managerial perspective regarding design in an organization, and the existing information is either unreliable or depending on the context. Due to the lack of information, the research on Design in organizations is either incomplete or undeveloped, and a few numbers of researchers have associated the concept of DT in the organizational setting (Jelinek, Romme, & Boland.C, 2008). Considering that DT is interpreted in various fields, in a paper written by, Johansson Sköldberg et al. (2013) a caparison was made between DT and the notion of 'designerly thinking' that is derived from the professional context of designers in the academic design field where only a few associations and references were made between both topics.

While in the literature between researchers and practitioners' various terminologies are being used to define the main steps that are being implemented in DT. Seidel & Fixson (2013) state that the three most important steps are prototyping, brainstorming, and need discovery. The design field has developed from the adoption that is taking place from cross-functional implementations in user-centered design in addition to the various field that is non-design related and is implementing DT into their processes. Kimbell (2011) states that DT can be used as a resource for the organization to explore innovations. Di Russo (2016) mentions that the constraints coming from economic and environmental factors also had a role in the development of design practices. Firms had to reevaluate their current business models on product development and the recent trend in social media that stress on business to focus on meaning, people, and loyalty.

In the study of Di Russo (2016), a framework was built with the most cited features of DT by researchers and field practitioners aiming at clarifying the misperception over DT that developed originally from

design practices and to finalize the ongoing discussions and perspectives on the topic. From the studying of the literature, Di Russo analyzed that the main terminology that has surfaced like, for example (empathy, visualization, wicked problem, innovative) that held constant across all modern definitions on the topic. From Di Russo's point of view, the ongoing discussion on DT has not resulted in a broader field of study; instead, it resulted in a definition of how designers reflect and operate.

Figure 1: Implementation of DT according to the level of complexity. Source: Di Russo (2016)
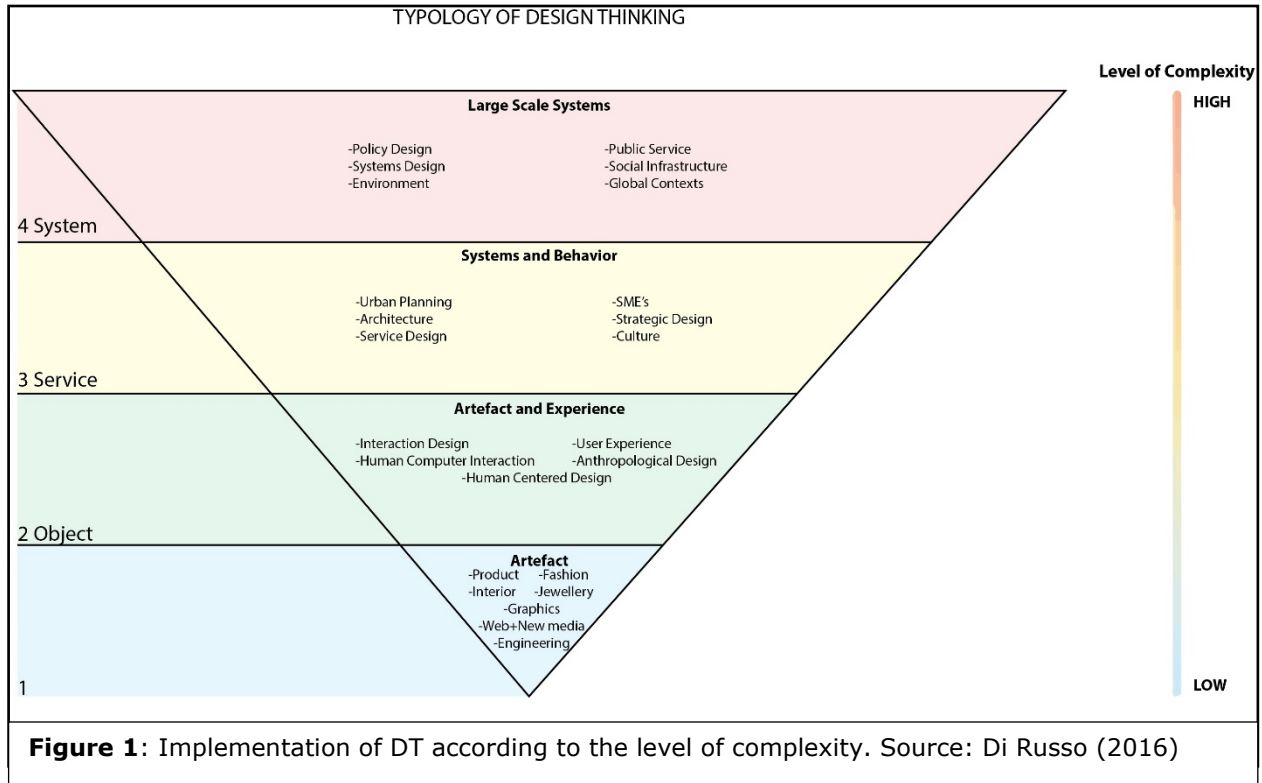
The figure above, according to Di Russo, ranks design practice from the least to the most complex (Di Russo, 2016). From her representation on DT, the figure aims at elaborating the use of DT in the organization. Representing at the bottom of the figure that DT can start at the level of an object and move upward toward the Service level, then moving upward, DT can be implemented on a system that is mainly concentrating on services and finally most complex systems like for example infrastructures.

3. DESIGN THINKING BUILDING BLOCKS

Figure 2: d.school's 5 Stage Process Design Thinking building blocks
Source: Author/Copyright holder: Teo Yu Siang and Interaction Design Foundation.

The method as represented by the Stanford School of Design, now known as the Hasso Plattner Institute of Design (Stanford d.school. 2010) which has been attributed partially for the spread of DT has evolved to become one of the most common techniques on DT (Carlgren, Rauth & Elmquist, 2016). A 5-step non-linear repetitive method that in general is represented in order to move from one function to another along the process: empathize (founded on data gathering), define (analyzing gathered data to better understand and formulate a problem statement), ideate (coming up with novel ideas to find solutions), prototype (generate models and concept that represent the ideas) and test (experimenting the concepts with users). The section below will elaborate in more detail every step of the way and the transitional element to move from one step to another along the process.

3.1 Empathize

As discussed previously, DT is a "human-centered" approach, and one of its first foundations is empathy. Empathizing is a task that requires recognizing the other person in regard to the DT process. The function of empathizing is to realize how things are being accomplished and the essential and significant requirements that need to be fulfilled. In addition, to understand how people differ in mentality and why things do matter.

When engaging in a DT process, the complicated situation that needs to be resolved is, in general, related to somebody else. In order to engage with the team that requires a solution, empathy is a major factor that needs to be taken into consideration as a way to better understand and recognize their needs (Devecchi & Guerrini, 2017). DT enables project teams to explain better how users perceive and experience things, which leads to recognizing their requirements better. Observation can detect detailed knowledge, like, for example, ways of acting and speaking. By empathizing, according to Stanford d.school (2010), design thinkers can uncover the non-relevant information that will help in better

understanding people's perception. These hidden insights will lead teams to come up with novel solutions that would not have been obvious in the first place. The most promising answers are derived from a better understanding of people's actions while the ability to identify these important actions is not an easy task. The complexity occurs because the human brain diverts many thoughts while kept unnoticed and our minds automatically filter out much information without even realizing it. A direct human interaction exposes a lot on how people reflect on matters and their principles in general. Engaging in direct interaction between project teams and users can expose a lot of uncovered knowledge that was not previously obvious. Excellent strategies are founded on the strong comprehension of principles and perceptions.

Moving from Empathize to Define.

To be able to shift from the empathy stage to where the results will be analyzed from the derived process, the principle requires combining all the gathered data from monitoring and interacting with users while selecting all the necessary information. The transitional phase is called "Unpacking," where all the gathered information is distributed with everyone on the team then visualizing the most significant information. All gathered information is to be hanged on a board where the links can be drawn. Things, for example, like using stick notes and images of observations and interviews, journey maps, and items of memorabilia that will assist in remembering of identifying additional info leading to the "definition" stage (Stanford d.school. 2010).

3.2 Define

The purpose of the Definition stage is to create transparency and generate attention in the design process. At this point, the designer task is to define the ongoing project while relying on the information gathered from the users and the environment. According to Stanford d.school. (2010) the purpose here is to effectively interpret the data that has already been collected in the empathy step. The main idea behind this stage is generating a significant and functional problem statement that will lead to a better viewpoint and understanding. Having in-depth knowledge is not an easy task, primarily when the data is derived from summaries and the task of finding existing links and patterns that make sense.

The definition stage is an important task that can summarize a better viewpoint, which leads to better answers for the challenges people are dealing with. Significantly better viewpoints outline the correct problems to be dealt while referring to the previous step. Deciding on a more central problem statement might seem somehow unreasonable, but the selection has the tendency to generate a better and superior number of answers. This stage is also an attempt to combine and formulate the gathered information into reliable insights. Liedtka, J. (2015) states that the definition stage is where a "common mind" is created. Combing the empathy stage with the definition is beneficial for gathering insights that can be implemented to influence and support the design process. Questioning why users react accordingly to specific situations enables project teams to link people to a more significant setting. This will assist the designer in better interpreting their users. In this case, the designer should create and

chose a specific set of needs that are significant for the user in addition to putting the extra effort to demonstrate the vision created from the combined data in the empathy step and the conducted studies.

Moving from Define to Ideate

The definition stage aims at identifying the right tasks to handle these challenges while the ideation phase concentrates on coming up with the right solutions to find answers to these problems. Having framed and communicated the various point of view on the subject will enable a smooth transition into ideation. This can be used to examine whether the chosen problem statement matches the perspective. The major question here is to ask, "how is it possible to? What can we do? The questions are generated from the research question set in the empathy step. Stepping into ideation in order to generate the optimal solution, enables teams to create the most successful ideas. (Stanford d.school. 2010).

3.3 Ideation

The ideation step in DT is where teams come up with the best ideas. This phase consists of broadening all perceptions and results. This is the main motive and foundation for creating new physical concepts that were never developed and laying them out (Stanford d.school. 2010).

Ideation is used to shift from recognizing difficulties into coming up with the best possible answer. This is where the previously gathered knowledge mixed with creativity will result in the most innovative concepts (Mueller, R., & Thoring, K. 2012). Specifically, in the beginning, ideation is more into generating the most significant amount of ideas on which teams can pick from a range, not just choosing the best idea. Identifying the most suitable is later discussed in the testing phase.

Critical steps for efficient ideation

- Looking further than the evident answer to have a higher percentage of laying out more innovative concepts
- Linking together similar ideas
- Searching into untapped fields "ideas."
- Generating a significant amount and a wide variety of novel possibilities
- Diverting from the most common answers while trying to push the group into more unusual ones.

Moving from Ideation to Prototype

For the sole purpose of not wasting all the possible outcomes developed in the ideation part, filtering at this stage is considered an essential step as all successful ideas should advance to prototyping to stay on the right track and sustain novelty. Groups can select the most reasonable, feasible, and unanticipated ideas. The ideas that received the highest number of votes are the ones that are in favor of getting prototyped. Selecting a couple of ideas to be prototyped removes the doubt of having chosen one idea in which only a few people on the team have already approved (Stanford d.school. 2010).

3.4 Prototyping

Prototyping is a repetitive process that entitles the creation of physical concepts to assist designers in finding a solution that will move them toward their final goal. In an HBR article written by Kolko (2015), the author mentions that the MIT media department has a quote saying "Demo or Die," meaning that the only way to generate real value from ideation is by prototyping. In the initial steps of the process, designers' inquiries can be too broad. In this case, forming a simple and basic model allows generating useful feedback from the team (Stanford d.school. 2010). With the aim of moving forward in the design process, enhanced prototype development and user inquiries should be in place. It can be the case where designers generate more advanced models that are focused on discovering what people genuinely appreciate. The prototyped created should be in a form that people can engage with like, for example, a board with stick notes or an object that can be assembled, an act, or a scenario. Having people watch an act can be helpful, but engaging them in a real-life scenario reveals accurate answers and feelings.

The importance of Prototyping (Stanford d.school. 2010).

- Ideating and finding solutions.
- Building prototype reveals accurate answers and feelings
- Engaging in discussions; communicating with people is more fruitful when the object of discussion is placed in the middle. Physical models are a topic of discussion and a conversation starter
- Safe playground for trial and error; devoting small inputs to every idea result in significantly faster and less costly developments
- Experimenting with opportunities; building basic and simple models enables teams to proceed with idea development without engaging soon enough.
- Handling better structural solutions; determining variable which stimulates teams to simplify the more significant challenges into minor ones.

Moving from Prototype to Test

The last two steps in the DT process are rather combined than consecutive. Take into account testing and figuring out how people are going to experiment is a crucial step before building a prototype. Studying the prototyping and testing steps in parallel raises the bar when it comes to evaluating a prototype. Even though these two steps are often associated together, it is perceived that evaluating and testing the prototype is an essential last part that designers should undergo to complete the process (Stanford d.school. 2010). Placing the newly developed concept in the hands of people and expecting immediate interaction is a big misconception, the best user response is derived from precisely studied methods on how people are going to experiment with the design.

3.5 Testing

The testing step in DT is about evaluating the developed concepts from gathered inputs in the previous stages and where designers benefit from the user's empathy. Testing for designers can also be an additional chance to know the users for whom they are designing. The way it differs from the previous steps here is that answers have already been structured, and concepts are ready to be tested. These two steps are a way of interaction with the people for whom they are designing. Merely relying on questioning if users agree on the solution is not accurate enough on the contrary questions like "why?" "what" can be more beneficial as better insights are gained on the challenge, including finding new possible answers (Stanford d.school. 2010). The best possible way to test concepts is in the user's environment. Liedtka, J., & Kaplan, S. (2019) mention that testing should take place in the real world to determine if the concept will survive. When it comes to concrete prototype, users should implement them as part of their daily life. While for intangible concepts recreating a real-life case can be very advantageous. Designers should continuously prototype with confidence but test with doubtfulness. This phase in the process is where fine-tuning is critical.

The importance of testing, according to (Stanford d.school. 2010).

- Improving prototypes and results. The testing process facilitates multiple concepts, in some cases going back to initial sketching.
- More profound knowledge of the user. Testing can be considered a chance to establish a better understanding using vision and interaction which may lead to unanticipated knowledge
- Better viewpoint. In some cases, testing may uncover that besides coming up with the wrong answer, the structure of the problem is also incorrect.
- Operating in a loop cycle and customizing the process

Figure 3: Representation of the non-linearity of design thinking and the iterative process
Source: Teo Yu Siang and Interaction Design Foundation. Copyright license: CC BY-NC-SA 3.0
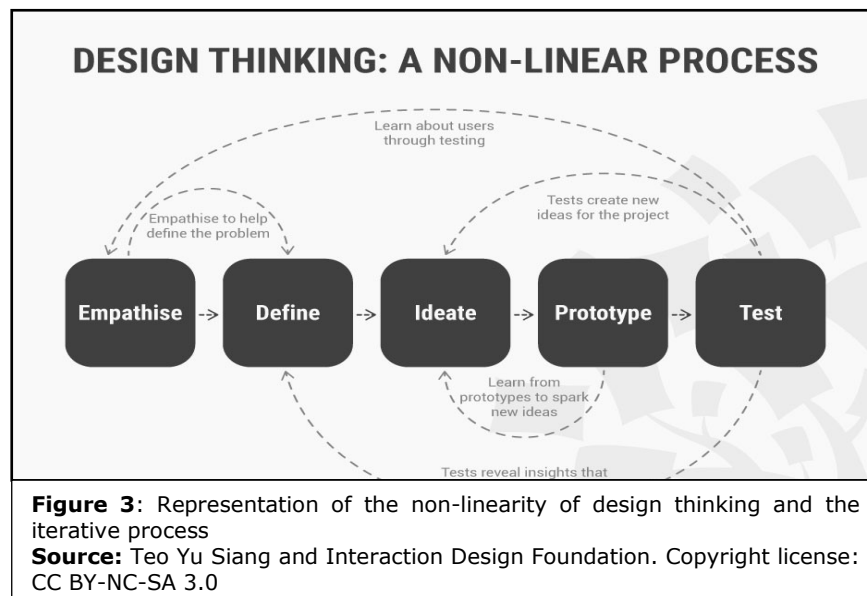
Repeating steps in a loop iterative form is essential for DT (Liedtka, J. 2015). Iteration is a fundamental component of good design. Moving in loop cycles from a step to another and also within every step alone, for instance, when ideating increasing the cycle of coming up with new ideas when some of them do not conform. In prototyping, designers should undergo different trials or even going back to the drawing board to try and come up with good designs. Although DT is a principle to funnel concept Martin, R. (2010) when teams move in the form of loops, their search funnels into becoming even more specific. The above explanation on DT five building blocks is the more basic representation of how the process should be conducted, although many different aspects, procedures, and terminologies exist on DT Seidel, V. and Fixson, S. (2013) the aim here is to present the more fundamental steps. People and organizations can adopt the process while customizing aspects making it fit in their environment.

The table below will elaborate on Stanford d. School, (2010) guidebook in more detail the steps to take into considerations when applying DT in order to implement the building blocks effectively.

Guidelines for implementing each step along the process	
Empathize	- Monitor. As one of the major understandings on people is derived from the perception of what their actual intentions are and the way they genuinely behave - Interact. Encouraging discussions openly while trying to gain more in-depth insight and using "why" will lead to better knowledge - Observe and Hear. Interacting with people in their settings while placing them in their comfort zone will result in more profound knowledge and understanding.
Define	- Drawing attention and structuring the challenge - Motivating the group - Instructing the requirements for assessing challenging ideas - Enabling teams to take decisions autonomously - Building trust with users - More focused perspective, "problem statement."
Ideate	- Engaging in creative thinking influences the team synergy to come up with more valuable ideas by adding on top of each other - Physically creating a sample of the idea. Prototyping an idea enables teams to determine certain aspects that were not obvious at first - Drafting, conceptual mapping, and brainstorming the central aspect is determining the best outcome, which is distinguishing between ideation and assessment.

Prototype	• Engaging in construction. To handle uncertainty, grabbing stick notes, glue, or any available element to prototype is considered a good start. • Brief and rapid prototyping. When having the feeling of becoming too attached to the concept, this is a reason for knowing when to stop. • Detecting the outliers. The model created must respond to a specific question when experimented. Keeping on the look for unexpected reasoning that can be beneficial from other people's interaction with the concept. • Prototyping while taking people into account. What is the main reasoning behind it? The anticipated attitude? Answering these questions will help in better concentration and gaining better evaluation in the last step.
Test	• Proving it rather than saying it. The process of observing how users properly deal and understand the prototype is essential as remarks or questions may arise • Generating experiences. Prototyping in a way that would generate an experience for users instead of having an assessment session. • User analysis. Presenting a different set of prototypes enable users to assess multiple concepts which may expose hidden needs

Table 1: Explanation of the different steps of the design thinking process guidelines as represented by the Stanford School of Design (Stanford d. School, 2010)

4. CHALLENGES WITH IMPLEMENTING DT

The table drawn in the previous section elaborates on the guideline for implementing DT for each step along the process in the organizational setting. Currently, organization are enrolling their employees in DT seminars, while some firms have even partnered with design consultants on specific project. Some organizations firms have even started a specialized team focusing on disseminating DT across their entire processes. Considering the number of organizations that were successful at implementing DT, few have encountered many complications while trying to adopt the process. The article published by Mahmoud-Jouini, Fixson & Boulet, (2019) on how to make DT work in organization, states that two primary considerations should be taken into account, one is adjusting DT to the right situation, and two acknowledging that innovation principles like DT are lengthy and require sufficient time in order to succeed. According to Seidel & Fixson, (2013) if the DT principle is inadequately implemented, the challenges with diffusing DT will eventually lead to abandoning the principle without grasping the beneficial outcomes.

Butler & Roberto, (2018) state that people in general do not carry the natural tendency to excel at DT. DT is an unusual principle that challenge people's perception in acts that contradict to natural forms of thinking. Although the implementation of any innovation process like DT is never considered an easy task, especially when it comes to incumbent firms, complications become even more difficult when the openness of the method contradicts the hierarchical organizational structure (Carlgren, Elmquist, & Rauth, 2016). In an article written by Rufat-Latre, J., (2010), the author states that the CEO and Chairman of P&G A.G Lafley quote: "Openness is critical … If your mind is not open, you can't even interact with a customer. If your mind's not open, you're not going to be able to engage in a growth process."

In a paper written by Carlgren, Elmquist, & Rauth (2016) on studying the challenges of implementing DT in the organizational setting, the study focuses on five large companies that operate in the product and service industry. The research was based on qualitative interviews to enable a deeper perspective on the method. The studied organizations were implementing DT for more than five years, and three interviews took place in each company from the most experienced personnel to the least experienced in DT where each individual was interviewed accordingly. Data gathered differed from one company to the other as by when, how, and by whom the process was being implemented. All five organizations adopted DT with the sole intention of becoming more innovative. The companies were using DT for either launching new products or changing their internal operations. In a certain organization, DT was implemented for developing their business plan or restructuring. The section below will elaborate in-depth the challenges that resulted from the study of DT in the organizational setting.

4.1 Non-conformity with already established processes

In scenarios where DT was implemented as a tool for new product development, collisions occurred regarding how DT processes operate and NPD basic methods. Implementing DT is considered strongly reliant on capabilities and a preliminary process, which somehow makes it hard for an organization to highlight. Additionally, the iterative processes and the unconventional way of problem-solving clashed with the traditional stages of problem formulation. In general, the interpretation is that DT is prone to be dissolved by the routine processes. For example, in the case of heavy tasks, teams tend to dismiss all DT related activities. The organization might encounter problems while trying to gather the required information to conduct user studies, experiment with prototypes, or the DT principle as a whole. Large companies face difficulties in allocating resources and the right procedures for radical innovation. In some cases, operational managers consider DT as additional charges. Appointing employees in the process is not an easy task, mainly because individuals are not willing to add more workload in addition to their daily tasks. Additionally, organizational departments that were physically located far from each other encounter difficulties in cooperation while implementing DT processes "spacial ambidexterity." Liedtka et al. (2017) state that large organizations do not encourage interpersonal risk-taking behavior. When resulting ideas are not appointed to expert teams, difficulties occur for additional advancement in the future steps. The consequence resulting from idea formation and further product development are considered difficult to measure as the exact degree of novelty on the innovation is difficult to interpret.

4.2 Complications in applying DT novel Concepts

The ideas and outcomes that resulted from DT sessions can be considered as non-conforming with the upcoming projects that are planned by companies. Consumer needs that are discovered from ethnographic research and additional studies conducted by DT teams might not align with organizations' current product lines or plans for the upcoming organization projects. An additional difficulty facing the generated DT concepts is the high level of ambiguity and question marks that are derived from the different corporate divisions. Rauth et al. (2014) explain that concepts coming out of DT in most cases do not align with the organization's future projects. DT concepts can be restricted in some organizations due to the unavailability of production aim or quantitative data prior to manufacturing. Early studies have proven that while firms are looking into becoming more innovative, the reality is that organizations encounter many complications regarding implementing innovations that are considered outside the firm field of expertise.

4.3 Complications in measuring DT effectiveness

Proving how the implementation of DT can determine fast outcomes is hard to quantify and assess. Additionally, problems regarding tracking can also occur since when the concept is launched and available to purchase, it is considered a hard task to measure the involvement that DT played initially while the concept was still under development. Although a small number of studies exist when it comes

to calculating value for recent innovations, major evaluation techniques have nothing to do with creative problem solving, which is a foundation of DT. Rauth et al. (2014) state that DT is an innovation process that is considered really difficult to measure along the value chain. Most major organizations implement KPIs as a tool to measure effectiveness in realizing business objectives that might not align with the DT principle. Firms, in general, measure effectiveness and efficiency by using orthodox methods like, for example, KPI's. Shifting to a DT attitude, and having personnel change their daily operations is considered a complicated mission as an organization is constrained by its current structure.

4.4 Difficulties with embracing DT into the Organizational Culture

Organizations that do not encourage risk-taking behaviors and where failure may not be tolerated might not conform with DT. The principle is founded on fast idea prototyping with the notion of learning from mistakes and moving in a fast-iterative process. In some organizations, the idea of having different opinions than the one suggested by the group or superiors might not be fully accepted. Dunne & Martin (2006) state that projects resulting from innovation principles like DT might not fit the organizational structure. When it comes also to decision-making, personnel are unable to take action before everyone agreement. DT principle is based on testing and repeating while embracing mistakes that are encouraged in flat organizational structures. Considering DT to be a fun activity, some organizations might perceive it as a non-serious method. Additionally, the difference in the organizational background where, for example, presenting a concept for a client that is still undergoing modifications might be culturally unacceptable in some companies.

4.5 Challenges with passing decision making

Already established development teams may not fully accept the idea of having to undergo DT principles. In some cases, highly experienced personnel might feel that their competencies are being doubted, or the team might feel intimidated by the new ways of doing things. When these situations occur, established teams might be unwilling to learn from DT project teams, considering how their expertise and knowledge might be examined. Dunne & Martin, (2006) state that DT helps organization to set targets rather than only working to achieve them. DT pushes established teams out of the comfort of being secluded in their department and now having to do things differently. Managers may also feel intimidated when it comes to implementing the DT principle where decision making will be passed down to project teams, flattening the organizational structure, and enabling decision making at the first level. In most organizations, the big number of employees and different available departments affect the way people cooperate, and in some cases, some departments or employee titles have more control than the rest of the group, which causes a shift in power dynamics.

4.6 Complication with DT tools

Obtaining the necessary tools to implement DT is not an easy task, especially when it comes to DT applications and processes. For example, in the case of picturing concepts sketching and making preliminary models is very beneficial, but it is also considered a hard task to acquire. Having also to deal with qualitative studies that are based on ethnographic research that may question the validity of the gathered data, which might affect the results. Complications also regarding the repetitive non-linear processes which are part of DT like, for example, going back to the drawing board and deciding on whether the final result is good enough. Working with cross-functional teams may also cause a challenge in some situations where personnel would have to shift between handling different tasks and taking a decision on everyone's behalf, which requires a certain attitude and mentality that some people do not encompass. Organizations that enroll their employees in DT brief master classes and expect them to deliver immediately will face difficulties as some people might find the theory different from the practice. Assigning DT teams on an organizational project is not an easy task.

4.7 Complications with Design thinking terminologies

Lastly, communication barriers can be taken into account, especially when it comes to presenting or debating on a certain idea. Furthermore, the use of visuals to describe the idea and data that could not be converted into practical input is also considered a difficulty. Terminologies from design-related activities are not always recognized by implementors and engineers were some keywords were already used with other unrelated activities such as iterate and prototype.

5. PERCEIVED EFFECTIVENESS AND OUTCOMES OF DESIGN THINKING

Orilkowski (2010) suggests that a method can be evaluated from a three-point of view: while concentrating on how the method is being implemented, different viewpoints on the methods, and the ideology and reasoning behind it. All three aspects are considered successful evaluation methods for DT. Regardless of the different contradictory opinions that reside on the primary use and implementation styles of DT in the organizational setting, conducting extensive research to evaluate the complex results generated with the use of diverse techniques and monitoring multiple phases of the process is not considered a simple task. In a recent article published by HBR, Liedtka (2018) studied for the past seven years around 50 projects from different industries like business, health care, and support services. Liedkta found a similar concept to social technology, which is DT, and the author states that it can accomplish for innovation just what TQM managed to achieve in the industrialization period.

Currently, researchers and supporters are starting to investigate how successful the concept is when non-professionals are applying it. While DT is gaining more popularity in the business world, some of the well-established organizations are implementing DT into their innovation processes like for example Cirque du Soleil, Procter, and Gamble these organizations are implementing DT across their organization to stimulate their level of innovation (Green, 2009). In an HBR article written by Armstrong (2013), the author states that Zappo's implementation of DT was with the aim of people to operate alongside each other to stimulate creativity and innovation. Armstrong additionally mentions how the healthcare industry is taking into consideration Design principles as a way to enhance the quality of patient care services.

In an article published by accidentaldesignthinker (2017), 40 success cases on international organizations implementing DT in the various fields are interpreted. The article is divided into 10 categories with well-known organization interpreting DT like for example in the consumer product, P&G with their Olay case, Nike, PepsiCo, Braun, Deutsche Bank, Bank of America, GE healthcare, Airbnb, Apple, IBM, Google, Uber, SAP as well as various other field like NGO's, transportation, education, and journalism.

In a study report written by Schmiedgen et al., (2015) on page 94 is a figure with all the outcomes from the first extensive sample survey with a total of 235 responses on DT in practice where different size companies from all over the world took part in this conducted research. The research was conducted in the form of qualitative and quantitative data, and the outcomes on the most significant areas of application resulted in 21.77% being from the communication and information sectors.

Below is a table summarizing the successful product that has been realized within various categories like as an example the Nivea Roll-On Invisible Black & White, Hello Bank, Jawbone, and Grindr. It is also stated that the result from the survey on the DT principle proved that the process helped in developing new business models, event planning, job role definitions, recruitment methods, strategies, syllabus, internal operations, and many more.

Category	Successful Outcomes
• Classical Product Engineering	• outdoor devices, antiperspirant, dissector systems, baby incubators, cement products and packages, science projects
• Digital User Experience Design	• dashboards, websites, marketing campaigns, working conditions, and collaboration spaces
• Complex Analogue and Digital Product-Service Systems	• pharmacy experience, pick-up services, healthcare, shopping, invoicing, price plans
• Software Applications	• financial advice, business intelligence, sailing analytics, collaboration, database applications, reporting, mobile games, IT solution for calculation of EPEI (lean production)

Table 2: Representation of the successful outcomes of DT according to various categories expanded from the book by (Schmiedgen et al., 2015)

Tim Brown (Brown, 2009), in his book *Change by Design,* symbolized DT as a toolkit that embraces innovation and promotes the adoption of DT by entrepreneurs and social innovators who want to answer ambiguous and double-edged problems. In the management literature, few researchers have interpreted the effectiveness of DT in the organizational setting as most of the discussion on the implementation can be found under the form of business magazines or perspectives from field practitioners. Nevertheless, some studies do exist on the effectiveness of interpreting the effect of DT. Ben Mahmoud-Jouini, Midler, & Silberzahn (2016) stated that the organization is implementing DT as a tool to handle uncertainty and an essential skill for managers. As managers start to estimate the influence of design, the majority of corporate executives interpret DT as a solution to all their problems (Kolko, J. 2015). In policy-making, Mintrom, M., & Luetjens, J. (2016) note that DT is capable of improving problem definition, mechanism design, and implementation. Liedtka, J. (2017) states that DT improves organizational outcomes by improving the possibility of implementation and adaptability. The section below will elaborate the three cases on the effectiveness of DT and the resulting outcomes from the literature.

The aim of the research by Seidel & Fixson (2013) was to study how amateur cross-functional teams implement design techniques to generate new concepts effectively. Teams were selected from two different private schools that were named east and west coast. The evaluation was based on innovative projects that were assigned to these students. The purpose of the experiment was to realize how professional design techniques and unprofessional teams can play a major role in the design process as claims state that DT is considered a tool that can be implemented by non-professionals. The study was conducted on 14 cross-functional groups of students from different faculties or institutions. The study was analyzed from both the ideation and selection phases in the DT process. The significant finding in the study concluded that teams that implemented DT enhanced their outcomes in the ideation as well as in the selection step. Brainstorming proved to be effective when merged with different techniques,

while excessive creative thinking sessions resulted in adverse outcomes unless recruits were added to the group. Implementing DT emphasized reflexivity in the case of interaction, techniques, and ideation to prototype but proved positive outcomes in ideation while slightly effective in the selection step. Finally, the researchers concluded that DT is a great innovation tool for non-professional when they are guided to merge DT with different techniques (Seidel & Fixson, 2013).

The research by Wattanasupachoke (2012) aimed at studying Thai organizations that are enlisted in the Asian financial market. These major innovative companies are considered between the top 500 in the country. Primary data was gathered in forms of surveys and questionnaires from these organizations to conduct this study. The main findings behind this study concluded is that implementing DT in their organizational processes can emphasize and augment the innovativeness level for these firms. The variables considered in this study involved consumer studies, user involvement on NPD, enhanced prototyping, funneling ideas, and improving design characteristics for development. The study found that the main reason behind the organizational performance is the degree of innovation. However, the researchers concluded that DT processes have an indirect effect on organizational outcomes within the innovation context. According to Wattanasupachoke (2012), for companies to enhance organizational performance, innovation is a crucial aspect, and the strategic tool that can be implemented in this case is DT. In addition, success factors also rely on effectively applying DT into organizational processes.

In a research paper written (Mahmoud-Jouini, Fixson & Boulet, 2019) on how DT can become more effective in the organization setting. The research aimed to examine the implementation of DT in the large French conglomerate "Thales" who is specialized in transportation, defense and security, and aerospace and, in general, is not considered a user-driven organization. The company project was to relocate 30 executives who most of them are from the high-level ranking personnel to Silicon Valley. The project aimed at introducing executives to IDEO and Stanford d.school DT processes. As a trial project for police officers, a group of 8 people from the design division and business unit launched "Project W" aiming at increasing police officer security and defense. Ethnographic research was conducted on security and defense. New technological innovation and urban protection models were studied in a one-day workshop with a cross-functional team from marketing, R&D, and business development. More than 100 ideas were put up for selection, and 12 concepts were created. In the end, the prototype phase led to the selection of 3 novel concepts: AR glasses, smartwatch, and an interactive ballistic vest. Eventually, the smartwatch was nominated for the best product design. Technologically oriented firms rely on systematic reasoning when making decisions and where innovation is considered a significant factor for success. DT can cause internal complications; however, the principle can be diffused when being correctly implemented (Mahmoud-Jouini, Fixson & Boulet, 2019).

6. RELATED INNOVATION PROCESSES

Every step in an innovation project is aligned with its various levels of uncertainty. Principles and methodologies such as DT, lean startup, and agile development are considered excellent methods at de-risking the innovation process. Implementing these principles delivers convenient and reachable methods for teams to handle risk. They assist in closing the gap between what people think they recognize and what they genuinely do. Engaging in a decision-making process that is founded on evidence will result in knowledge on every step of the innovation process. The more knowledge gained along the way, the better the detection of errors and dead ends (Pinder, 2019). The failure rate of startups is around 90%, and this is since the generate products do not align with the consumer interest; by implementing these principles, the result will be a radical decline in failure. All three principles are user-centric, and the user is at the heart of the process through direct feedback. The feedback iteration process guarantees that no generated outcome is unaligned with the end-user (Mantini, 2018). While the three principles are derived from diverse backgrounds industrial design, manufacturing, and software development, they share several resemblances (Schneider, 2017)

Lean is considered an answer to scientific management applications in manufacturing. Companies wanted efficiency from using guidelines, processes, and procedures, while management was only focusing on control. In today's world, control is inapplicable, matters are too complicated, too volatile, and things move too fast to be controlled. Lean was the answer by offering an entirely new way of operating. The main idea is about discovering the unknown and making decisions by learning and testing (Schneider, 2017). Lean is a principle that de-risk innovation while discovering and confirming theories, expectations, and propositions in a methodical scientific process with the use of rapid iteration founded on evidence (Pinder, 2019). Mueller, R., & Thoring, K. (2012) state that Lean was first mentioned in the IT sector, targeting startups that were focusing on software. Nowadays, the term is becoming more familiar in various sorts of innovation fields to be more specific. The definition of a startup is an organization formed by people targeting to generate novel products and services in unpredictable circumstances. The process emerged for the consumer development technique. The primary notion behind the process is that although the focus here is on generating new products, startups lack consumer understanding, so implementing this factor will assist in recognizing consumer needs in a more understandable way. Implementing "Lean Startup" aims to find and generate answers based on a user-centered approach while adjusting the development to their current wishes. The purpose is forming an ongoing feedback cycle with consumers when trying to come up with novel products and processes. The method aims to test the fundamental hypothesis and customer expectations at the beginning of the production loop and, in some cases, even before any development occurs (Mueller, R., & Thoring, K. (2012).

Agile is, in a way, connected to lean; the contrast is mainly in what these principles are implemented for and how (Schneider, 2017). In situations of ambiguity, agile delivers software systems that are active and can adjust to different variations. The idea is not only about iteration but also about

measuring and the ability to develop solutions with time. When an organization admits that the current solution is going to be different from the future one, then firms should concentrate on finding the direct needs in a manner that does not contradict the firm capacity to react when things change in the future. The main principle of Agile is adapting to evolving requirements with the use of the software. Being agile, according to Paluch et al., (2019) in a paper on Stage-gate and agile development in the digital age, is having the capability of moving quickly, easily while handling situations, and adjusting to a fast-moving uncertain setting. The term agile refers to when information that has been gathered in prior is being put in combined with present practices to provide products with superior quality under tight financial planning in a restricted schedule. To be more precise, agility combines the characteristics of adaptability, speed, education, and answers to transformation. Implementing agile development focus on applications that allow software programs to assess the role of users and collaboration, the required distribution of operating programs, interaction with consumers, and the ability to handle modifications along the development process.

Mainly the Lean principle affects decision making in terms of what to do, when, and how to adjust the strategy, and the principle is the turning point where the developed strategy is awaiting to be executed. Lean offers a guideline on how to learn, make decisions, and synchronize the steps on the way to realize goals. Bringing together the scientific and critical thinking delivers a framework for challenging the concepts and improving strategy through knowledge (Schneider, 2017). The learning by experimenting method can operate effectively only if the system's aspects are very flexible. While Agile delivers technological solutions that advance and adjust according to the learning and response to different necessities that appear from new measures. The continuous flexibility characteristic of Agile provides the advantage of being a facilitator and circumvent the restrictions to change delivering the adaptivity factor, which is a highly competent principle for bringing technology outcomes to instant value (Schneider, 2017).

7. METHODOLOGY

Research is familiar for being a methodical process of collecting and analyzing data for trying to discover an answer to a question or a solution to a problem, to confirm or test an existing concept. One of the research key aspects is to examine existing social and economic problems and to plan & design a program, project or activity aiming at dealing with the problem.

The framework of this conducted research is exploratory. This research aim at investigating the role of DT in organizations and the effect the principle carries on improving organizational outcomes. Therefore, an in-depth study was conducted on how organizations define DT, the challenges, and the effectiveness related to the implementation processes.

7.1 Research Methodology

The design will be conducted in the form of qualitative research due to various reason which are:

A small number of studies exist on how to quantify value for innovation developments. Since the principle of DT being implemented infirm is hardly studied, this field of research is believed to be a promising area for conducting an exploratory qualitative research design (Carlgren, L., Elmquist, M., & Rauth, I, 2016). Principles like DT, a topic that is gaining popularity in the management discourse but is considered a difficult topic to perform empirical studies on due to the diverse existence of tools and processes and the difficulty of quantifying the outcomes it generates (Liedtka, 2015). Comparing DT processes before and after the implementation process can provide concrete indications on the quantifiable value and results of DT (Elsbach & Stigliani, 2018). Carlgren et al. (2016) state that the main struggle is in quantifying and assessing the involvement and consequences of DT processes. The main difficulty lies in the field with organizations that have a lengthy market launch and where the return on investment "ROI" is the method used to measure value.

Therefore, due to all the above-stated reasons and because the chosen organizations for this research are international companies that operate in different countries with various mindsets and perceptions on DT. This research will be under the qualitative analysis considering that the quantitative technique, in this case, would be inadequate in determining the true essence of this research.

In (Kallio et al., 2016) framework for developing a semi-structured interview guide, the author notes that prior information on the subject of study is an essential requirement for conducting qualitative research. The sole purpose of a qualitative researcher is to grasp in-depth knowledge and understanding of the studied subject (Kallio et al., 2016). Researchers are entitled to take into account their logic, theoretical framework, and methodology when conducting qualitative studies to gain a complete and accurate comprehension of the topic and its various perspectives before starting the interview.

For this study, a theoretical framework was put into place by performing extensive research to be more acquainted with the various principles, key definitions, and established literature around the topic.

Regarding the chosen subject, the case study by Carlgren et al. (2016) on studying the challenges of implementing DT in the organizational setting (see chapter 4), and semi-structured interviews were organized to enable the link with the academic groundworks and the empirical processes.

Regarding the interviews conducted for this research, using semi-structured interviews was considered the best method. Semi-structured interviews are one of the most common data collection methods in qualitative research, and the type & quality of the interview primarily affects the outcomes of the study. Kallio et al. (2016) state that the key benefit is that the semi-structured interview process is determined to be most beneficial in allowing valuable information interchange between the interviewer and the interviewee. It gives the ability for the interviewer to prepare follow-up questions built on the answers of the interviewee.

The data for the research was gathered from 6 interviews within the organization and consultancy context. The first section focuses on the perception of defining DT according to every organization, whether DT is perceived as a process or a mindset. The second part focuses on the challenges by Calrgren et al. (2016) in order to test these challenges and depict any additional complications. The third section focuses on the discussion of the main areas of perceived effectiveness.
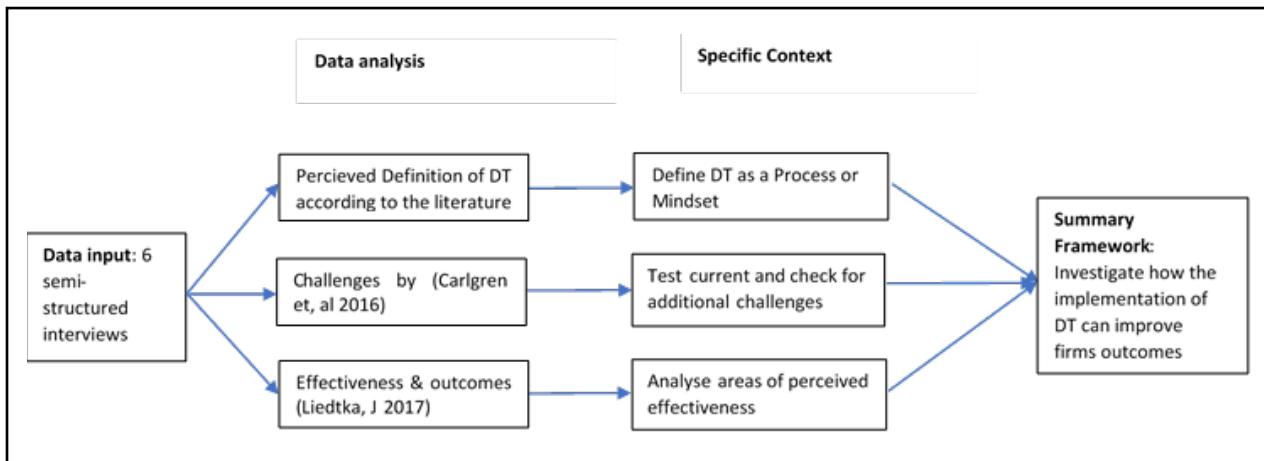
Figure 4: The general framework for the research

7.2 Data Collection

To be able to answer this study research questions, the information was gathered in the form of primary data. The construction of the questionnaire was written at the beginning of November 2019, and 6 semi-structured interviews were scheduled between the second and the third week of November. The interviews were conducted in two different languages English or French, and this was solely according to the interviewee's preference.

The questionnaires were written from the acquired information gathered from the literature review and the personal knowledge acquired on the topic. Given that the interviewed organization perceived and implemented DT in various contexts, some previous online research was conducted on the interviewed organizations to understand and perceive how DT is being implemented, which context and by whom.

The interviews targeted 2 types of organizations, innovation consultancy firms that offer DT as a service, and organizations that are applying DT to innovate their organizational processes. Due to the reason that both types of companies were implementing DT internally as well as externally, one interview guideline was prepared and adjusted according to the aim of implementing DT, whether for internal use or external. To better grasp and understand how DT is being implemented in large organizations, this research aimed at understanding how DT is being interpreted across various types of innovations like, for example, service innovation, social innovation, and technological innovation.

All conducted interviews started with the introduction of the thesis subject in addition to the research question, the specific objectives, and its purpose. This brief introduction assisted in establishing a better understanding before starting, and it was also considered an ice-breaker that helped in creating a stress-free environment between the interviewer and the interviewee (see more in Annex). At the beginning of the interview, questions centered around the current position on the interviewee concerning the subject and when was DT implemented in addition to why DT was introduced in the first place and finally how DT was introduced whether with the help of an external consultant or developed internally.

List of the introductory questions for writing a brief overview of the interviewed organizations.

Introduction:

1. How does your current position relate to Design Thinking?
2. When did you first start implementing DT?
3. Why was design thinking introduced in your organization in the first place?
4. How was Design Thinking introduced? Was it with the use of external consultants or developed internally?
5. How is Design Thinking currently used in your organization? (is it used internally or externally with users or both)

Short description of the interviewed organization and the role of design thinking.

BARCO

A global Belgian technology organization that focuses on the design and development of visualization products for different specific professional markets. Barco envelops Sales & Marketing, Customer Support, R&D and Manufacturing in Europe, North America, and the Asia Pacific. The person interviewed for the research holds the title of director of innovation and DT at the organization where his main focus is on design and user experience. Previously, Barco had a small design community of Design Thinkers, and the design team also was specialized in product development where they were applying DT principles

on a couple of solutions. It was not until the past 4 years that when the interviewee moved into the corporate HQ and to challenge their innovation processes together with the new CEO that the organization moved into adopting DT at the corporate level to uncover major related issues.

Due to a company background in product design and as designers, having the DT mindset and toolset started at the organization since the beginning. The team at Barco in the year 2000 did a project with IDEO and Tim Brown in London applying the DT principles, but at the time, none of the titles of the books were written by Brown yet on the subject. The interviewee mentioned that it was not until 2005 that people started seeing other areas in which DT can be applied, product development, and product solution.

Regarding the introduction of DT at BARCO, the organization has been for years a tech company, so the majority of the developers are engineers, where they were mainly focusing on technological innovation without taking into account the consumers. The lack in user-centricity resulted in missing on involving their stakeholders in various processes. Considering Barco's operations are mostly in a B2B environment, which is considered a complex environment, the organization does not get to interact with its users and vice-versa, resulting in complicated processes and value chains. This was also the case why engineers always believed that they knew what is in the best interest of their users since the company was coming up with products from engineers to engineers. Barco operates in 3 leading markets: healthcare, enterprise, and entertainment, so most of the people interacting with their products are engineers. Lately, the perspective toward product development altered, considering that not all the future organization products will be dedicated to highly expert users as some of the new product will have a more user-friendly interface.

At BARCO, people are trying to implement their own DT developing processes and toolsets inside the different stages of the solution development methods and stage development processes to be able to bring the translation much closer to what they are as an organization.

DT at Barco is used internally like, for example, with HR to design a better employee understanding for the experienced senior personnel to generate a better employer experience. From the service organization part, DT is used to assist BARCO in becoming a more customer-centric organization, as for external implementation, DT is used for market purposes, so it is within their customer value discovery and development. DT is considered a solid innovation principle and has been a key element in the success of various new products and solutions that the organization has been launching for the past couple of years.

PROXIMUS

Part of the Global Proximus Group is a telecommunication & ICT company that operates in the Belgian and the global market, Proximus delivers end-to-end services to the private, corporate, and public sector. The organization is considered the biggest provider of telephone, internet, television, and network-based ICT services in Belgium under the Proximus and Scarlet brands. In Proximus, the market

research department is the entity taking care of DT within Proximus, so the person interviewed for this research was mostly taking care of facilitating DT workshops and currently is holding the position of a full-time dedicated coach. The interviewee is one of the people that are working on scaling DT within the company.

DT at Proximus started around the year 2017 when a group of managers within the organizations went on a field visit to Silicon Valley were DT was already well established. The previous CEO decided that DT is a principle that should be implemented at Proximus. At first, it was only with the help of the board of innovation where the company ran some pilot project to check if the principle has an added value to implement in the business. Afterward, the organization started giving training across their entire division in order to scale the methodology, and currently, a dedicated program exists to manage the DT principle internally. Proximus is also in the phase of recruiting more DT coaches all over the business to help in spreading the concept.

DT at Proximus is currently used internally as well as externally so for a considerable number of internal projects where, for example, sometimes teams go through the whole design sprints. In some cases, divisions often apply some steps of the DT techniques such as brainstorming, making a persona, ethnographic studies, and doing interviews. DT is encouraged to be used as much as possible within internal projects. Concerning the B2B business unit's DT is also being sold as a service where people from the organization engage in facilitating DT workshops at external businesses and companies that are considered customers of the firm.

DT at Proximus is currently used in most departments inside the organizations, but there are some departments where there is an emphasis on investing extra time and effort, taking into consideration that these are the main areas or functions that should be focusing on applying DT. For example, product and solution for the B2B and B2C business unit, the customer experience departments, and marketing. These primary divisions are where DT is being implemented as the standard way of working at Proximus.

Currently, DT at Proximus in the expansion form and the DT facilitators are overwhelmed with requests from senior management to facilitate workshops in order to better diffuse and scale DT across the company. In the future, teams at Proximus will be operating in a completely new way of working where DT is at the start of every challenge they come across and where DT is used to better implement projects rather than the standard process of business operations.

BOARD OF INNOVATION

BOI is a strategic consulting organization that offers support and training services as well as boot camps for startups. The organization, grand services portfolio, embraces innovation strategy, intrapreneurship programs, market validation, business model development, and many more. Design Thinking was first introduced at the board of innovation back in 2008.

The board of innovation facilitates the innovation processes and the application of DT in various innovation accelerators, and lately, the firm guides Fortune 500 organizations globally in the application

of the principle. The person interviewed holds a senior innovation consultant title. The interviewee's role at BOI is to implement business and innovation management through hands-on consulting, training, and facilitation of tailored innovation programs. At first, BOI started implementing the Business Model capability building with large corporates, and after the extensive requests from organizations into becoming more user-oriented and move into solution development processes, DT was initially introduced as an answer to the market request. DT is a user-centric process, and the principle is used in the B2C environment, and the principle of DT was an extension of validated learning on innovation concepts.

DT at the board of innovation was developed internally based upon learnings from the literature, research, and toolkits that were available at the time. DT at the board of innovation is used internally as well as externally. The way the process is used internally is basically for whatever required purpose like, for example, in the case of introducing a new tool, method, process and coffee machine according to the interviewee, whatever the problem is DT is always implemented. The process starts by validating the problem making sure the problem is painful enough, then moving on to prototyping, suggesting a solution, and validating whether or not this is the case while doing that in the shortest possible time.

The main areas of internal application are, for instance, when BOI organizes a yearly offsite where the firm runs a mini innovation strategy sprints in order to look at crucial growth areas, fundamental internal problems or strategic plans that the organization is considering. DT, as a methodology, is used by instinct to structure how the firm operates and how problems are being solved on a more tactical institutional level.

KNIGHT MOVES

Underlying the organization of the Belgian "Leap Forward" Group, "Knight Moves" is a design and innovation group that assists in delivering breakthrough products, services, and experiences to the user in a reliable manner. The group is specialized in service design, user research, new service concepts, service strategy, experience design, and training and coaching. Leap Forward is also part of the "CRONOS" group, a large IT and design company in Belgium, and it consists of all sub-companies operating independently, with approximately 6000 employees.

The person interviewed holds the position as a service designer for Knight Moves, where his main focus is on creatively solving business problems and elevating the customer experience. Considering that "Knight Moves" is part of the "Leap Forward" Group, DT is integrated into the entire organization's work processes. DT at "Leap Forward" is used in an iterative non-linear process where no ongoing project will be handed in straight back to the customer unless a large number of feedback sessions are undertaken in the process. Besides, consumers also work together with "Little Miss Robot which is also part of the "Leap Forward" group; "Little Miss Robot" is an expert in making visual designs and creating prototypes for digital products.

At "Leap Forward" for every project that is executed with clients, a DT sprint, or at least some learning principles from the DT methodologies, are included in the process. DT at "Leap Forward" was introduced since the beginning from the moment the company was founded; the firm started applying DT as well.

The DT principle was introduced at "Leap Forward" for the primary reason that one of their core values is being human-centric, and considering that DT thinking is a user-centric approach, the firm extensively puts the users and clients at the center of their design process which is a core factor of success. Considering that Leap forward is a consultancy firm, the DT principle was developed internally by the team with no assistance from external factors.

For an internal project, DT is used to continuously develop thei organizational processes by implementing DT sprints in which iterations are key in their processes. DT is also used externally where users are extensively included, for example, in conducting interviews, focus groups, qualitative and quantitative research. When moving to the solution phase, the principal is used to co-create with clients as well as users and early adopters. Moving on to building a prototype, the whole product is not fully built rather more like a digital solution that can be used to look back at testing the prototype with potential users. As a way to test these prototypes, tools like cameras, mouse tracking, and extensive questionnaire enable extensively testing the prototypes. DT at Knight Moves is perceived to be a successful innovation tool considering that the principle fits within the organizational culture, and it is aligned with the firm's ongoing projects.

MAKESENSE

Makesense is an NGO known for being a platform for social innovation. The company operates in 8 different countries with different levels of corruption and the nature of the political institution. Makesense partners with public institutions, companies, and help personnel to overcome difficulties posed by social entrepreneurship. The organization is a community-based platform where online forms are submitted as a way to link personnel with social entrepreneurs, educate on topics concerning ventures, organizational challenges, and eventually handle the main areas of complications in creative workshops. Makesense facilitates workshops for organizations to design policies and to determine business solutions.

DT is used daily at Makesense as it is considered one of the firm co-creation activities. The way DT was introduced is due to one of the founders who previously worked at "Gemalto," a digital security firm in the innovation department, and part of his job was to implement innovative methodologies, including DT. After quitting Gemalto, the founder carried innovative ideas in order to develop and implement them for social and environmental goals. The founder introduced the DT principles from the corporate world and the innovation department into founding "Make sense."

DT at Makesense was developed internally were some of the employees that were recruited had done their studies in innovation management, where project teams also brought their expertise with them by working on specific projects elsewhere. The team at Makesense also received help from NGO's and creative agencies who elaborate some "pro bono" work in helping the NGO improve their methodology.

With the purpose of implementing DT at making sense, part of the inspiration had to be imported from outside.

In regards to the main areas of DT applications at "Make Sense," the organization trains social entrepreneurs who are one of their key organizing workshops, in addition to citizens who are invited to volunteer during 2 hours to help the social entrepreneurs with concepts development like for example crowdfunding campaigns, training volunteers, etc. Makesense adopts a flat organizational structure, and the way decisions are taken inside the organization, and their governance style is based on DT. The team keeps on trying new concepts, learning from their successes and failure, and then suggesting new organizational methodologies. To maintain a flat organizational structure, the organization keeps on reorganizing itself every six months, which makes them agile and adaptable. Makesense are always flexible on new projects or context and continuously questioning their values, so in that sense, adaptability and agility are the way the firm make decisions and the way they organize their structure.

BNP PARIBAS FORTIS

A banking and financial institution that emphasizes transparency, founded on values of innovation, humanity, responsibility, and enthusiasm. BNP Paribas Fortis delivers for consumers a wide range of financial products and services. BNP Paribas Fortis network extends to almost 75 countries.

The interview for this research was conducted with a risk innovation officer from the BNP risk division, which comprises around 6000 employees, and part of the interviewee's responsibility is handling all innovation initiatives within the risk division. For the risk department, DT was introduced a couple of years ago, but regarding when DT was introduced at BNP as a whole, there was no concrete answer due to the different divisions and the existence of various innovation teams. The way the division function is within the 15 innovation champions that are formed throughout the risk division. Individuals are considered intrapreneurs throughout the different teams, and they coordinate projects with each other. The innovation portfolio is around 300 projects, so in order to help these concepts go from an idea to implementation, the DT process is being adopted.

Concerning the introduction of DT at BNP Paribas Fortis, the interviewee stated that the managers underwent an executive training on DT by MIT and Harvard to better master the principle and the basis. In terms of particular projects where extra support is needed, external DT consultants are recruited on specific projects to assist in the execution. In regards to the main areas of applications at BNP risk division, the DT is being implemented in numerous projects that are being developed and that are related to the application of new technologies to improve processes.

DT at BNP is considered a successful innovation method considering that the principle deals with the current requirements of BNP users, and when users are unaware of their requirements, DT provides long-lasting solutions.

Summary of the interviewed organization

The table below refers to the organizations interviewed for this thesis, the names of the personnel were not revealed due to privacy protection, and the table only mentions the job title the interviewee held inside the organizations. Additionally, in the description below is specified both the country where the organization is established and the nature of its operations.

#	Interviewee	Country of operation	Job Title	Date	Duration	Nature of the interview	Nature of the organization
1	**Barco**	Belgium	Director of Innovation & Design Thinking	13/11/2019	40 min	Videocall	Technology
2	**Proximus**	Belgium	Business and Innovation Designer	14/11/2019	1hr30 min	Live	Telecommunication & ICT
3	**Board of innovation**	Belgium	Senior Innovation Consultant	12/11/2019	60min	Videocall	Strategic consulting, support, and training services
4	**Knight Moves**	Belgium	Service Designer	20/11/2019	45min	Videocall	Service design innovation
5	**Make Sense**	France	Community Developer	18/11/2019	42min	Videocall	Social innovation
6	**BNP Paribas Fortis**	Belgium	Risk Innovation Officer	13/11/2019	38 min	Videocall	Banking and Financial services

Table 3: *List elaborating on the details of the interviewed organizations and the conducted interviews.*

7.3 Data analysis

The primary data for this thesis was collected from interviews conducted with specific organizations. During the interview, notes where taken, organized, and analyzed afterward. All interviews were recorded and transcribed. Afterward, significant quotations from primary data were emphasized and subdivided under different groups that structured the sub-parts of the following chapter.

The interviews were mainly conducted to understand: (Research questions Chapter 1)

1-How can firm by implementing Design Thinking improve their organizational outcome?

With the more specific objectives of the research

Chapter 8 will handle the findings gathered from the interviews and will be divided as follow:

The first part will identify how DT is understood in the organizational setting and what do users more specifically perceive and define DT as being.

The second part will test what could be the related challenges with implementing DT, whether from the perspective of management or related complications in terms of tools, methods, and any additional challenges discovered that are not mentioned in the literature.

The third part will identify the effectiveness and the related outcomes that result from implementing DT and the related processes and the context where DT is perceived to be most effective.

8. PERCEPTION, CHALLENGES, EFFECTIVENESS AND OUTCOMES OF DT

The following chapter is the fundamental part of the thesis. This section will handle the findings gathered from the interviews on the understanding of DT in the organizational context. A more in-depth elaboration will be interpreted on the definition of DT according to every interviewed organization (see chapter 2.2). The challenges that interviewed organizations face following (Carlgren et al, 2016) findings (see chapter 4). Finally, the perception of effectiveness and the generated outcomes from the implementation of DT and related processes (see chapter 5-6).

8.1 Definition of DT in the organizational context

For the first specific objective of this thesis and to better understand the differences in perception on DT (Chapter 2.2) following every interviewed organization, the analysis was structured according to scholarly articles as two major perspectives exist in the literature on DT. The most common discussion is how experts define DT, whether it is considered a process or a mindset.

When asking the question on *"Would you describe DT as being a process or a mindset?"* the first answer received, in general, was *"that's a good question to ask," "it's an interesting way to look at it."*

Interviewee 1 stated that DT is a mindset and the way the principle is perceived as being a means to an end. In the firm's perspective, bringing the mindset closer to what they are as an organization will bring better outcomes than merely applying the 5-step procedural framework the way it is. The perception of DT is achieved by selecting some steps of the DT principle with other innovation processes toolsets for better solution development rather than applying the five stages framework of DT.

DT is considered a mindset for people to engage with. In addition, a specific organizational mindset should be in place, even if the right guidelines and tools are being implemented across different processes. Interviewee 2 states that the way DT is used daily inside their organization is by implementing some steps of the framework like, for example, prototyping a particular concept or for the empathy stage doing some interviews or brainstorming rather than implementing the entire methodology. The 5-step framework is implemented only in case of a design sprint or Bootcamp. Embedding the mindset in their team's ideology is considered to be more successful than simply implementing the process of DT throughout teams or divisions. The organization is currently reviewing all the training inside their organizations, and the plan as of 2020 is to diffuse DT across the entire organization. People that have followed the training should engage in a constant DT mindset while feeling more comfortable in applying it intuitively themselves afterward. DT is a guideline that the organization learns from combined with other innovation processes and where some steps of the DT methodology are implemented accordingly. Interviewee 4 mentioned that their firm also does not apply DT in full; teams always borrow some elements from the DT process. From the firm perspective, DT is also a mindset as considering it a process entitles them to follow the entire 5-stage framework accordingly, whereas the primary pinpoint is for people to apply DT intuitively for their daily objectives.

"I see it more as a mindset. There's a lot of steps, and we borrow from this mindset. We're not just going to follow it blindly, we have our processes as well, but I think it's more like a mindset that you learn from you select from it" (interview 4)

Labeling DT as being a process from the perspective of interviewee 5 is a false judgment considering that DT cannot be framed. Instead, it's a mindset that can be taught to teams and people, which should be embedded in their attitudes, skills, and knowhow. The company stated that in order to innovate, implementing a process is not the right to operate. Instead, DT is a mindset that is capable of achieving innovation. Interviewee 6 interpretation is also similar to interviewee 1-2-4 as, in general, for the daily tasks in the risk division, DT is implemented in a more instinctive way rather than the 5 steps framework of the DT process is being implemented. The only time where DT is explicitly used is preferably in Design Sprints, but in general, the way the principle flows inside the organization is in the form of a mindset.

Project teams undergo a period of skepticism when they are trying to experiment with the value of implementing an innovation tool as DT. Once people get into the early-stage adoption and usage of DT, this entitles them to see the traceability, the outcomes, and the impact in terms of business. The impact of DT starts changing people's routines and values. Once the principle starts doing that, then project teams start adopting it and realizing the professional value that it carries. According to interviewee 3, a different perspective exists on what DT is considered. The way to consider whether DT in being a process or a mindset depends on the duration of the implementation. At first, when DT is recently introduced to the organizational process, the principle itself is still considered a process, but the more the process is used regularly, the label tagging the principle gets detached. DT becomes part of the daily organization routine imbedded in the intrinsic way of working; people stop naming the principle as it becomes the standard way of working. *"I would say that the dependent variable there is at what stage of usage you are with it as to whether it is a process or a mindset. Initially, it becomes a new process when the team starts using it but then it becomes a mindset the more and more you use it; it becomes an intrinsic way of working"* (interview 3)

Summary – Definition of DT in the organizational context:

In total, all the interviewees state that DT is considered to be a mindset rather than a process, and in general, steps of the DT principal are used on a daily basis. The only time where organizations implement the complete DT process is in general when firms engage in a DT Bootcamp or a design sprint. Labeling DT as being a process from various viewpoints is a misconception considering that DT cannot be framed. However, the principle is a mindset that can be taught to people and should be embedded in the project teams' attitudes, skills, and knowhow. Once an organization starts adopting DT, this allows them to see the business impact, which will eventually start changing people's routines and values and lead to realizing the professional value that it carries. Finally, in order for an organization to perceive whether DT is considered a process or mindset the distinction depends on the history of the introduction. In the case where DT is recently introduced to the organization, the principle is still defined as a process, and for it to become a mindset, it requires training, time, and effort, which will eventually become the standard way of working.

8.2 Organizational challenges resulting from the implementation of DT

The following part will highlight on testing the challenges of implementing DT according to the paper written by Carlgren et al. (2016), where the author states that few studies have been conducted on the challenges of implementing DT in the organizational setting.

This section will focus on elaborating according to the interviewed organizations why implementing DT as an innovative method to improve organizational processes is considered a challenging task, in addition to recent challenges that have been explored from the conducted interviews.

The table below summarizes the challenges identified by (Carlgren et al. 2016) research on five different large companies that have been using DT, and the question asked for this research intended to test the related challenges with the interviewed organizations.

Challenges (Carlgren et, al 2016)	Interview questions
1.Non-conformity with already established processes	Did you ever face any problems with DT as it was not considered the way of getting things done?
2. Complications in applying DT novel ideas and concepts	Are the resulting ideas and concepts from DT considered challenging to implement?
3. Complications in measuring DT effectiveness	In your perspective, do you consider it easy to measure the involvement of DT after launching the concept on the market?
4. Difficulties with embracing DT into the Organizational Culture	Do you consider that DT principles may not fully be aligned with your organizational culture?
5. Challenges with passing decision making	Do you consider that established teams would be intimidated by your principles and the management when it comes to decision making?
6. The complication with DT tools	In your perspective, do you consider that people find it challenging to apply design thinking tools?
7. Communication Barrier	Do you consider that people find communication barriers and do not easily understand when translating DT principles and terminologies in general?

Table 4: summary of the challenges by (Carlgren et al. 2016) following the questions asked in testing the challenges on the interviewed organizations.

1. Non-conformity with already established processes

Design Thinking is being implemented by organizations as a problem-solving technique and a tool for new product development. Various complications are occurring regarding how DT processes operate and the NPD basic methods. Implementing DT is considered strongly dependent on capabilities and underlying processes, which somehow makes it difficult for organizations to handle. Additionally, repetitive iteration processes and the unconventional way of problem-solving clash with the already established problem-solving techniques.

Interviewee 1 states that this is a challenge, as in their perspective, the fact that by implementing DT principles means that they always have to challenge the status quo inside the organization. Considering how the principle of DT is founded on iteration and moving in a repetitive cycle to gain feedback, DT steps can be lengthy and time-consuming. The interviewee stated that some managers still consider that what has already been established is the right way of operating.

Due to their inability to quantify DT, firms are unable to convince management in how DT can be an innovative principle to implement rather than sticking to the already established process. Regardless of their belief in how successful DT can be as a tool for getting things done better and faster, Interviewee 2 stated that one of their biggest challenges is trying to implement and diffuse DT across the organization.

There's a need for consultancy firms on the market to help organizations in innovating their internal processes. Interviewee 3 states that this is also definitely a challenge for organizations, although the majority of firms know that their already established processes are not competitive on the market anymore. Organizations require a faster innovation process, and DT is a mean to deliver a structured and efficient way of becoming more user-centric.

> *"Yeah, that's why this company that works for exist is because they know they need to be more customer-centric; they need to speed up their innovation process and they need to save money in doing it. Yeah, the reason it exists is that people are not working in that way and DT is just a mean to be able to operate in a structured and repeatable process"* (interview 3)

Interviewee 4 notes that internally, they never face this type of challenge, considering that they are a consultancy firm founded on innovation. In their perspective, this may be a challenge for organizations that they operate with, especially when their processes are too straight forward, and DT operates in an iterative loop cycle that will result in clashes with conventional processes.

Interviewee 5 stated that management always involves the human factor while making decisions. At some point, the management decisions rely on established processes, and when considering other people's opinions and views, the DT principle may not be in accordance or the methodology itself contradicts organizational processes. Interview 6 statement is, in a way close to interviewee 4, mentioning that when the tasks are too straightforward, management always relies on their already established processes in getting things done. DT principles may not be considered, in this case, the best

way to move forward in the solution process, considering that DT is a lengthy process that takes into account other people's opinions and points of view.

> *"sometimes innovation project managers do want us to implement a certain way of working when the task is straightforward so DT is not always the first method that comes in mind when trying to solve a problem" (Interview 6)*

Summary of the 1st challenge:

In general, all the interviews acknowledged that the DT principle is prone to clash with the already established process, also stating that this is one of the biggest challenges that organizations are currently facing at the moment. Consultancy firms mention that considering that they are an innovation studio, DT is not considered a mismatch with their established processes. From the consultant expertise as working with users and clients, DT is expected to be a principle that can cause major problems with already established processes. Finally, considering the nature of DT, where there is a reliance on everyone's opinions and point of view, management processes may contradict with the openness of DT.

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2. Complications in applying DT novel ideas and Concepts

The ideas and outcomes that resulted from DT sessions can be considered as non-conforming with the upcoming projects that are planned by the organization. Consumer's needs that were discovered from ethnographic research and additional studies conducted by DT teams might not align with organizations' current product lines or the upcoming concept plans.

The statement from interviewee 1 is that in their organizations, this does not pose a significant challenge. For the resulting ideas and concepts, the company includes its stakeholders and users since the beginning of the process. Customers or user validation is guaranteed from the initial steps of engagement in a DT workshop. *if you're applying your DT well, you are also including your internal stakeholders, so that means that also internally aligning the roadmap and capability (interview 1).*

This entitles a more efficient implementation rate for the outcome of DT. Idea generation by including users onboard is steered toward the user's direction in the form that when using DT to generate novel concepts, the results are less challenging to implement. This applies to the case, whether for internal purposes with managers or externally with users. The problem that organizations are currently facing is the number of already running projects. Interviewee 2 mentions that in regards to whether generated concepts are too difficult to apply, the generated ideas and concepts themselves are not too difficult to implement. Instead, already having multiple projects running the same time makes it harder and lengthier to implement the newly generated outcomes from DT workshops. A different standpoint toward this challenge was started by interviewee 3, as from the interviewee's perspective if the ideas and concepts generated from a DT are too challenging to implement, the result signify that the implementation of DT ended up being successful. The outcome of a DT sprint should disrupt the core

business and challenge the existing processes and find new growth markets. When the generated concepts and ideas do not fit the strategy of the organization, then in this case, DT was implemented successfully, and the outcomes will surely carry a positive return.

> *"DT should be optimally used to disrupt the core business, to cannibalize the profit, to challenge the existing business and to find new growth areas where existing market areas do not exist and if it's used in a way that doesn't fit the strategy, then the outcomes are very good because you are creating entirely new growth areas." (interview 3)*

Interviewee 4 also agrees that it is hard to implement the generated ideas and concepts. In most cases, the firms try to measure the outcomes of these ideas and concepts by benchmarking them with some KPI's, which gives a better picture of outcomes and feasibility. The interviewee also mentioned that by including users on the selection process, as mentioned by interviewee 1, it is easier to select what is the best technically feasible and possible outcomes to proceed with accordingly.

> *"what we do is we place them in front of some KPI's that these companies have and we try in co-creation select the best ideas, but it's also true it's hard to really implement these ideas because you have to make a business case you have to see what's technically feasible, so it is true that it's hard to go from an idea to implementing it." (interview 4)*

The user can influence the implementation of DT novel concepts or ideas, according to interviewee 5, it all depends on the person you are working with. If the people implementing DT have some expertise on how to move from idea to implementation and if the people have some insights on how these concepts or ideas can be implemented afterward, then executing them would not be considered a challenge. Interviewee 6 notes that since the ideas and concepts generated from DT are not in general considered to be aligned with the organization's current strategy or carry any additional added value, then getting approval from top management is considered very difficult.

Summary of the 2nd challenge:

Management today still considers that if the project goals do not align with the organization, future plans, then the outcomes will not be carrying positive returns, and moving to the execution phase may be unapproved. Some organizations are overcoming this challenge by including stakeholders from the beginning and removing the doubt of having the concept not accepted afterward. In some cases, the number of ideas generated is too difficult to execute due to the number of already running projects. Trying to fit a new project where there is a low estimate on the return on investment (ROI) with already running projects is a difficult task to manage. If the outcomes of DT are too challenging to execute, then the workshop resulted in successful projects. Outcomes that challenge the status quo and disrupt the core business are considered to be the most successful ones. In general, as a way to overcome this challenge, including stakeholders and using a metric system to measure the feasibility makes the process less challenging before engaging in the execution process. In addition, the people that are engaging in a DT workshop can influence the execution whereby having professional expertise and insights on how things can be implemented afterward makes it less of a challenge.

3. The complication in measuring DT effectiveness on a project

Proving how the implementation of DT can determine fast outcomes is hard to quantify and assess. Additionally, problems regarding tracking can also occur since the concept is already launched and ready on the market. In general, measuring the involvement that DT played initially while the concept was still under development is considered one of the most difficult challenges.

Interviewee 1 considers that the challenge is measuring the success of the DT project is a lengthy process and can, in the future, be measured with the return on investment (ROI) . The current organizational focus is on the process metrics, which measures DT qualitatively. The organization takes into account the time spent with their users in developing a project and moving from idea to implementation. This is how DT should be measured in terms of how to quantify and link the principle with the success that it carries on a project.

> *"That why I consider it a mindset it is about how much qualitative touchpoint you have with your sponsor users but you have as a metric how to show that it brings impact on the better outcomes for the customers" (interview 1)*

Considering quantifying DT as one of their biggest departmental challenges, interviewee 2 is facing quite a lot of problems in measuring the effectiveness of DT. The firm's top management is convinced about the effectiveness of DT. Managers do believe that the DT principle has an added value on their innovation processes, but in terms of measuring the effectiveness, it is considered a significant challenge.

Process and impact metrics are the tools used to calculate the effectiveness of the project resulting from a DT workshop, as mentioned by interviewee 3. Counting the number of stick notes used, the number of ideas generated, ideas killed is a type of process measures that can be used to account for the effectiveness of DT. While on the other hand, the impact metrics are quite the challenge, the KPI's used can be considered a challenging task to evaluate.

> *"you can have two types of metrics there are process metrics and impact metrics it is straightforward to track the process metrics, the number of posts it's used, the number of ideas generated, the number of ideas killed it's a straightforward reporting metric. But the impact metrics is the important one, the KPI's that you apply" (interview 3)*

As for interviewee 4, the organization stated that they are facing the same challenges as the rest of the interviewees. The firm also mentioned that measuring the process metrics is not a difficult task. The case, for example, of measuring the number of clicks on a newly designed website, having a digital outcome from a DT workshop, can be measured by using tools that track the improvement process. While having to track the impact process, on the other hand, can cause a significant challenge, especially in large organizations where all the projects are running at the same time.

> *"it's hard to measure the impact. For example, we worked for a company where you can develop photos online, and you can also buy merchandise. There we could really measure it because we*

improved the user experience of the web-shop we also changed the visual design, and we really could track with metrics if there were more customers clicking on this product. The conversion rate went up by 30%; this was the case where we could really measure it" (interview 4)

Not having a benchmark to measure against in addition to measuring innovation was the reply from interviewee 5. The latter stated that measuring the effectiveness of DT in successfully launching a project is indeed really hard as there is no other method to compare it to in terms of creativity and idea generation. People might be using creativity to achieve a specific goal or launching a particular concept, and this might be due to DT or other external factors that played a role in making this idea successful. The statement from Interviewee 6 was that anything that is coming out of innovation is tough to measure. Currently, the organization is facing a lot of problems in quantifying the value of their innovation portfolio and the effectiveness of DT.

Summary of the 3rd challenge:

To summarize this challenge, two types of metrics have been identified to be used in measuring the effectiveness of DT, which are the process and impact metrics. The process metric is easy to evaluate as it relies on tools that have been used to achieve a particular outcome while the impact metric, on the other hand, is complicated to measure in terms of setting specific KPIs or other measuring techniques. In general, all interviewed organizations stated that it is an enormous challenge that they are currently dealing with. Relying on the process metric to measure the effectiveness is achieved by taking into account qualitative measuring points to identify the effectiveness of DT in the success of a new product. In addition, there is no benchmark to compare DT success in terms of creativity with another method. When the project is already launched, it is challenging to try and remove the principle from the equation and to check for the role DT played in making an impact as there is no other similar principle to compare with.

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4. Difficulties with embracing DT in the organizational culture

Organizations that do not encourage risk-taking behaviors and where failure may not be tolerated might not conform with DT. The principle is founded on fast idea prototyping with the initial use of trial and error and moving in a fast-iterative process.

Internal management style is currently clashing with the DT principle and the way it is perceived in regards to their organizational culture, as mentioned by (interviewee 1). The latter mentioned they are trying to diffuse DT across the entire organizational system. Organizational members state that they are working with the DT principle, where in reality, they are still operating the old-fashioned way. To better diffuse DT across the organizational systems, personnel and teams are having to undergo revitalizing processes to review their values in a way to better diffuse the DT principle and become more customer-centric.

Fully embracing DT in the organizational culture is still considered a challenge that the organizations are trying to overcome. Interviewee 2 mentions that from the management perspective going in an iterative loop cycle, which is one of the principles of DT or fails fast learn is still considered somehow not fully embraced internally. The interviewee also mentioned that even though a lot of meetings are conducted within divisions and discussions in terms of future processes, the final say in some cases always goes to the managers starting from their perspectives rather than the perspective of the customers or users.

> *"For example, learn and fail fast is something for management so hard to acknowledge, or when something doesn't work, they need to drop it rather than maybe learn something out of it, but no, they will continue going. Before I started in this position, I used to spend my entire days in meetings, but it would just be the managers having the final say in the decision"*
> *(interview 2)*

DT will always clash with the organizational culture as it was never the way things used to be done. Interviewee 3 states that if the DT principle does not match the internal organizational culture, this means that the organization should shift in a different direction or start thinking in revamping the internal culture. The role of design thinkers is to be constructive trouble makers, and when project teams face resistance from upper management, it means that they are doing their job right.

> *"If DT principles are not in accordance than that's brilliant because they need to find ways to do things differently quickly and more effectively so if I get resistance from managers than I'm doing my job right and if I'm keeping the ship as it is already then I failed my role is to be a constructive trouble maker" (interview 3)*

Due to the design nature of their business, Interviewee 4 stated that this is not a challenge for them as one of their core values is being human-centric. The DT principle is based on user-centricity, placing the clients or users at the center of their process is embedded in the organizational culture.

The answer from interviewee 5 is similar to interview 4, acknowledging that DT is embedded in the corporate culture, and the principle is used daily inside their organization; people are always trying new ideas and concepts where they encourage thinking outside the box. The interviewee stated that out of their ten core values, four of them are derived from the DT principle.

> *"No, I think even like DT is embedded in our corporate culture. We have it in our core values so our teams try to think outside the box we try to learn and learn again out of ten principles that guide our daily work I think like 3 or 4 of them are a direct decedent from DT." (interview 5)*

One of the significant values at their organization is coming up with the best possible solution to keep their customers and their employees satisfied. Interviewee 6 stated that DT was implemented to complement their value as it is most certainly being diffused across their entire corporate culture.

> **Summary of the 4th challenge:**
>
> Managers and employees might still consider the old-fashioned way instead of trying and execute new projects while using DT. From the perspective of management going in an iterative process, which is founded on DT principle or fail and learn fast, is still considered not entirely accepted. In general, most organizations mentioned that there are some cultural clashes when it comes to implementing DT within their organizational processes, while others answered that DT is embedded in their culture, and their core values are partly linked to the DT principle. Nevertheless, people are trying to diffuse it and scale it up by using various methods as their goal is to implement it across the entire system. The answer to when DT clashes with the internal culture means that the organizations should start questioning their internal culture, considering that the designer's job would be to innovate.

5. Challenges with passing decision making

Already established development teams may not fully accept the idea of having to undergo DT principles. This may be since established team competencies might be doubted, or the intimidation feeling caused by the new ways of doing things. Managers may also feel intimidated when it comes to implementing the DT principle as decision making will be passed down to project teams.

Interviewee 1, states that this is a big concern and especially when it comes to senior engineers having to question their expertise in the DT workshop. The way they are dealing with this challenge is by bringing established project teams and managers together on the DT workshop. Giving managers a better overview of how DT operates in practices and by working side by side with established project teams in order to change everyone's points of view on certain contradictory aspects.

> *"I'm putting everybody inside the DT experience either internally or externally so people have to learn what DT will bring and can bring. I'm currently working with different project teams and business managers to take them through that experience so they can work together to see how now we are going to apply specific processes and according to our specific cases" (interview1)*

Agile development and self-steering teams are intimidating managers more than the DT principle in the case of (interviewee 2). The interviewee mentioned that in the case of DT, management still has the final say when it comes to decision making, although that is not the objective, but that is currently the situation. When it comes to established teams, the people and teams are not intimidated; instead, people are curious about learning what DT methodology is, and some are even interested in becoming DT facilitators.

DT is a method that is designed in a way to stop managers from making decisions based on ego. Interviewee 3 states that it is indeed considered a challenge as managers hold on to their politics and gut feeling where their functional role should be to find a strategic fit for the outcomes of DT rather than worrying about decision making. In addition, having engineers on board a DT workshop can be extremely valuable, considering the solution-orientated skills that technical people carry.

Yes, there is a danger but DT is designed to stop managers from making a decision based upon politics, gut feelings, egos. It's designed to bypass managers altogether ideally their role should be to find whether there's a strategic fit for those concepts. Including engineers, in particular, is important because they are just problem solution-orientated, they can be extremely valuable people in that process. (interview 3)

Managers do have strong opinions, especially when it comes to decision making. Passing down decision making is not an easy task, especially when it is considered that they are experts in executing tasks (Interviewee 4). To overcome this challenge, DT plays the role of a facilitator by providing managers with better insights than what they think they know or what is best to execute in this situation. Besides, teams also come together to learn from each other, as learning from each other is rooted in their organizational culture.

Organizations that have a flat hierarchical structure engage in decision making at the front level. Interviewee 5 states that managers are not intimidated by passing decision making due to their horizontal organizational structure, and this is what makes them agile and adaptable. Having a flat hierarchical structure enables the organization to keep on experimenting while learning from their success and failure. Regarding whether teams might be intimidated from their principle, the interviewee stated that people want to learn the principle, but in some cases, they are still not ready to implement the process.

"Our governance is based on DT we are a very flexible organization, so we keep on trying new stuff, trying to learn from our successes and failure and then suggest a new organizational methodology that's what makes us agile and adaptable. At some point, people tend to come to us to facilitate some workshops they want to invent with other people but in the end, they are not that ready to implement the solution" (interview 5)

Top management will decide in this case as things can be too straightforward was the statement by (interviewee 6). Senior employees are not used to these types of processes where teams operate in an autonomous, self-steering way. This can be the case, especially when matters become too complicated, but as in bringing management along a DT workshop, the factor can influence management perspective toward decision making at the first level.

Summary of the 5th challenge:

Regarding passing decision making to the front level management, this is considered a big challenge by most organizations. Having a flat hierarchical structure enables firms to keep on experimenting while learning from their success and failure. Firms that are operating in a flat hierarchical structure embrace the principle of DT as it keeps them agile and adaptable. When it comes to established project teams being unwilling to learn from DT, people are not intimidated rather curious in learning what DT is about and, in some companies, even becoming a facilitator. As a way to overcome passing decision, bringing everybody on board a DT workshop, help in convincing people and overcoming this challenge.

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6. Complications with DT tools

Obtaining the necessary tools to implement DT is not an easy task, especially when it comes to DT applications and processes. For example, in the case of picturing concepts, sketching and making preliminary models, these tools are considered highly beneficial, but they are also considered a hard task to acquire.

The space where the DT workshop takes place is considered an essential factor for success. When the DT workshop takes place outside the boundaries of the organization members of the DT workshop, feel more engaged in interacting with DT tools and building blocks. People, in some cases, can be intimidated when interacting with unfamiliar tools, so the most strategic action is to understand what makes engaging members more comfortable. Users that have a non-designer or a highly technical background might not feel very pleasant in drawing a sketch of a certain prototype. The way to overcome these challenges during a DT workshop is to implement an excellent facilitator or coach, and the location where the workshop takes place plays a crucial role in making people feel comfortable while implementing DT tools.

> *"often people are afraid of a white piece of paper, so you have to know as a facilitator and coach what could be the struggles of the team the space design where is the workshop taking place is very crucial. Also, because asking a person from HR or software development to draw a sketch of something tangible is not something that people like to do." (interview1)*

People that have an open mindset do not always find difficulties in implementing DT thinking tools interviewee 2 states that one of the factors that facilitates the use of DT tools is the people that are on board. But there will always be people that aren't willing to fully cooperate as they are accustomed to a particular way of working, which makes it challenging to get them on board.

Acknowledging that this is challenging, interviewee 3 notes that having easy to use tools and a guideline book that can be distributed for participants is a way of overcoming this challenge. By having a guide book, people can cite back whenever they face challenges with implementing any tools of the DT processes. In regards to having an internal coach or facilitator, this can help facilitate the workshop for people to enjoy the process and assist in scaling it across the organization.

> *"Firstly, you need easy to use tools, and secondly, you need a playbook or guidebook to show teams how to use these tools and methods when you're not around. We have a playbook and a toolbox that they can use and then repeat the process, hopefully intrinsically motivated in their normal day to day working" (interview 3)*

Having a knowledgeable facilitator was also mentioned by interviewee 4, as this also can be quite a challenging factor. The facilitator in these workshops should always hold an unbiased view of all the participant's objectives. Holding a neutral position will lead to better idea generation and stimulate the workshop leading to more positive results.

This can be considered a challenge, but having easy to use tools, according to interviewee 5, is also a way to overcome this challenge. In addition to having an excellent facilitator, as mentioned in the rest of the interviews, these two factors can enable everyone to implement DT tools effectively.

This also poses a challenge when it comes to interviewee 6. People are not accustomed to this way of working and having high ranking business personnel making prototypes can be quite the challenge. The way to overcome this challenge, as mentioned by the rest of the interviews, is to have a knowledgeable facilitator that will help the team in creating a synergetic environment and generate better outcomes.

Summary of the 6th challenge:

Regarding the complications with DT tools, hand sketching certain ideas and making prototypes was considered a challenge for most interviewed organizations. People are not fully accustomed to this way of working, some people are still used to the old-fashioned way, while high ranking personnel might feel uncomfortable prototyping a particular concept. The identified way to overcome this challenge is by having an excellent unbiased facilitator or coach during a DT workshop that can help people in using the tools and stimulate the members of the session to generate better outcomes. Additionally, the importance of having easy to use tools and a guidebook that can be available for the participants to elaborate on these tools better.

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7. Communication barriers

Communication barriers can be a challenge, especially when it comes to presenting or debating on a certain idea. Terminologies from design-related activities are not always recognized by implementors, and engineers as some of the keywords are already used in various unrelated activities.

Collaboration is a way to overcome the communication barrier. Interviewee 1 stated that this is considered a challenge and by creating a confidence culture inside the workshop, this will engage people in stepping up and giving the members a sense of freedom to operate, and the collaboration on any unclarity will result in overcoming this barrier.

> *"That's why DT puts a lot of emphasis on collaborative and creative spaces you need to have in your culture a creative confidence you need to have people being outspoken because in the end in a design thinking you are trying to work with multidisciplinary teams and you are operating in a flat hierarchical structure in these workshops"* (interview 1).

In the early stages of a DT workshop, people may find difficulties in understanding the actual meaning of words, but the role of a facilitator, in this case, is to clarify the definitions as stated by interviewee 2. Coaches take their time in translating complicated visuals and words that, by the end of a DT sprint, everyone in the room is accustomed to the terminologies.

Having a glossary in the guidebook can facilitate this type of complication in a straightforward way. In most cases, it takes people 2 to 3 days to get used to the principle of DT. People, after a couple of days,

start adopting the same terminologies, and this happens very fast, words like, for example, "validation & assumption," which is impressive how fast people grasp the principle according to interviewee 3.

> *"We have to explain it to people in just simple terms within the playbook. There's always a glossary in the back just to make it really simple. I find that people in just two-three days they start to use the same language they start talking about validation and assumptions and filing and learning, prototyping that comes very quickly" (interview 3).*

When it comes to visuals and terminologies, interviewee 4 states that this indeed causes a challenge. Having a facilitator can summarize the definitions for people and help in explaining a precise visual figure while also helping people in understanding the terms. People are limited by their languages. In a DT workshop, people from various backgrounds like, for example, the technical background, will always prefer to use the more scientific synonyms while the rest of the people would instead use the more common terminology. Interviewee 5 states that by the end of a workshop, people end up using the same keywords. The main reason here is that when people engage in a DT workshop, they all have the same goal in the end, but like every other factor, language can also be a barrier.

> *"We all are limited by our languages, so at some point, you always end up with the same keywords the same trendy posh words. Sometimes people want the use the methodology to think outside the box, but they still speak like everybody else. These people as just as innovative as everybody else" (interview 5)*

People may be using terminologies to prove that they are talking in the right context where, in general, they encounter many misconceptions when it comes to DT. This is considered a challenge, according to interviewee 6, where people find the terminology to be entertaining, but in some cases, it is not even used in the right context.

Summary of the 7th challenge:

All interviews resulted in considering that this is a challenge, and communication can be a barrier, although it is not perceived as a major one. Collaboration and confidence culture can engage people in stepping up and overcoming the visual and communication barrier. Having a facilitator or a coach will help in overcoming this challenge as when things become unclear, the coaches can intervene and explain either by translating terminologies or helping people in drawing a visual representation to explain the member's ideas better. Additionally, having a glossary in the guidebook with the definitions of complicated terminologies where people can always refer to, and people will get used to it in a couple of days. The terminology itself may be complicated, and in a way, considered a challenge, but the end goal will always remain the same.

All things considered, below is a summary of the challenges and the main findings.

The previous section aimed at testing the challenges of DT with the interviewed organizations according to the paper by (Carlgren et al. 2016). In general, most of the challenges were agreed upon by the interviewee. When asked if DT is complicated to embrace consultancy firms, however, answered more optimistically than the rest, considering that DT coaching and implementing is a service that they offer. Measuring the effectiveness of DT was, in general, the biggest struggle everyone way facing considering that innovation is challenging to measure. Organizations that have recently introduced DT, like for example, interviewees 2-6, are still facing various challenges internally trying to embed DT with already established processes.

During the interviews, various actions by the interviewee were mentioned to overcome these challenges. Having a "coach" or "facilitator" in a DT workshop, in addition to some rewards and training, enables an effective diffusion, especially for people that are new to the principle. Having project-related impact and process metrics like, for example, KPI's this will help in better evaluating and applying the generated outcomes. Including also the users or stakeholders on the DT workshop plays a significant role in applying new ideas and concepts. In addition to the mentioned challenges, two additional complications were identified from the interviews regarding the implementation of DT in their organizations.

Additional Challenges:

Interviewee 1-5, stated that an additional challenge they are currently facing right now is that people engage in a DT workshop already having a concept in mind. When field experts engage in a DT workshop, these people try to persuade and convince other attending members that their solution is the best possible solution or in some cases, even try to sell their ideas. Attending a DT session already having an idea in mind can alter the outcomes of a DT workshop or result in a negative outcome.

> *"I've also been in workshops where too many of the technical people are trying to sell the solution and trying to convince other people why their solution is the best solution these things happen, and that's where of course there's this kind of disappointment the people that went into the workshop already had their prototype in mind so they just went to sell their concept and get their concept validated with the customers who are also not the way design thinking works as there can be an unexpected or opposite outcome"* (interview 1).

> *"the person had her idea on what to do, so I had the feeling that everything done previously was useless. She asked everybody's opinion but did not take anyone's opinion into account. At some point, I was disappointed because at first the women seemed super co-creative and was eager to organize a DT workshop but she didn't care that much about the result of the workshops and showed that she had her idea in mind. I think there is no use of organizing DT workshops if afterward people already know what going to happen next"* (interview 5)

An additional challenge stated by interviewee 1-2 is that when the group is too big, matters become really complicated to manage. The complication occurs especially during DT workshops when people are

engaging with DT for the very first time. DT facilitators and coaches find difficulties in maintaining a high level of synergy between members as people tend to fall back and lose focus or interest during workshops. In addition, considering that everyone's opinion is taken into account during the DT workshop, large teams encounter difficulties in maintaining a precise level of communication.

"When the group is too big, it does not help in kind of focusing, and I couldn't facilitate enough in the process this is kind of insight from my part that the group can't be too big" (interview 1)

"The challenge we are facing right now is that we're only three people on the team, but we recruited four extra coaches but we are still only seven people for a company with 10000 employees, so it makes things hard to manage" (interview 2)

8.3 Perceived effectiveness and outcomes:

The following section will focus on the perceived effectiveness and outcomes of DT in the context of this thesis. As mentioned in (chapter 5), currently, researchers and supporters are starting to investigate how successful DT when it is being applied in organizations as an innovation tool. From the perceived effectiveness of DT already mentioned by researchers in the literature, the following figure aims at representing the general framework for this section. In a paper written by Liedtka, J. (2017) on evaluating the impact of DT in action, the author hypothesizes five DT working elements. Improve successful project implementation, and project selection are selected for this framework. In addition to improving the quality of ideas generated and reducing risk and failure that have already been extensively discussed in the literature.
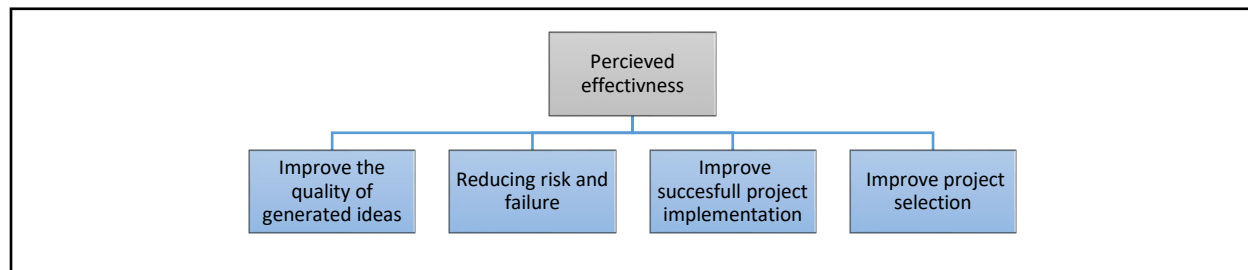
Figure 5: representation of DT main areas of effectiveness according to the research

The table below is set to examine the effectiveness criteria of DT in regards to the question answered during the interview.

Perceived effectiveness	Question
Improving the quality of idea generated	*Did you find that DT improved the quality of ideas generated? /quality of choices? Can you tell me why?*
Reducing risk and failure	*Do you consider that the DT principle helped in reducing risk and failure?*

Enabling successful implementation	*Do you consider that DT improved the percentage of successfully implementing the generated concept?*
Improving project selection	*Did you find that DT removed the idea of the best possible solution already chosen by management and now having a portfolio of solutions to choose from?*

Table 6: Summary of the question asked to examine the effectiveness of DT on organizational outcomes.

Improving the quality of generated ideas

The results proved that DT improves the quality of the idea and concepts generated. Going in an iterative cycle or even going back to the drawing board when the ideas are not concrete enough is a fundamental factor of the DT principle. DT is set to increase the firm's innovation performance by creating better quality ideas and concepts. In the empathy stage, ethnographic research is extensively executed with users to gain better insights. The implementation of DT aims at stimulating creativity and innovation by enabling people to become more user-centric. The ideation phase helps development teams to start moving in the direction of their consumer's wants and needs. With great user engagement design thinkers, step into their user's shoes and get to observe from a previously unseen perspective what may be the answer or solution to a specific problem in order to generate an improved unexpected outcome.

DT is set to increase the firm's innovation performance by generating better quality ideas and concepts, the focus on quality in this context is by improving internal processes and increasing the value for users. The way DT has been perceived to improve the quality of generated ideas in the organizational context is by making experts rethink their choices, as stated by (interviewee 1). When development teams engage in a DT workshop, their preset assumptions are put aside, and by collaborating, various insights can be discovered; mistakes can be prevented, which eventually results in better idea generation.

> *"I saw in several cases where engineers had to reset their hypothesis and POV, so they take a lot of sanctions in what they do. By experiencing DT, you prevent a lot of opinion development and mistakes throughout the process so yes, as a result, the outcomes are a better solution for the customer"* (interview 1)

Interviewee 2 notes that the implementation of DT aims at stimulating creativity and innovation by enabling people to become more user-centric. In the ideation phase, development teams start moving in the direction of their consumer's wants and needs. Going in an iterative cycle or even going back to the drawing board when the ideas are not concrete enough is a fundamental factor of the DT principle. Getting feedback from users and going back to the initial starting point to ideate again improve the quality of ideas as mentioned by interviewee 4. The repetitive process of receiving feedback and keep on ideating until the concepts are tailored to the user's needs result in an improved generation of valuable ideas.

"When you include DT in your process, it's really iterative that after you get feedback from the user, then we do go back again to the ideation part to solve the new pain points. DT helps in ideation mostly when we do iteration, and we get feedback that we can ideate again and again and improve in our products and services" (interview 4)

Engaging in a DT workshop wherein the empathy stage, ethnographic research is extensively executed with users to gain better insights and to better understand the user's needs and pain points. Interviewee 6 states that with extensive user engagement, development teams step into their user's shoes and get to observe from a previously unseen perspective what may be the answer or solution to a specific problem to generate an improved unexpected outcome.

Brainstorming with people that have one goal in mind, which is becoming more innovative or trying to find a solution to a particular problem, according to interviewee 5, generates greater outcomes. When individuals that have one goal in mind either finding a solution to a certain problem or generating a novel concept reunite in a DT workshop, this will result in people building self-confidence and stepping up to propose unexpected novel concepts that lead to generating high-quality ideas.

"The fact that people came together during 2 hours and got enthusiastic for a social project and like when we did our impact assessment it turned out that the relation and the self-confidence that people have developed between the workshops were far more interesting so at some point, DT can bring good ideas" (interview 5)

Reducing risk and failure

The research proved that DT is a principle used to help organizations in reducing the risk and failure that are linked to innovation. The process focuses on fast learning in action while minimizing cost. Rather than spending months or significant budgets in developing concepts that will eventually be launched with no existing market and result in total failure, DT enables cheap and fast developments. The generation of several physical prototypes that get tested in real-life situations ensures a product or service that has already been validated and tested by users. The findings regarding the idea discussion proved that teams that debate over ideas tend to develop novel innovations. Additionally, conflicts in the discussion have proven to be a crucial aspect for improving decision-making.

DT is a principle used that helps organizations in reducing risk and failure that are linked to innovation. The generated prototypes that resulted from the user understanding go through an iteration cycle. "*I think the iterative process is really important to reduce risk" (interview 4),* and while getting real-life testing with users will eventually result in lowering the number of unvalidated concepts.

"because DT is about building evidence directly from your understanding and connection with your customers and users" (interview 1)

"The key aspect of DT is you challenge the assumptions; all ideas are based on your assumptions so it's all about testing your most critical assumptions as you move ahead and you de-risk the development of an idea" (interview 6)

The generation of several physical prototypes that get tested in real-life scenarios ensures a product or service that has already been validated and ensures the success of the product on the market, as stated by (interviewee 2-4). Organizations, rather than spending an enormous budget in trying to push the product by extensive marketing campaigns, concepts that are derived from a DT workshop, ensure that there is an existing market for it.

"With DT you really involve customer so much that in a few days' time you already have so much customer feedback you see them during different stages in the process which really reduced the risk to indeed make a product or service that no one cares about (interview 2)

The ideation phase in DT ensures for project teams a thorough investigation of the main concerns that may eventually lead to project failure. Prototyping a certain idea enables teams to determine certain aspects that were not obvious at first. Presenting a different set of prototypes enable users to assess multiple concepts that may expose hidden needs. Interviewee 6, gave the example of a previous innovation project where DT was implemented, stating how DT resulted in reducing risk on a newly developed product.

"At an energy company, we made a design sprint on developing a voice assistant for Gaz stations so the team worked on developing an Alexa based voice assistant and they had one of the best ideas and during the design sprint. when we actually contacted gas stations around the world to check whether the concept would work, we realized that a lot of their concerns were not practically possible due to how well the concept was developed." (interview 6)

DT methodology helps in de-risking under extreme uncertainty and reducing ambiguity. The Process focuses on learning in action as fast as possible in an inexpensive way, as stated by (interviewee 3). Rather than spending months or a massive budget on developing a concept that that will eventually be launched with no existing market and result in total failure. DT is a knowledge management principle that enables cheap and fast developments.

"It just allows you to do it quicker; that's the whole point. You want things to fail as quickly as cheaply as possible, and then big budgets being spent on projects that nobody wants. Yes, it's essentially a methodology to de-risk extreme uncertainty and ambiguity in new concepts in new ideas that its primary function. (interview 3)

Additionally, conflicts in the discussion have proven to be a crucial aspect of improving decision-making. According to Interviewee 5, DT helps in reducing risk but can also cause conflict as people would start arguing or disagreeing, although this has proven to be a good sign when it comes to decision making. Idea discussion proved that teams that debate over ideas tend to develop novel innovations. Additionally, conflicts in the discussion have proven to be a crucial aspect of improving decision-making.

"when social entrepreneurs use DT, it can help in reducing risk as you said people can bring feedback but it also can bring conflict because at some point people can disagree with the project leader and I think it's kind of interesting" (interview 5)

Successful project implementation

DT is a user-centered process, and the implementation of innovation outcomes is not an easy task. However, in the empathy step of DT by doing extensive research on the users and stakeholders, the process will result in a more effective execution and the success of new projects. Innovation outcomes require a particular set of social skills to implement newly generated concepts. DT aims at transforming the rigid internal structure of an organization in becoming flatter and more agile in order to improve project implementation. Currently, organizations are starting to realize the outcomes of DT and how effective the methodology can be in order to facilitate the implementation of future projects.

Innovation outcomes require a certain set of social skills to implement newly generated concepts. Successful project implementation in DT is minorly affected by the creative ideas generated and the iterative testing process. According to interviewee 1, since DT is a user-centered process and the implementation of innovation outcomes is not an easy task, conducting in-depth research on the users and stakeholders in the empathy step, will result in a more effective and successful project execution.

"your product has a higher opportunity to succeed on the market from a user perspective. Again, having the desirability and a clear understanding of the user and different stakeholders is a key in the success of your product and solution in the market" (interview 1)

The structure of organizations can play a significant role in determining the effectiveness of newly validated projects. Since organizations are trying to improve their innovation capabilities, DT aims at transforming the rigid internal structure to a more flexible and adaptable to better improve project implementation. Interviewee 2, for example, stated that *"In the future, all teams will be working in a new way where DT is really at the start of every challenge they come across, and then they use it to better implement projects than the standard process of doing business."*

According to Interviewee 2, due to the old infrastructure and IT constraints, newly generated concepts require an extensive amount of time in order to be implemented. However, management is starting to realize the outcomes of DT and how effective the principle can be in order to facilitate the implementation of future projects. Nevertheless, changing the firm's internal structure requires a lot of time and effort. When management perceives the real value of DT in how fast solution are generated that are already validated by users, then the organization internal structure start changing in favor of facilitating the implementation of newly developed projects.

"employees are always excited and management as well because they are surprised by the things and solutions that we end up within such a short time and with customer validation (interview 2)"

Holding a regular meeting with different people to ideate or find a solution to a specific problem may not always be useful. According to interviewee 5, the implementation of a project is affected by the people engaging in the workshop. DT workshops are, in general, held with the presence of multi-disciplinary and cross-functional teams. Engaging in DT workshop with t-shaped people and cross-functional teams that are highly experienced in their field will lead to a successful implementation process. The interviewee gave the example of a project where organizations wanted to create a futuristic manufacturing plant. The people that attended the workshop were only high-ranking business executives who were considered to be the future managers. The workshop outcomes ended in total failure as not a single person from the working community, or the union representative was invited to attend. The people that engage in the DT workshop will have an impact on the effectiveness of implementing the validated concepts and ideas.

> *"in Toulouse a company wanted to invent the factory of tomorrow they organized a DT workshop and a lot of young, rich, mostly the future managers participated in the workshop. The company did not invite a single union representative they did not invite a single worker, the DT workshop failed because of the lack of human values and failed to consider the ones that should have been participating"* (interview 5)

Improving project selection

This section aims at studying how DT can effectively improve project selection when it comes to decision making on a new project while already acknowledging that management typically opts for the highest strategic fit and projects that are aligned with the organizational values. The results proved that DT is designed to stop managers from making a decision based upon politics, gut feelings, and egos. Another finding in this research is that DT can effectively improve project selection when it comes to decisions on new projects as it delivers for management concrete insights. The visual prototypes that have already been validated by users are convincing management in project selection rather than solely relying on their instinct in choosing what is in their user's best interest. In addition, due to DT, internal organizational culture is starting to change, and middle managers are starting to become more user-centric, considering that they are the ones in the position to give validation on DT projects.

The concepts that resulted from a DT workshop, once validated with customers and users, can provide better insights and evidence-based information to prove for management that the project outcomes can be of great success. Rather than management merely relying on personal opinions or expertise in selecting the projects to proceed with, DT can provide tangible insights on project selection. Holding a DT workshop with personnel from the management on one side and users on the other side can guarantee a portfolio of projects to choose from. Management will be convinced when there is a visual prototype that has already received validation from the user rather than solely relying on their instinct or consider that they know what is in the best interest of their users.

> *"The evidence you have from the customer and user point of view makes it much easier to convince them that there are more options than the solution that they thought about. Putting*

them all together in a visual way as DT is already a very visual help to convince them also that there are more options to customers and users to solve their problems" (interview 1)

"Sometimes, when you sit with clients, there are still some high position managers that have their own opinion, and they already think that they know the answer to everything. When we do some research, and we talk with our user and then we often provide them with some insights that they didn't even know" (interview 4)

A noticeable change in the internal culture of the organization, according to interviewee 2, is starting to happen where middle managers are becoming more user-centric, considering that they are the ones in a position to give validation of DT outcomes and projects. The impact of DT is starting to alter middle management perception into becoming more customer-oriented *we have been able to have that change in mindset for a lot of the middle managers, so managers are willing to listen to customers" (interview 2).*

According to interviewee 3, DT is formulated to postpone the manager's decisions that are based upon politics, instincts, and self-centered choices. When DT has been effectively implemented, the decision on proceeding with projects should be from the bottom up rather than top-down as the team is the one that should be collectively deciding on the best-proposed solution. When the DT team proves with evidence-based learning and customer validation that this is the most strategically fit solution, then the management role, in this case, is to guide these projects into implementation strategically. When all the pieces are in place, the firm's management will be unable to challenge the project validation.

"Getting buy-in from a strategic fit POV showing with validated learning evidence that the solution is solving the problem from the customer POV, even the CEO of the company cannot challenge that validation all he can do is make a call on a strategic fit" (interview 3)

The contextual factors on the effectiveness of DT

Coming to the last part of section 8.3 that aimed at finding the perceived effectiveness and outcomes of DT, this last section aimed at studying the context in which DT is perceived to be most effective, according to the interviewee. The general question asked in order to gather the insights from the interviews is: *In which context do you consider DT to be the most effective?*

DT fits best for organizations that are looking to develop their customer-centricity principles and to improve their innovation capabilities while becoming more adaptable and agile, like in the case of (interviewees 1-2-4 and 6). Additionally, DT is used when there is a need to create or improve the experience and for organizations to become more user-centric while creating a better match with the company users and customers. The DT mindset helps people in thinking outside their current processes, and in order to become more innovative and reach capabilities that are outside the current structure of the organization, the principle can be the right tool to be used. DT has proven to increase the project teams' efficiency in their way of working while helping members in coming up with outside the box

solutions. DT is a solution generation method, and when users have an idea that requires development, DT can be a tool used to de-risk the concept and successfully implement it.

Interviewee 1 stated that 25 years ago, the organization was mainly focusing on a niche market. When the previous CEO was appointed a couple of years ago, he aimed at entering new markets for their technologies rather than only focusing on niche markets. The current newly appointed CEO is aiming at additionally entering new markets and trying to turn the organization into a service organization. In order to move from product to service, customer centricity plays a major role in achieving organizational goals. In order for an organization to become more user-centric, DT assists firms in finding whether users are in need of their solution or if the generated ideas are really solving a particular problem. This is why, primarily, the user-centric perspective is being sought by organizations as a strategic advantage.

> *We had a very strong and only focus on feasibility in niche markets. Previously, we focused on new markets for our technology, so we went from one market to another because that was the only way we could grow. The next CEO was very much focusing on how to make a business impact, not only on the niche market but also on growing in the existing market. Now with the current CEO, we're focusing more on the desirability (interview 1)*

According to interviewee 3, the DT principle in B2B (business-to-business) is considered a nascent and challenging field, due to the process of analyzing the insights of the organization's customers, this eventually can lead to a massively untapped and rewarding market segment.

> *"although it is really not that common to use it in B2B, which is a very nascent field of it because you need a very specific flavor of DT that has been developing for the past couple of years. In B2B you need to get to your customer customers although it is a bit more energy and effort challenging in how you interpret insights" (interview 3)*

Regarding the context in which DT is considered to be most effective, interviewee 5 states that in case of emergency DT may not be the best possible solution. In case of emergency and when an urgent solution is required to solve a certain problem, bringing teams together to try and ideate a specific concept under a short time schedule may not be management best option. Trying to find a solution to a certain problem and considering the lengthy and time-consuming process of DT, in many situations, it may result in being an ineffective innovation tool.

> *"for instance, if you get attacked by an army you do not do a brainstorming to decide how you are going to answer so in many situations in case of emergency DT is not always the best way to get things done I think that also because management involves a lot the human factor indeed I don't think that from the perspective of management DT is always the solution" (interview 5)*

Summary of DT effectiveness.

This section aimed at finding the effectiveness of DT in the organizational setting. Four primary areas of effectiveness were discussed: improve the quality of generated ideas, reducing risk and failure, enabling successful implementation, and improving project selection. The main findings in this section proved that DT is perceived to have a direct effect on improving the organizational outcomes. The section below will summarize the main findings from the above section in showing the effectiveness of DT in improving organizational outcomes.

DT has proven to reset people's hypotheses and points of view in order to prevent mistakes and biased opinions. The iterative process that is a fundamental factor of the DT principle or going back to the ideation step, whenever the ideas are not concrete enough, has resulted in creating better quality ideas and solutions. DT aims at stimulating creativity and innovation by shifting the organizational direction toward becoming more customer-centric. The use of empathy to help in gathering insights from a previously hidden perspective may result in the next innovative idea or an imaginative solution to a specific problem that will generate an improved and unexpected outcome.

The research proved that DT is a principle used to help organizations in reducing the risk and failure that are linked to innovation. The principle of fast-acting learning cycle while maintaining a low cost throughout the entire process is a significant advantage from the adoption of DT. For organizations rather than spending a significant budget, time, and expertise in developing an innovative product that will eventually be launched with no existing market and result in total failure, the physical prototypes that undergo real-life testing ensure an early validation of the developed product or service by consumers and users. The findings regarding the idea discussion confirmed that teams that debate over generated ideas tend to develop novel innovations. Additionally, the conflicts in the discussion have proven to be a crucial aspect of improving decision-making.

The empathy step in DT that focuses on doing extensive user research will result in more effective execution and the successful launch of a new project. The adoption of DT aims at transforming the organization from a centralized, rigid structure into becoming flatter and more agile in order to improve project implementation. The developed prototypes already validated by consumers are convincing management in choosing what is in their user's best interest. Rather than making conclusions founded on politics, instincts, and egos, the results proved that DT delivers credible managerial insights. In addition, considering that middle management is in charge of giving validation on DT projects, the introduction of DT is starting to alter management perception into becoming user-centric oriented.

DT has proven to create a better match for the organization with their users and customers when there is a need to create or improve an experience. DT is set to increase the project teams' efficiency in their way of working while helping members in coming up with outside the box solutions. When users have an idea that requires further development, DT is a solution generation method that de-risks the development process and assists in successful implementation.

9. DISCUSSION AND CONCLUSION

This chapter aims to conclude the research on the exploration of DT in European firms while going back to the specific objectives proposed in chapter 1.1.3 and answering the specific research question 1.2. In order to reflect on the role of the topic in contributing to the research and the literature on DT, the objectives of this research focused on determining the definition of DT, the challenges, and the resulting effectiveness from adopting the principle.

Design Thinking is a non-linear principle that aims at perceiving the user's needs, challenge assumptions and restructure difficulties in an effort to uncover various approaches and answers that were not previously considered. Simultaneously, DT is a solution-seeking principle that manages complex problems. DT is a reasoning and functional method in addition to being a set of direct application tools. Thomas Lockwood defined DT as a human-centered innovation process that highlights observation, cooperation, rapid learning, idea picturing, fast concept prototyping, and simultaneous business experimentation (Liedtka, J. 2015). DT is an answer to ambiguous and double-edged problems (Brown, 2009). The term DT is considered a recent introduction in the management literature. DT has been gaining popularity lately among field experts Seidel & Fixson (2013), for its capability as an innovation driver. Currently, the design principle is diversifying into new dimensions like strategy, service, and organization restructuring that expands beyond the interpretation of design (Hassi & Laakso, 2011).

Organizations today require speeding up their innovation processes and become more user-centric. The consultancy firm's role in diffusing DT is foreseen not to exist a couple of years from now as people will be intuitively operating in the design principle way of working. Besides, organizations today are moving toward embedding the DT mindset in most of their organizational values as a way to increase their innovation capabilities and capacities. DT is expected to be supported at the c-level of every organization. Companies will be having a chief innovation officer or a chief design officer responsible for maintaining the level of knowledge needed to support the effective use of DT.

The study concluded that DT could be defined as a process and a mindset, but when it is recently introduced as an innovation tool, the principle is still perceived as a process. Project teams that are engaging with the DT principle for the very first time are still going to follow the 5-step framework. Having a groundwork and a structured process to follow will help in better training people on the actual use and the main objective behind implementing the principle. As a result of testing the challenges by Carlgren et al., (2016), implementing DT as the new way of working is considered a difficulty, especially when it comes to incumbent firms having to change their already established processes. Additionally, the repetitive non-linear iteration processes and the unconventional way of problem-solving is currently clashing with the traditional problem-solving tools. Due to the inability to quantify DT, organizations are unable to convince management of how DT can be an alternative to already established problem-solving solutions. The finding in this research identified that if DT is used in a way that does not fit the

organization strategy, then the outcomes generated are going to be extremely valuable and profitable as new untapped areas are uncovered.

Implementing the generated outcomes of DT can be resolved by including the users or stakeholders in DT workshops as they play a significant role in applying the new ideas and concepts (Rauth et al., 2014). Besides, considering that customer's or managers' validation is guaranteed since the beginning, the remaining input to implement the generated outcomes successfully is internally aligning the roadmap and capabilities. When organizations recently start implementing DT, the generated outcomes require finding space, budgeting, and allocation, but due to already running projects, finding at fit for new ideas makes it difficult for management to handle. After validating the DT projects defining the areas of implementation requires additional testing within business models. Today managers can evaluate the outcomes of a DT workshop while assessing them with internal KPI's that will help in evaluating the most strategically aligned and feasible ideas to implement. Rauth et al. (2014) also state that when having project-related metrics like, for example, KPI's this will help in better implementing the outcomes.

Considering the innovative nature of DT projects, direct implementation with the already established projects can be quite challenging. Innovation outcomes are challenging to quantify and measure. Evaluating the contribution and outcomes of DT in terms of success rate is the biggest challenge identified in this research. Implementing DT can determine fast outcomes, but the difficulty lay in quantifying and assessing the principle. Nevertheless, from this research, some ways have been identified to measure the efficiency, which are the process and impact metrics, where Rauth et al. (2014) additionally states that metrics are tools to be used in order to assess innovation outcomes.

The organizations that are recent to the introduction of DT and, in the course of diffusing it across their entire processes, are still encountering internal cultural clashes. According to Liedtka, J. (2011), most managers have become so dependent on the analysis that they overlooked that the best knowledge and information come from real-life interaction and not from the previous experiences. Project teams are trying to diffuse DT and scale it up by using various methods as their goal is to implement it across the entire system. When DT clashes with internal organizational culture, it might be a turning point for firms to start thinking about changing their strategic direction. Already established development teams may not fully accept the idea of having to undergo DT principles. The research proved that bringing high ranking personnel, experts on board a DT workshop will result in successfully convincing people and overcoming these boundaries. Mickahail, B. (2015) states that training is the primary link that exists between the management support on DT and the organizational development initiative.

The gathered data from interviews proved that DT is designed in order to stop managers from making decisions founded on biased views. DT plays the role of a facilitator by bringing everybody on board and convincing management in passing the decision to the first level. Similarly, the research proved that people are not entirely used to this method of working when an artistic perspective is required to increase creativity. As stated in the study, having an excellent unbiased facilitator or coach during a DT workshop can help people in using the tools and stimulate the workshop members to generate better

outcomes. An open mindset and a willingness to learn is a way for DT adopters to overcome the implementation tools.

Psychological safety is a crucial element in supporting implementation challenges. As stated by Liedtka et al. (2017), facilitators are the essential players in creating an environment of psychological safety where people can freely express themselves, step up, and overcome challenges. Collaboration and confidence culture can engage people in stepping up and overcoming the visual and communication barrier. The supportive actions that were mentioned by the interviewee help in overcoming challenges that result from implementing DT. Some of the challenges, such as an excellent facilitator or including user and stakeholder on decision making, were mentioned in all six interviews and thus highlighted as a critical factor to diffuse and scale-up DT across the organizational context. Considering that there is no golden rule when it comes to successful implementation, a thorough investigation of the supportive actions is not included in the scope of this thesis; however, the findings offer a foundation for future research.

The result proved that DT improves the quality of the generated idea and concepts. In order to improve the quality of generated ideas, DT is a principle used that helps organizations in reducing risk and failure that are linked to innovation. The process focuses on fast-acting learning cycles while minimizing costs. DT is improving project selection when it comes to decisions on new projects. The concepts that are resulting from DT workshops once validated with customers and users are able to provide management with evidence-based information. In addition, organizational managers are becoming more user-centric, and the validation of DT projects is becoming popular among practitioners. Currently, the adoption of DT is improving project teams' efficiency in their way of working while helping members in coming up with outside the box solutions. DT is formulated to stop managers from making decisions based upon politics, instincts, and ego. After guaranteeing user validation, project selection is decentralizing as project teams are starting to decide on the chosen project in order to move forward.

The generation of several physical prototypes that get tested in real-life scenarios ensures a product or service that has already been validated and tested by users, as stated by Kolko, (2015) that the only way to generate real value from ideation is by prototyping. In addition, prototyping ensures the launch of a novel concept with the lowest risk possible and an already existing market. As mentioned by Liedtka (2017), DT tools present an improvement in teams' capability to examine their untested assumptions and to check for any misconception in the gathered data. The findings regarding the idea discussion were confirmed in this research. Teams that debate over ideas tends to develop more novel innovation (Seidel & Fixson., 2013).

Additionally, conflicts in the discussion have proven to be a crucial aspect of improving decision-making. Since DT is a user-centered process, the implementation of innovation outcomes is not an easy task. However, by conducting in-depth research on the users and stakeholders in the empathy step, the study will result in more effective execution and success of innovation projects. Moreover, space, where the DT workshop is taking place, was stated as a factor that can affect the outcomes of a DT workshop. The

value of building dedicated DT spaces was stated by Rauth et al. (2014), for example, the areas that have a startup atmosphere and a dynamic interior that encouraged DT projects and group work.

Most importantly, considering the four effectiveness areas are interrelated for organizational processes, it is the combination of the main findings that have proven to have an impact on the outcomes. Regarding the contextual setting for DT, the principle is ideally used when individuals or project teams have a specific concept that requires further development, DT can be the instrument used to de-risk the idea and effectively execute it. When a crucial solution is required to solve an urgent problem, the research proved that DT is not the best conceivable solution. The study demonstrated that in the event of a crisis, DT is not the ideal innovation method to be used. In these types of situations, different processes like the waterfall principle would be best recommended. Besides, DT would mostly be useful in B2C business-to-consumer. In B2C, DT is used straightforward where DT teams can directly engage with users in a workshop and try to understand their pains, needs, and generate solutions. The DT principle in B2B (business-to-business) is considered a challenging field due to the process of analyzing the insights of the organization's customers. Finally, the effective diffusion of DT requires deliberate learning and adjustment of methods, tools, and mindsets over time (Mahmoud-Jouini, Fixson & Boulet, 2019).

Managerial Implication

The learnings in this study propose some implications for the practical work of designers, managers, and facilitators. This thesis suggested that the most successful way for organizations to implement DT is to incrementally start by training personnel on the 5-step framework at the beginning and later move to have the principle intrinsically embedded in the organizational system. DT facilitators should undergo an effort to understand the organizational contexts and the existing layers and dynamics. In practice, at first, designers need to implement the steps of the DT framework that align with already established processes, e.g., iterative ideation cycle, prototyping certain concepts, which will in a way minimizes resistance and help in rapidly diffusing the mindset.

The findings of this thesis highlight the crucial role of managers in the implementation of novelty that does not conform with the organization's current running dynamics. For organizations that are recent to the adoption of DT, recently generated ideas are recommended to go either through business incubators or divested in a separate entity. Managers are the most critical stimulant in creating psychological safety that is necessary for employees to feel safe and adopt innovative methods. The managerial support can be, naturally, seen as enhancer and diffuser. Thus, when introducing DT, the training and diffusion should come from a separate dedicated DT coaches or with the help of a consultancy firm. DT coaches should be held responsible for spreading the principle and the mindset within the organization in addition to conducting hands-on training session to understand how the principle is going to be adopted in order to best fit within the organizational context.

Limitation and future research

The result derived from this thesis provides a solid foundation for future research; however, in order to replicate and improve this research, limitation on the methodology are essential to be mentioned. From the research design perspective, the first implication is the limited amount and the narrow availability in the data. One interview was conducted per organization, and the interviewee varied from high ranking personnel to level employees. A better data collection and understanding of the principle of DT would have been possible in the case of multiple interviews from various ranking personnel within the same organizational context.

In addition, the research concluded that the impact and process metrics are tools used to measure the effectiveness of DT. This thesis was conducted while using the qualitative data collection method, whereas as a way to measure the impact of DT in the organizational setting, quantitative research would have ideally provided accurate data regarding the outcomes of the DT principle.

Finally, since this study focuses on the challenges, the supportive actions demonstrated to be useful in the adoption of DT. The findings in this research uncover the potential for an in-depth understanding of the supportive actions for further analysis of the data. A more in-depth examination and understanding of the supporting activities will be effective in the future in order to overcome the challenges related to DT in the organizational context.

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APPENDIX

Interview guideline:

- Personal introduction
- Introducing the topic of the research
- Presentation of the research question
- Discuss the aim and the specific objectives of the research

- Explanation of the reason behind the choice of the organization
- Ask for permission to record the interview

Introduction:

- How does your current position relate to Design Thinking?
- When did you first start implementing DT at your company?
- Why was design thinking introduced in your organization in the first place?
- How was Design Thinking introduced? With the help of external Consultants or developed internally?

Definition:

- How is Design Thinking currently used in your organization? (is it used internally or externally with consumers or both)
- What are the main areas of application? Which departments are using it, and for which purpose?
- Would you describe DT as being a process or a mindset?

Effectiveness & Outcomes:

- Do you consider that DT improved the quality of idea generated? / quality of choices? can you tell me why?
- Do you consider that the DT principle helped in reducing risk and failure?
- Do you consider that DT improved the percentage of successfully implementing the generated concepts?
- Did you find that DT removed the idea of the best possible solution already chosen by management and now having a portfolio of solutions to choose from?
- Regarding your latest Design Thinking project in your organization, how would you consider the outcome of the project were? Can you tell me about the project?
- In which context do you consider DT to be the most effective?

Challenges:

- Did you ever face any problems with DT as it was not considered the way to get things done?
- Are the resulting ideas and concepts from DT considered challenging to implement (like, for example, the ideas do not match your plans or the strategy?
- In your perspective, do you consider it easy to measure the involvement of DT after launching the concept on the market?
- Do you consider that DT principles may not fully be aligned with your organizational culture?
- Do you consider that some teams or departments might be intimidated by your principles? And do you consider that other teams or departments might be willing to learn from you?
- According to your expertise, do people ever find it challenging to apply design thinking tools, "like for example, sketching, prototyping?
- Do you consider that people find communication barriers and do not easily understand when translating DT principles and terminologies in general? Words like conceptualizing, ideating...?
- Are there any additional challenges you would like to mention that were not mentioned?

Conclusion

- How do you think Design Thinking will be used in your organization in the future?
- How successful has Design Thinking been in your experience?
- Any questions for me regarding the research? Is there anything to add or something that wasn't mentioned you would like to mention?