Embedded Design Thinking

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submitted by

Christophe Julien Vetterli

from

Kaltenbach (Thurgau)

Approved on the application of

Prof. Dr. Walter Brenner

and

Prof. Dr. Christoph Meinel

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St. Gallen, November 2, 2015

The President:

Prof. Dr. Thomas Bieger

Preface

Design Thinking caught my attention from the very first appliance and changed my view on how companies should create value. Just like Embedded Design Thinking can only work with the help of many, this dissertation project has been made possible with sustaining help of different people who I would like to thank for:
First and foremost, I would like to thank Prof. Dr. Walter Brenner for giving me the opportunity to pursue a PhD at his chair. The context of his chair has given me the unique chance to learn about my PhD-topic at the forefront of practice with a strong academic backbone. Walter has always had a very good instinct – also with Design Thinking. Prof. Dr. Christoph Meinel, I would like to thank for being my second assessor and bridging HPI and HSG. Furthermore I would like to thank my project leader during my PhD, Prof. Dr. Falk Uebernickel, who has strongly supported me in that very dynamic environment of Design Thinking. I think as a team we have pursued something truly great with taking Design Thinking @HSG to a next level. Besides the content-work there is a lot of support needed to keep the chair's engine running and provide a grounded environment for the highly dynamic Design Thinking context. This complete merit goes to Barbara Rohner. Moreover I would like to thank following colleagues for a developing environment, intensive discussions and supportive community when times where intense: Saskia Zelt, Dr. Florian Hamel, Alexander Neff, Dr. Thomas Herz, Dr. Friederike Hoffmann, Dr. Sebastian Dudek, Andreas Györy, Alexander Eck, Fabienne Meienberger, Isabelle Harsch, Philipp Skribanowitz, Sophie Bürgin, Dr. Bernhard Schindlholzer, Prof. Dr. Reto Hofstetter, Dr. Peter Gut, Susanne Gmünder, Prof. Dr. Hubert Österle, Prof. Dr. Larry Leifer, Katharina Berger, Prof. Dr. Stefan Sander, the walkerproject ag Team and last but not least Dr. Michael Klaas who initiated my Design Thinking start.
My strong private backbone has always supported my work performance and I would like to thank all my close long-lasting friends. Your friendship is a real gift.
The last mile of a dissertation is probably the longest, especially then, support is priceless: For unlimited patience, last minute help and a wonderful relationship I would like to thank my partner Sandra Reiff for being with me.
All the great possibilities and learnings that I have experienced the last years were especially enabled by my mother! Maman je te remercie pour tout: Ton Ptit-bout-de-choux!

Content

Abbreviations

BE	Business Engineering
BISE	Business and Information System Engineering
CEO	Chief Executive Officer
CIO	Chief Information Officer
DT	Design Thinking
e.g.	exempli gratia (latin: for example)
EDT	Embedded Design Thinking
IT	Information Technology
IWI-HSG	Institute of Information Management of the University of St. Gallen
RE	Requirements Engineering
RMM	Reference Metamodel
RQ	Research Question

Summary

Highly dynamic markets require different approaches in the value creation. In an uprising digitalized world IT is the decisive driver for business, services and products. Therefore one of the crucial starting point to determine and address the customer's need is the organisation´s IT. The speed and agility of IT organizations will decide of dropping out of the market or not. Companies and especially IT executives have realized that proximity to customers will be key for their success.

Customer-oriented organizations have proven to be highly competitive in terms of financial performance and customer satisfaction. Design Thinking adds significant value in a complex organisational environment, with its human-centred approach. Design Thinking focuses on customers and therefore uses its own combination of practices, thinking styles and mentalities. This combination roots in the designer's profession, whereas Design Thinking has further evolved through the managerial discourse. Several companies such as SAP, IDEO, Procter & Gamble, Intuit, Kaiser Permanente or Deutsche Bank have already, some since years, started implementing Design Thinking as an approach to foster new competitive advantages.

Design Thinking has been discussed intensively, especially since the early 2000 from a managerial perspective, but no unified definition for Design Thinking has resulted yet. Researchers rather ask to maintain the flexible understanding to address the different needs which occur by the complex environments organizations are facing. This fragmented understanding of Design Thinking also results in very own ways of applying Design Thinking in the corporate environment. This uniqueness leads to currently hardly replicable ways of embedding Design Thinking.

The cumulative dissertation at hand therefore addresses following leading question:

> What is an embedded approach for Design Thinking and which core elements support this embedding?

The dissertation gives an overview of the current state-of-the-art of scientific literature on embedded design thinking, identifies key elements of the approach and provides a unique longstanding case study which provides insights to the evolution of embedded design thinking within IT organization of a financial service provider. The dissertation is addressing both, practitioners and researchers alike, which want to follow-up with embedded design thinking.

Zusammenfassung

Dynamische Märkte verlangen nach unterschiedlichen Ansätzen, um einen nachhaltigen Mehrwert am Markt zu generieren. In einer sich fortwährend digitalisierenden Welt ist IT der Treiber für neue Geschäftsmodelle, Dienstleistungen und Produkte. Die IT ist daher ein zentraler Ansatzpunkt, um die Bedürfnisse von Kunden adäquat zu erfassen und zu adressieren. Die Geschwindigkeit und Agilität mit der sich IT Organisationen bewegen wird über Misserfolg oder Erfolg am Markt entscheiden. Unternehmungen und speziell auch die IT-Führungskräfte haben erfasst, dass Kundennähe ein zentraler Schlüssel zum Erfolg ist.

Kundenorientierte Organisationen haben bewiesen, dass sie in Bezug auf Finanzkraft und Kundenzufriedenheit hoch kompetitiv sind. Design Thinking generiert mit seinem mensch-zentrierten Ansatz, einen Beitrag im komplexen Unternehmensumfeld. Design Thinking fokussiert Menschen, bzw. Kunden und nutzt hierfür die eigene Kombination aus Methoden, Denkansätzen und Haltungen. Diese Kombination fusst auf der Profession des klassischen Designs, wobei Design Thinking sich über den Diskurs im Management weiterentwickelt hat. Zahlreiche Unternehmungen wie bspw. SAP, IDEO, Procter & Gamble, Intuit, Kaiser Permanente oder die Deutsche Bank haben begonnen Design Thinking in Unternehmensabläufe einzubetten - gewisse bereits vor Jahren.

Design Thinking wurde seit Beginn des 21. Jahrhunderts vor allem aus der Perspektive des Management Diskurses intensiv diskutiert. Bisher wurde noch kein durchgängiges Verständnis für Design Thinking generiert. Einige Wissenschaftler bevorzugen das Beibehalten des divergierenden Verständnisses von Design Thinking, um die unterschiedlichen Unternehmensherausforderungen adressieren zu können. Diese heterogene Verständnislandschaft führt zu sehr unterschiedlichen Anwendungen von Design Thinking im Unternehmenskontext. Diese Einzigartigkeit führt zu kaum replizierbaren Ansätzen bezüglich dessen Einbettung. Die vorliegende kumulative Dissertation adressiert deshalb die folgende Kernfragestellung:

> Was sind Einbettungsansätze für Design Thinking und welche Kernelemente unterstützen eine nachhaltige Einbettung?

Die Dissertation gibt einen Überblick des aktuellen State-of-the-Art der wissenschaftlichen Literatur zu Embedded Design Thinking, identifiziert Kernelemente des Ansatzes und bietet Lerneffekte aus einer mehrjährigen Fallstudie zur Entwicklung von Embedded Design Thinking in einem IT-Umfeld eines Finanzdienstleisters. Die Dissertation adressiert Praxis und Wissenschaft, welche Embedded Design Thinking nutzen bzw. weiter erforschen wollen.

Part A Synopsis

1 Introduction

Value creation is key to sustainable competitive advantage. The understanding of value creation has significantly changed over the last years. Companies face highly dynamic markets, and customers demand more interaction and involvement in the value creation process. Highly dynamic and globalized markets require stability on one hand and agility on the other. The IBM C-Studies (2013), which are based on face-to-face interviews with more than 4000 executives, show that technology will be the decisive driver for business in coming years (Kagermann & Österle, 2006; Kagermann et al., 2010). Additionally, executives have stated that customers will be key for strategic decisions. Combining these two findings suggests a strong need for Information Technology (IT) divisions in companies to create structures to deepen the understanding of what the customer wants in order to create business advantages. Weil and Woerner (2013) stress this view from the CIO's perspective by showing that CIOs of leading innovation companies spend more time on *external customer* activities. Design Thinking focuses on customers and value creation, especially in business and IT, through different principles and tools (Cooper et al., 2009; Dorst, 2011; Lindberg et al., 2011).

The cumulative dissertation discusses a newly crafted artefact: embedded design thinking. This iteratively created and developed artefact is discussed both scientifically and practically through the different publications integrated in this cumulative dissertation. The dissertation presents a three-fold structure of parts (A, B and C). Part A describes the situation that motivated this dissertation, presents an overview of the research results, summarizes the publication of the cumulative dissertation and critically reviews the research results. Part B discusses the state-of-the-art of current literature, and Part C contains the single publications that ground this cumulative dissertation.

1.1 Initial situation and motivation

Global competition and the increase in complex challenges force companies to rethink their value creation processes. This dynamism comes with customers who request more transparency, involvement in innovative processes and increased individual communication between them and solution providers (Thomas et al., 2006). Innova-

tion has been accredited as a decisive source for competitive advantage in terms of value creation (Crossan & Appaydin, 2010; O'Connor, 2008; Tushman & O'Reilly, 1996). Friedmann (2005) showed that, especially in today's increasingly "flat" world, innovation competencies are even more important. What makes the innovation context challenging is that it is typically complex, highly ambiguous and unknown (Eisenhart & Tabrizi, 1995; Lester & Piore, 2004; O'Connor, 2008; Schreyögg, Kliesch, & Eberl, 2007). Even those companies that have recognized the value of innovation find it hard to accomplish successful innovations for most of them (Jaruszelski et al., 2013; O'Connor, 2008). These difficulties and market drivers force companies to search for alternative approaches. Ultimately, this search has led both practice and research to focus on the topic that is being addressed as Design Thinking (Borja de Mozota, 2010; Hassi & Laakso, 2011; Liedtka et al., 2013; Mutanen, 2005). This can be described as being on its way to become a state-of-the-art innovation method (Thienen von, Noweski, Meinel, & Rauth, 2011). The categorization of Design Thinking as an innovation method (see also Brenner & Witte, 2011) is widely discussed among scholars, and there is no clear definition for Design Thinking (Johansson-Sköldberg, et al., 2013; Kimbell 2011). Instead, scholars seek a flexible approach to address the different needs that need to be served by Design Thinking (Hassi & Laakso, 2011; Johansson et al., 2011). Martin (2009) and Brown and Katz (2011) support the potential for the wide application of Design Thinking, especially with regard to its characteristic of being learnable by anyone and applicable to any innovation challenge (see also Wong 2009).

Though attention has grown and Design Thinking is being used intensively (e.g., Liedtka, King and Bennet, 2013; Mc Creary, 2003), scientific research on the effects or learning of Design Thinking in real corporate contexts or on the strategies to embed it in a managerial context are rare (e.g. Jahnke 2013, Johansson-Skölberg et al., 2013). Exceptions include works by Vetterli et al. (2011); Lindberg, Köppen, Rauth and Meinel (2012); Carlgren, Elmquist and Rauth (2014); and Vetterli et al. (2012).

As Dorst (2011) has shown, Design Thinking can develop significant potential, especially in IT. The Hasso Plattner Institute, together with Stanford University, has initiated research programs like *Design Thinking in the Development Processes of the IT*

Industry to foster findings concerning applying Design Thinking within the IT industry. These research programs focus on such questions as: How can Design Thinking be imparted and organizationally implemented? (Lindberg, Köppen, Rauth, & Meinel, 2012). These sorts of questions need to be seen in the innovation context of IT. Uebernickel and Brenner (2013) summarize the challenges as follows:

1) Agility and Speed: Since the market's dynamism is increasing, it is necessary for IT to create structures that enable a short time to delivery, such as services with high degrees of effectiveness, efficiency and quality.
2) Products, Services and Business Models: The position of IT is changing as IT-driven businesses are growing (Kagermann et al., 2010), and IT is being seen as decisive for further success in terms of creating innovation to enable competitive advantage.

Brenner et al. (2014) demonstrates that Business and Information System Engineering (BISE) needs to refocus on the users of new system(s). User-centric methods and approaches will help to fulfil this transformation. The authors also suggest the usage of methods and tools from other disciplines and show that first attempts have already been made to integrate the (digital) user into development processes. Lindberg et al. (2011) shows the dimensions in which there are significant differences between Design Thinking and IT development approaches. These dimensions are: Building on Diversity, Exploring the Problem Space, Exploring the Solution Space and Iterative Alignment of Both Spaces.

Nevertheless, BISE is very well positioned to identify and address the new ways in which users seek to interact with and experience solutions from companies (Brenner et al., 2014). Lindberg et al. (2011) mentions two main areas to focus on from an organizational perspective: On one hand, a methodological approach focuses on the "very front-end of a development process" (p. 15). From first applications of Design Thinking within IT environment, Lindberg et al. (2011) learned that the more focused Design Thinking is on the front end of a development process, the easier it is to embed Design Thinking within IT. The level of integration into existing processes and management systems seems, therefore, to be a crucial point in embedding Design Thinking. On the other hand, the focus on Design Thinking "as a comprehensive develop-

ment philosophy with strong implications for organizational processes and structures" (Lindberg et al. (2011), p. 15) goes along with the already mentioned strategic dimension that Design Thinking has been claimed to support (e.g., Clark & Smith, 2008; Fraser, 2007; Holloway, 2009). IT is as strategic asset (Kagermann et al., 2010; Picot et al., 2003; Roberts & Sikes, 2011) for organizations; thus, it is a critical area to foster innovation. Gassmann and Sutter (2008) show that innovative companies generally outperform non-innovative companies in terms of profitability. At the same time, it can be observed that most innovation initiatives fail. This area of conflict, which can also be observed in IT, defines the research gap that has been identified from both scientific and practical perspectives, since many scholars discuss whether the application of Design Thinking increases the probability of innovation success or not (Lindberg et al., 2011).

In sum, innovation is strongly driven by IT in established, large companies; therefore, IT has high innovation significance for companies. IT organizations need to search for alternative approaches to innovation, since the context of the need to innovate has changed. Specifically, from the IT perspective, there is a strong need to increase the proximity to the user of future systems. Design Thinking accounts for human-centricity and the fostering of innovation; hence, research needs to increase its application of Design Thinking within an IT environment

1.2 Goals, Research Questions and addressees of the dissertation

The goal of this dissertation is to analyse the as-yet insufficiently researched implementation of Design Thinking in an IT environment and, therefore, to create Embedded Design Thinking consisting of core elements. Embedded Design Thinking should foster the adoption of Design Thinking in the targeted organization context. Based on the initial situation and motivation, the following leading question can be defined:

> What is an embedded approach for Design Thinking, and which core elements support this embedding?

Scientific discourse is characterized by two essential aspects: The rigor of the work (i.e., the theoretical grounding) and the relevance of the research topic (i.e., the link to the practical environment) (Hevner, 2004). As Chapter 1.3 will explain, the artefact of

Embedded Design Thinking has been closely developed with practice, applied in practice and evaluated through practice. Chapter 1.3 will, at the same time, address the required research rigor, through describing what research approach and research methods were used to scientifically ground the cumulative dissertation. Hevner (2004) also demands rigor through the building of relevance on the basis of rigor, such as the already given body of knowledge. This capture of the body of knowledge, or the so-called state-of-the-art, is defined as "an essential first step and foundation when undertaking a research project" (Baker, 2000). From this perspective, the first research question can be derived as follows:

> RQ1: What is the current state-of-the art of implementing Design Thinking in organizations?

To address the specification of an artefact like Embedded Design Thinking, as mentioned in the central question, it is necessary to address the following research question, since there is no unified definition of Design Thinking or Embedded Design Thinking:

> RQ2: What are the key elements of Embedded Design Thinking for sustainable embedding into IT organizations?

RQ2 leads directly to the next research question, which is linked to the IT organizational context. This context has been described by Lindberg et al. (2011), Dorst (2011) and Lindberg et al. (2012) as an embedding context with high potential. Therefore, it is important to identify connection areas, such as those that Lindberg et al. (2011) have already noted as being part of the organizational and process view. This leads to Research Question 3:

> RQ3: What possible connections can result from merging Design Thinking with IT development processes?

Since the artefact Embedded Design Thinking has been evaluated over three years in practice and has followed an iterative improvement mode, an evolutionary perspective can be gained. Hence, the following research question can be derived:

RQ4: What are embedding steps, challenges and enablers in implementing Design Thinking?

These research questions will be addressed through the different contributions (part C) presented within this cumulative dissertation.
The following descriptions will concretize the contributions to academia and practice. The dissertation will address practitioners, such as decision makers in (IT) organizations or innovation, as well as researchers interested in analysing or enlarging the current body of knowledge:

- **Researchers:** Through its research results, this dissertation provides a base for discussion on how Design Thinking can be embedded in a corporate (IT) context. Further, it offers a discussion environment for capturing evolutionary models of embedding Design Thinking that may be taken on in further research projects. The long-lasting implementation of Design Thinking in a specific IT context provides an interesting research base for analysing the implementation processes. Through reflection on these implementation processes, researchers have access to a significant body of knowledge, which can be used for further research. Besides gaining from this content-wise added value, researchers have the opportunity to reflect on the evolution of such artefacts and, possibly, to further improve artefact development from a scientific perspective.

- **Decision makers from practice:** Design Thinkers, IT staff, executives and project workers can all gain new insights from this dissertation's embedding model, which can be taken as a starting point for their own implementation efforts. The artefact of Embedded Design Thinking should be subject to further development, through practice, to a final Design Thinking approach.

- **Business engineers:** Business engineering has a decade-long history within the research context in which this dissertation has been written (see Section 1.3). Business Engineers are characterized mainly by two main elements. First, Business Engineers have the focus to transform companies — and, in doing so, they follow engineering approaches that help to aid transformation along clear paths, milestones and transformational structures. Business engineers can especially gain value from this

dissertation, since Design Thinking provides a structured approach to designing solutions with a strong customer/human focus. Since business engineers are also focused on customer processes, Design Thinking with a strong focus on the customers themselves could have high value for business engineers.

- **Students and scholars:** On one hand, students can benefit from the insights of a practical case to learn how companies embed customer-centric approaches. On the other hand, scholars can use this case as a teaching case, with a focus on benefits, challenges, and decisive evolutionary triggers.

1.3 Research approach and research environment

The dissertation at hand was written at the Institute of Information Management of the University of St. Gallen. The applied research project—Design Management—provided the research and practical context under the project chair, Prof. Dr. Walter Brenner. Within this applied research project, some findings were already compiled (Schindlholzer et al., 2011); these findings served as a basis for further research. The author collected the research base during his employment period as a research assistant from May 2010 until October 2013. The applied research project focused mainly on projects with durations of about five months each. These projects were recurrent annually over the duration of the dissertation and were divided across two different companies (in total: six different projects of five months each). In parallel, the research took place within graduate class (2010-2013) at the University of St. Gallen. This favourable constellation enabled a design science research (Hevner, 2004) on the creation of approaches for embedding Design Thinking. These projects focused on embedding Design Thinking into the corporate IT structure, as well as on providing a useful basis for deriving scientific results. The year-long duration of the embedding projects created an adequate setting for following the Design Science Research Methodology Process Model put forth by Peffers et al. (2007). In addition to these embedded and focused Design Thinking projects, the chair initiated an unique opportunity for students to learn about Design Thinking through company-contracted mandates in an intensive 10-months setting - a program that began in 2005. The applied research project had the goal of educating involved students and accompanying these student teams in work on real-world innovation challenges, with research on, for example, the applicability of innovation challenges (see Vetterli et al., 2012b). This student-based course also inter-

acted closely with Stanford University (me310.stanford.edu/) and other Design Thinking schools (http://sugar-network.org/). The proximity to mechanical engineering students from Stanford University (and other Design Thinking schools) and to business innovation students of University of St. Gallen provided an optimal research habitat for multidisciplinary ecosystems of Design Thinking.

The research setting of the institute of information management—and, hence, this dissertation—can be linked to the design-oriented approach (Oesterle et al., 2011). This approach follows the research methodology called Design Science Research, which can be understood as a research method for creating designs that are rigorous, from a theoretical point of view, and relevant, from a practice-driven point of view (Hevner, 2004). This dissertation aims to design artefacts, "namely constructs (e.g., concepts, terminologies, and languages), models, methods, and instantiations (i.e., concrete solutions implemented as prototypes or production systems)" (Oesterle et al., 2011, p. 9). The created artefacts differ for each contribution (see Part C). The goal of this dissertation is to examine the shortfalls of embedding procedures for DT and compiling approaches to solve the problem for the sustainable embedding of DT.
The research project at hand is defined as a cumulative dissertation, following the doctoral degree regulations of the University of St. Gallen. Thus, it is subject to a meta research process: in this case, that of Peffers et al (2007). The individual research projects that comprise the cumulative dissertation discuss singular or multiple facets of the leading question of the dissertation—and, hence, answer the single research questions (RQ1 through RQ4; see part A, Chapter 1.2). Österle and Otto (2010) define the-diffusion of findings from research projects to academia and practice. The author has followed this recommended procedure by regularly publishing the findings of this project. Most of the findings were directly validated within embedded Design Thinking projects. In terms of research methodology, each publication integrated a single or multiple research methodology. Overall, a pluralism of methodology is presented—which, in design-oriented research, has gained significant support (e.g., Gill & Bhattacherjee, 2009; Österle & Otto, 2010). In the following, the central research methods used in the different publications are described:

Literature analysis: At the beginning of the meta research process is a literature analysis. This literature analysis provides validity concerning the study's rigor by facilitating the identification of the topic's theoretical context. Baker (2000) characterizes this as an essential first step and foundation

when undertaking a research project. The process of literature analysis follows clear guidelines (Fettke, 2006; Webster & Watson, 2002) that facilitate the traceability of the results (vom Brocke et al., 2009). The standardized steps of Vom Brocke et al. (2009) guarantee that the research work integrates previously published work. This research method has been applied to nearly every single research project in the present dissertation, since it is the state-of-the-art motivating the focused topic.

Case Study Research: To capture the four and a half year Embedded Design Thinking project, a case study approach following Yin (2009) and Dube and Paré (2003) was conducted. The focus was on the identification of embedded Design Thinking elements, especially from an evolutionary perspective (Mc Alexander et al., 2002), as well as on the identification of major challenges in implementing and incorporating success factors for implementing Design Thinking in the specific IT context.

Semi-structured expert interviews: The semi-structured expert interviews were conducted mostly to provide data for case study research. The interviews were semi-structured to create comparability without losing the flexibility. The number of semi-structured expert interviews varied depending on the project timeframe. In the longest research project, the author conducted 71 in-depth semi-structured expert interviews over the duration of five years. These interviews are used both to ensure relevance within their specific research projects but also to evaluate the research results.

The brief description of the primary research methods used can be deepened within the specific contributions of Part C.

1.4 Structure of the dissertation

This cumulative dissertation is divided into three main parts (A, B and C). The following illustration visualizes the structure of the dissertation:

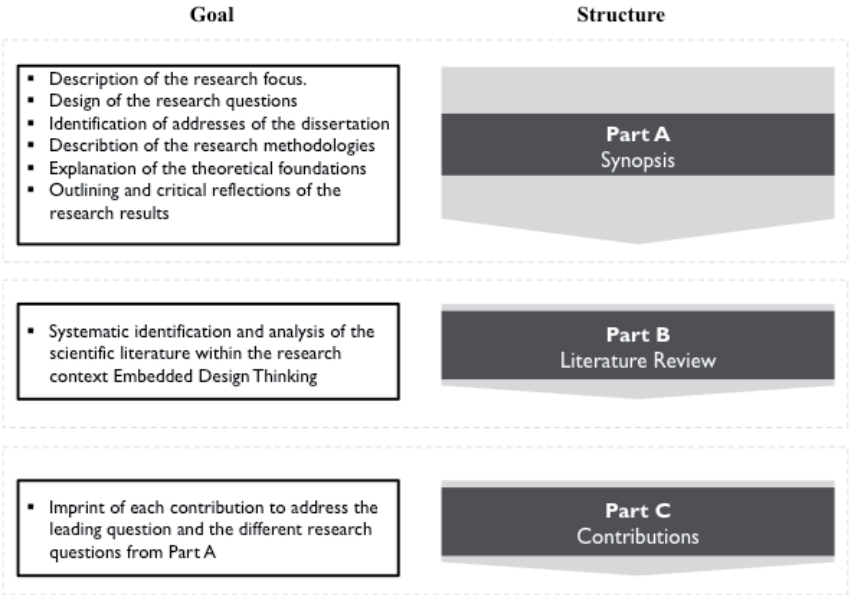

Figure A-1: Structure of the cumulative dissertation

2 Theoretical Foundations

The following definitions should elaborate on the terms of Design thinking and Embedded Design thinking, which is the implementation of DT within corporate environment.

2.1 Design Thinking

Design Thinking has been subject of definition attempts for a long time. Scholars have even highlighted the need to look for a unified definition that is adequate to Design Thinking as the practice of professional designers. The search has a discourse history of over 40 years. Johansson-Sköldberg et al. (2013) breaks the history of this discourse of *designerly thinking* (p. 123) into five different clusters, linking a core concept to each cluster:

designerly thinking clusters	key literature	core concept
Design and designerly thinking as the *creation of artefacts*	Simon, 1969	The science of artificial
Design and designerly thinking as a *reflective practice*	Schön, 1983	Reflection in action
Design and designerly thinking as a *problem-solving activity*	Buchanan, 1992; Rittel and Webber, 1973	Wicked Problems
Design and designerly thinking as a *way of reasoning/making sense of things*	Lawson, 2006 [1980]; Cross, 2006, 2011	Designerly ways of knowing
Design and designerly thinking as *creation of meaning*	Krippendorff, 2006	Creating meaning

Table A-1: Five discourses of design thinking (from a designer's profession perspective) [based on Johansson-Sköldberg et al. 2013]

These different discourses lead to the designer's capability, which is based on three main categories: "practices", "thinking style" and "mentality" (Hassi & Laakso, 2011, p. 6). The discourse on Design Thinking as it relates to the managerial perspective began in the early 2000s. This research stream can be divided into three main clusters (Johansson-Sköldberg 2013) and labelled *Design Thinking*:

design thinking clusters	key literature	relation to practice
Design thinking as design company *IDEO's way of working* with design and innovation	Kelley [2001, 2005] Brown [2008, 2009]	How design thinking is being done How anyone can use design thinking

Design thinking as a way to approach indeterminate organizational problems, and a *necessary skill for practising manager*	Dunne & Martin [2006]; Martin [2009]	How successful production companies do design thinking How any company (manager / individual) can do design thinking
Design thinking as *part of management theory*	Boland & Collopy, [2004a]	Design Thinking as an analogy & alternative

Table A-2: Three discourses of design Thinking (from a manager's perspective) [based on Johansson-Sköldberg et al. 2013]

Both discourses can be summarized through a focus on the managerial discourse of Design Thinking as the approach that describes how any firm (or parts of the firm) can use and benefit from a designer's practice (e.g., Brown, 2008; Carlgren et al., 2014; Dunne & Martin, 2006; Martin, 2011; Rauth et al., 2014).

2.2 Embedded Design Thinking

The term "embedded" can be defined as "to cause to be an integral part of a surrounding whole" (freedictionary.com, 2015). The Encyclopaedia Britannica (2015) introduces the following distinct logic: The concept of embeddedness explains how, although they each seemingly follow their own distinct logics and rules, different surroundings (institutions) and contexts interact and may complement or conflict with each other. The embedding process is the approach that targets the status of being an integral part of a surrounding whole by, at the same time keeping its own logic and rules—and, hence, intensively interacting with surroundings. Embedded Design Thinking can be defined as the concept that leads to the application of Design Thinking elements (practices, thinking styles and mentalities) within a corporate environment (Hassi & Laakso 2011; Vetterli et al., 2012). Embedding Design Thinking is, therefore, the process perspective on the procedure for reaching the state of being embedded. Embeddedness is achieved when Design Thinking is used in daily routines (Meinel & Leifer, 2015).

2.3 Method Engineering

The IWI-HSG focuses on the St.Galler Business Engineering, which comprises fundamentals and methods for different kinds of transformation projects (Österle & Winter, 2003). Embedding Design Thinking contains several elements of a method which is created through method engineering (Heym, 1993 & Gutzwiller, 1994). The

approach of method engineering as it is understood in this dissertation, is the systematic and structured process to design, modify and adapt (software developments) methods, through describing the method components and their relations among each other (Heym, 1993, p. 5). Methods are composed of following elements: Activities, roles, results, metamodel and technique. The different elements are interdependent as following illustration shows (Figure A-2):

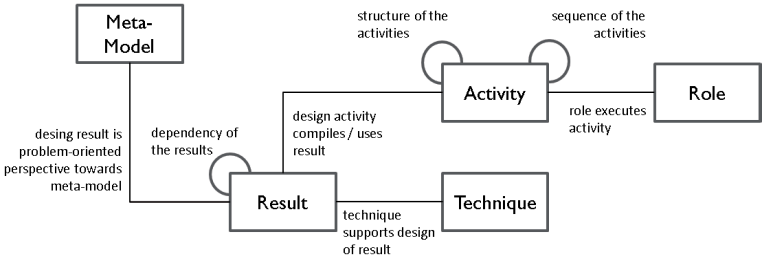

Figure A-2: Method components in method engineering (translated from Gutzwiler, 1994, p. 12-14)

An activity is the functional execution unit, which compiles results. Are activities being arranged in a sequence, a process model results. Activities are being performed by roles (e.g. persons or organisation units). Results are being documented in previously defined and structured final documentations. Techniques are being understood as detailled manuals for designing one or several final documentations. The metamodel structures the elements of the results as data model. The publications in part C partly contain singular elements for a method description, such as roles (contribution V) or metamodel (contribution II). Techniques as well as activities and results are being described in contribution III, VII, IX and X. These elements aim not to describe exclusively its dimension.

3 Results of the Dissertation

The strongly integration of research with practice projects ensure a high alignment with practice. This proximity had significant impact on the applicability of the research results. Hence, referring to Hevner and Chatterjee (2010) and Design Science Research, not only was the requirement of rigor addressed, but relevance was also assured, since the author was heavily involved in practical project work.
Figure A-3 provides an overview of the lead question and the main dimensions, which are linked to the contribution and the relevant research question.

> What is an embedded approach for Design Thinking, and which core elements support this embeddedness?

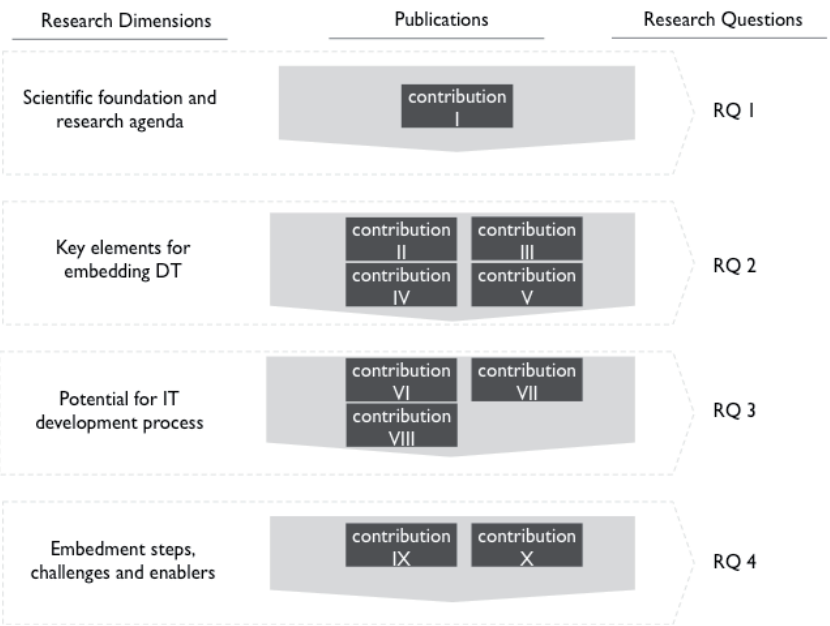

Figure A - 3: Overview research results
(contributions are printed in part B and C)

The explanations are divided into four sections (3.1 through 3.4), each addressing the central points of each research dimension. Each section summarizes the research results. Each specific article can be consulted for deeper explanations.

3.1 Scientific foundation and research agenda

The first research question addresses what the current body of knowledge represents. Essentially, two types of main categories can be distinguished: design discourse and management discourse. Design discourse is rooted in the design discipline and, thus, provides a stronger body of knowledge. However, the focus of this literature review was on managerial discourse, as the following research question outlines:

> RQ1: What is the current state-of-the-art of implementing Design Thinking in organizations?

The management discourse is a newer research stream. Academic publications mostly concern the theoretical usage of Design Thinking or group experiments in a controlled environment (Carlgren et al., 2014). The connection between Design Thinking and the organizational environment is only minimally discussed in the implementation of Design Thinking; rather, it is addressed through the application of Design Thinking. For example, researchers have focused on how the concept of Design Thinking is understood, how organizations use Design Thinking (mostly in relation to already existing innovation efforts) and, finally, who is involved in those efforts. The understanding of Design Thinking among different researchers within managerial discourse differs significantly. The issue is often argued due to the lack of a unified understanding of Embedded Design Thinking. However, some scholars argue that this lack of uniformity is beneficial. Such researchers argue that only this application ambiguity keeps the potential of Design Thinking high (Hassi & Laakso 2011). Currently, embeddedness understandings diverge significantly, and there is no clear understanding of what needs to be embedded (Carlgren et al., 2014; Johansson-Skölberg et al., 2013; Rauth et al., 2014), which organisational level(s) should be targeted (Chen, 2013; Liedkta, 2014; Lindberg, et al., 2011), and what constitutes the different learnings of embeddedness maturity. Therefore, the research agenda focuses on the enablers/triggers for successfully embedding Design Thinking. Furthermore, only a few researchers have focused on a specific industry, such as IT. The first attempts to explore Design Thinking in an IT environment are promising. Therefore, this industry should be added to the research agenda as well.

3.2 Key elements for embedding Design Thinking

The work of different scholars focuses on DT in mostly isolated research contexts. Following the design science research approach (Hevner et al., 2014), rigor is scarce. However, the relevance perspective offers a unique opportunity to apply Design Thinking within the boundaries of a financial service provider. To this end, more than three years of close observation and Embedded Design Thinking was launched as a sort of prototype that needed to be tested. This led to the first approach to determining the key elements of Embedded Design Thinking, as shown in Research Question 2:

> RQ2: What are the key elements of Embedded Design Thinking for sustainable embeddedness in IT organizations?

From a meta-model perspective, approximately 12 organizational touch points are targeted (Vetterli et al., 2012a). Three different levels can be identified: the *strategic* level, which requires relevant challenges and freedom of design. It is not certain what kind of challenge (i.e., product/service-based, process-based or business model-based) should be used, as long as it has strategic significance. On a *project* level, a model must be in place, including an enabling constellation and staff comprising the right competencies and tasks. Additionally, a communication concept helps to steer the attention that Embedded Design Thinking currently faces. Connections to ongoing project structures need to be designed very carefully in order to generate a shared interface among relevant processes (Vetterli et al., 2011), without giving up the potential of Design Thinking. On an *individual* level, the mindset of embeddedness in a suitable environment, as well as an adequate toolkit, serve as key elements. Sustainability is especially reached through the use of models and communication. However, this is not a mutually exclusive view; thus, further research needs to be invested.

3.3 Potential for IT development process

As already outlined in Section 1.1 from Part A, IT is critical to developing decisive innovation for companies' survival. Therefore, the alignment of IT and business is a prerequisite that needs to be fulfilled. However, business-IT alignment is an "evergreen" goal in CEOs' to do lists for the last 30 years (Luftman & Ben-Zvi, 2010).
The application of Design Thinking in an adequate constellation involving IT, a stragically relevant business challenge (i.e., problem to solve) and end-customer contact helps IT leverage its position in relation to the business. Furthermore, the potential for

an IT development process needs to be created through a typical Design Thinking approach, which will ensure a high learning speed. RQ3 requests the identification of connected areas where Design Thinking can be embedded to generate added value.

> RQ3: What are possible connections between Design Thinking and IT development processes?

It could be argued that it is easier to create connection areas where an end-consumer is being targeted as a user. Design Thinking would help a design team within IT to fully focus on (future) users/customers. Lindberg et al. (2011) have proposed two different connecting areas: the very front-end development process and the higher organizational application level within IT. As shown in Vetterli et al. (2013b) the very front end of development is definitely a potential connecting area. In particular, it has been connected to requirements engineering (RE). This area is often highly ill-defined, and Design Thinking has been accredited with the ability to solve "wicked" problems (Rowe,1987) and expand understanding of the end user beyond the abilities of classical RE. Agile approaches, such as scrum, could be extended through three different modes, depending on the ratio of software development and Design Thinking needed (Häger et al., 2015).

3.4 Embedment steps, challenges and enablers

Finally, the last research question (RQ4) addresses the embedding process of Design Thinking. The embedding subject is not clearly defined in the literature as shown in RQ1; however, the created artefact of the dissertation at hand has been embedded successfully over the last six years.

> RQ4: What are the embedding steps, challenges and enablers in implementing Design Thinking?

From an embedding pathway, three main steps occur during embedding. First is the step in which the organization learns about Design Thinking and its potential. Second is the phase during which the organization adapts some part of Design Thinking to make it more accessible within the organization. Third is the diffusion across different divisions and teams. Enablers for this pathway development include the operational model and the possibility of Design Thinking being applicable in different scenarios (e.g., radical innovation, day-to-day improvements and the testing of vendor offers). Challenges are related to resources in time and people - not necessarily a lack of peo-

ple, but the wrong people. Additionally, though this concern is industry-specific, the risk aversion of the financial industry as a whole must be considered. Stanford Health, as an exception to this rule, staffs its design teams by testing their willingness to take risks, especially across hierarchy levels.

4 Summary of the contributions

Hereafter is a profiling overview of the contributions which are part of this cumulative dissertation. Table A -1 gives an overview of the contributions. These contributions were selected to address the research questions formulated in part A, chapter 1.2.

contribution	title	publication medium	status	reference
I	Embedded Design Thinking in Organizations– a literature review	IWI-HSG	published	(Vetterli, 2015)
II	A Reference-Metamodel on Design Thinking for the corporate Information Technology context	d.confestival proceedings	published	(Vetterli et al., 2012a)
III	Die Innovationsmethode Design Thinking.	Dynamisches IT-Management - So steigern Sie die Agilität, Flexibilität und Innovationskraft Ihrer IT	published	(Vetterli et al., 2011)
IV	Designing innovation: Prototypes and team performance in Design Thinking.	International Society for Professional Innovation Management Conference proceedings	published	(Vetterli et. al. 2012b)
V	A Design Thinking Role Model Enables Creativity in IT: Case of the Financial Industry	International Conference on Information Resources Management proceedings	published	(Vetterli et al., 2013a)
VI	From Palaces to Yurts – Why Requirements Engineering Needs Design Thinking	IEEE Internet Computing	published	(Vetterli et al., 2013b)
VII	DT@Scrum: Integrating Design Thinking with Software Development Processes	Design thinking Research - Building Innovators	published	(Häger et al., 2015)
VIII	Brücken schlagen.	io Management	published	(Brocke et al., 2012)

IX	Initialzündung durch Embedded Design Thinking — Ein Fallbeispiel aus der Finanzindustrie	Organisationsentwicklung: Zeitschrift für Organisationsentwicklung und Change Management	published	(Vetterli et al., 2012c)
X	How Deutsche Bank's IT Division Used Design Thinking to Achieve Customer Proximity	MIS Quarterly Executive	forthcoming (March 2016)	(Vetterli, et al., 2016)

Table A - 3: Overview of all relevant contributions of the cumulative dissertation

4.1 Contribution I: Scientific foundation - A literature review

4.1.1 Publication overview

Title:	Embedded Design Thinking in Organizations – a literature review
Authors:	Vetterli, Christophe
Medium:	IWI-HSG (integrated as part B of this dissertation)
Year:	2015
Language:	English

4.1.2 Abstract

Organizations are forced to think about different approaches to gain a competitive advantage Design Thinking addresses the complex environment companies are facing nowadays adequately and therefore has received serious attention from practitioners as well as scholars alike. In comparison to the discourse about design thinking from a designer's point of view, is the managerial discourse about the embedding of Design Thinking still limited. This scant academic foundation is also linked to the fact that a few basic questions remain unanswered, such as what is meant by embedding design thinking in corporations. Therefore the state-of-the-art remains to be identified. This gap in the literature has provided the opportunity to present this literature review. To foster academic groundedness, the method used to identify, present and analyze the relevant literature is based an established literature review approach. The literature review presented here closes with recommendations for future research

4.2 Contribution II: The reference metamodel for Embedding Design Thinking

4.2.1 Publication overview

Title:	A Reference-Metamodel on Design Thinking for the corporate Information Technology context
Authors:	Vetterli, Christophe; Brenner, Walter; Uebernickel, Falk
Medium:	1st d.confestival proceedings
Year:	2012
Language:	English

4.2.2 Abstract

The different models within the Design Thinking body of knowledge and the missing unified understanding in the corporate environment, lead to unify terminologies of Design Thinking in the IT environment. A standard is needed which the concepts of concrete methods can relate to. Refering to the theory of Method Engineering a metamodel is one contributing part of method elements and connects the specific method and its element to a more abstract level. Thus the created Reference-Metamodel integrates the given elements of Embedded Design Thinking in a corporate context on the highest semantic level and provides a base for further model creations on a lower semantic level.

4.3 Contribution III: Initial Embedding of Design Thinking

4.3.1 Publication overview

Title:	Die Innovationsmethode Design Thinking.
Authors:	Vetterli, Christophe; Brenner, Walter; Uebernickel, Falk; Berger, Katharina
Medium:	(Eds.) Dynamisches IT-Management - So steigern Sie die Agilität, Flexibilität und Innovationskraft Ihrer IT. Symposium Publishing, Düsseldorf
Year:	2011
Language:	German

4.3.2 Abstract

Innovation provides the basis for successful companies in general as well as in IT. The Chief Information Officer however did not have many degrees of freedom in the last years to work systematically and open on innovation, due to cost pressure. Processes in innovation management were initiated but operative innovation processes within IT could hardly being run through. The Institute of Information Management of the University of St. Gallen has developed and successfully implemented Embedded Design Thinking, an operative innovation approach in the context of two projects together with the Deutsche Bank AG. The approach is based on Design Thinking. Findings for Embedded Design Thinking were gained from implementing an academically developed method into an IT-division of a bank. These provide a contribution to successfully foster Embedded Design Thinking to strengthen the business value of an IT-division towards business.

4.3.3 Abstract (original article language)

Innovationen bilden die Grundlage für erfolgreiches Unternehmertum – auch in der IT. Dem Chief Information Officer war jedoch in den letzten Jahren durch Kostendruck die Hände gebunden, systematisch und offen an Innovationen für das Geschäft zu arbeiten. Prozesse im Innovationsmanagement wurden zwar angestoßen, relativ selten konnten jedoch operative Innovationsprozesse in der IT effektiv durchlaufen werden. Das Institut für Wirtschaftsinformatik der Universität St. Gallen hat im Rahmen von

zwei Projekten gemeinsam mit der Deutschen Bank AG einen operativen Innovationsprozess mit dem Namen Embedded Design Thinking, entworfen und erfolgreich eingeführt. Das Verfahren basiert auf der Methode Design Thinking. Aus dem Transfer einer akademisch entwickelten Methode in den IT-Bereich einer Bank konnten Erkenntnisse für ein Embedded Design Thinking entwickelt werden. Diese leisten einen Beitrag, Embedded Design Thinking erfolgreich aufzubauen und den Business Value eines IT-Bereichs gegenüber den Fachbereichen zu stärken.

4.4 Contribution IV: Design Thinking applied on different innovation challenges

4.4.1 Publication overview

Title:	Designing innovation: Prototypes and team performance in Design Thinking.
Authors:	Vetterli, Christophe; Hoffmann, Friederike; Brenner, Walter; Eppler, Martin; Uebernickel, Falk
Medium:	22nd International Society for Professional Innovation Management Conference proceedings
Year:	2012
Language:	English

4.4.2 Abstract

This study investigates design thinking innovation teams working on three different innovation tasks: business model innovation, service innovation, and product innovation. Each task involves the generation of many prototypes, one of which needs to be selected as the final prototype. Further, one of the teams collaborated through virtual collaboration. By measuring both subjective and objective performances of the teams, we compared the different innovation tasks and their impact on design thinking teams. Our preliminary study shows that while the generation of many prototypes indeed seems to support the selection of the best final prototype, it is mostly the team process which impacts the quantity of all and quality of the final prototype. Especially the virtually cooperating team working on a service innovation task, experienced major difficulties in the process, while we can report that the business model innovation team generated the most prototypes while working in a rather harmonious team.

4.5 Contribution V: The Role Model as key element

4.5.1 Publication overview

Title:	A Design Thinking Role Model Enables Creativity in IT: Case of the Financial Industry
Authors:	Vetterli, Christophe; Brenner, Walter; Uebernickel, Falk
Medium:	International Conference on Information Resources Management proceedings
Year:	2013
Language:	English

4.5.2 Abstract

The challenge banks face to gain advantage over their competitors is being placed under pressure by the ever increasing speed of development which arises from the pace of innovation in computer technology, rapid changes in industry regulation and fast-changing customer needs. Banks have creative heads but the pursuing of efficient customer-centric creative work within an organization is often challenging. This paper presents a design thinking role model, which was iteratively designed over nine projects within a period of four years and implemented in an IT department of two leading multinational banks. It analyses the different roles of the design thinking role model and its multidisciplinary elements to enable creativity within these IT departments. It could be shown that creativity was enabled in this corporate IT context through the design thinking role model and thus a good base for the overall innovation process could be reached.

4.6 Contribution VI: Bridging Design Thinking with Requirements Engineering

4.6.1 Publication overview

Title:	From Palaces to Yurts – Why Requirements Engineering Needs Design Thinking
Authors:	Vetterli, Christophe; Brenner, Walter; Uebernickel, Falk; Petrie, Charles
Medium:	IEEE Internet Computing March / April
Year:	2013
Language:	English

4.6.2 Abstract

Requirements engineering systems are geared for large developing information systems („palaces“) and are not what is needed for today’s world of rapidly changing, app-enabled products („yurts“). These web and mobile apps are small, require rapid development, must closely fit customer needs, and change often. Therefore the authors present what the potential is of involving the customer in interactive prototypes throughout the development process and how the Requirements Engineering gains benefit out of Design Thinking activities within the company.

4.7 Contribution VII: Applying Design Thinking to agile methods

4.7.1 Publication overview

Title:	DT@Scrum: Integrating Design Thinking with Software Development Processes*
Authors:	Häger, Franziska; Kowark, Thomas; Krüger, Jens; Vetterli, Christophe; Uebernickel, Falk; Uflacker, Matthias
Medium:	H.Plattner, L. Leifer & C. Meinel, *Design Thinking Research: Building Innovators* (p. 263-289). Heidelberg: Springer.
Year:	2015
Language:	English

*Paper is based on: Vetterli C.; Häger, F.; Kowark, T.; Uebernickel, F.; Brenner, W.; Krüger, J.; Plattner, H. , Stortz,B.; Sikkha, V. (2013). Whitepaper for SAP - Jumpstarting Scrum with Design Thinking. Working Paper Institute of Information Management University of St. Gallen

4.7.2 Abstract

Design Thinking has shown its potential for generating innovative, user-centered concepts in various projects at d.schools, in innovation courses like ME310, used by design consultancies like IDEO, and recently even in projects at large companies. However, if Design Thinking activities are not properly integrated with production processes, e.g. software development, handovers become necessary and potentially prevent great ideas from becoming real products. To reduce the perception of these handovers as acts of "throwing a wild idea over the fence," different integration approaches have been proposed. A seamless integration of Design Thinking into the regular development processes of software development companies, however, is still subject to research. DT@Scrum is being presented as a process model that uses the Scrum framework to integrate Design Thinking into software development. Three operation modes, which differ in the ratio between software development and Design Thinking activities, form the foundation of our approach. Development teams chose their respective operation mode after each sprint based on how well the requirements of the product are understood. We present initial applications of our approach in two university courses, and preliminary results of an experiment that tests if and how Design Thinking can benefit from Scrum's planning techniques. The chapter concludes with an outline of future applications of our process model in industry scenarios and experimental validations of further techniques that supplement DT@Scrum.

4.8 Contribution VIII: Bridging the gap of Business and IT with Design Thinking

4.8.1 Publication overview

Title:	Brücken schlagen.
Authors:	Brocke, Henrik Finn; Vetterli, Christophe; Brenner, Walter; Uebernickel, Falk
Medium:	io Management September / Oktober
Year:	2012
Language:	German

4.8.2 Abstract

Reason for lacking of Business-IT-Alignment is identified in two main organisational gaps: Communication between technical oriented IT-organisations and business, and the identification of the users needs and creation of adequate solutions. The authors introduce Embedded Design Thinking, which combines an organisational setting with a methodological rigor, whereas prototyping-based design reduces the challenges of Business-IT-Alignment. Through the direct and continuous user involvement the IT-developer can identify the user's need and design user-oriented solutions, together with business. The authors describe how Embedded Design Thinking has the potential to sustainably improve the Business-IT-Alignment to finally incorporate the IT-division better into the organisational structure.

4.9 Contribution IX: An impact analysis on Embedded Design Thinking

4.9.1 Publication overview

Title:	Initialzündung durch Embedded Design Thinking — Ein Fallbeispiel aus der Finanzindustrie
Authors:	Vetterli, Christophe; Uebernickel, Falk; Brenner, Walter
Medium:	Organisationsentwicklung: Zeitschrift für Organisationsentwicklung und Change Management (2)
Year:	2012
Language:	German

4.9.2 Abstract

Through the implementation of Design Thinking the so-called Embedded Design Thinking was created – a concept, which enables the appliance of key elements of Design Thinking. Based on learnings, the on-going case study shows that embedding Design Thinking requires time and e.g. through an adequate project constellation Business-IT-Alignment can be fostered.

4.9.3 Abstract (original article language)

Durch die Einbettung von Design Thinking entstand das so genannte Embedded Design Thinking – ein Konzept, das die Kernelemente von Design Thinking im Unternehmen anwenden lässt. Basierend auf erfahrenen Lerneffekten zeigt die Fallstudie, dass die Implementierung Zeit braucht und durch eine geeignete Projektkonstellation, beispielsweise Business-IT-Alignment, erreicht werden kann.

4.10 Contribution X: An evolutionary view on Embedded Design Thinking

4.10.1 Publication overview (forthcoming)

Title:	Achieving customer proximity: Design Thinking at Deutsche Bank's IT division
Authors:	Vetterli, Christophe; Uebernickel, Falk; Brenner Walter; Stermann, Dirk; Petrie, Charles
Medium:	MIS Quarterly Executive
Year:	March 2016
Language:	English

4.10.2 Abstract

Design thinking is a customer-centric approach for integrating end customers in the innovation process. This article describes the 6-years evolution of design thinking in Deutsche Bank's IT division and its role in solving specific problems, better integrating the business and IT divisions, and bringing the bank's IT closer to its customers. The lessons learned can be used by CIOs and other business leaders striving for customer-centricity in their value-creation processes.

5 Discussion and Outlook

In the following, Part A closes with a critical reflection on the compiled research results of this dissertation and a discussion of limitations and possibilities future research.

5.1 Discussions und Limitations

The goal of this dissertation is to answer the primary question of this research:

> What is an embedded approach for Design Thinking, and which core elements support this embedding?

The leading question was divided in four more research questions:

RQ1: What is the current state-of-the art of implementing Design Thinking in organizations

RQ2: What are the key elements of Embedded Design Thinking for sustainable embedding into IT organizations?

RQ3: What possible connections can result from merging Design Thinking with IT development processes?

RQ4: What are the embedding steps, challenges and enablers in implementing Design Thinking?

Contribution I (Part B of this dissertation) identifies the status quo of the scientific discourse regarding why DT is embedded, how it is embedded, what is being embedded and who is doing the embedding. Furthermore, research gaps are identified. The scientifically focused literature review also suggests limitations, since popular management literature has already provided significant contributions to the research question. However, these contributions have not yet been transferred into the scientific body of knowledge.

Contributions II through V (Part C of this dissertation) address RQ2. The design of a reference meta-model (RMM) provides a unified terminology for Design Thinking (within IT), as well as a standard on which the concepts of concrete methods can be based in further research (contribution II). The description of embedded Design Thinking within the IT (contribution III) of a financial service provider addresses the first version of the artefact regarding what is being embedded within industry. Furthermore, a key element of Design Thinking concerns the challenge addressed by design teams

(contribution IV). It has been successfully proven that Design Thinking works for various challenges (e.g., processes, business models and services). Contribution V shows the Design Thinking model and its multidisciplinary elements for enabling creativity within the studied IT department. It proves that creativity can be initiated and assured in this corporate IT context. Another limitation exists in these research contributions, since the artefact and its element were designed at the very beginning and were followed by rather incremental adaptions of the approach, rather than with radical changes in embedding (which could have provided a strong comparison case). The elements were, therefore, identified as valid for embeddedness; however, they are certainly not conclusive. Additional limitations result from contribution IV, which was conducted only in a semi-relevant environment, since groups of students were observed in terms of their approach to accomplishing different types of real-world challenges.

Contributions VI through VIII address RQ3 and provide insights at the intersection of Design Thinking and IT's development process. Requirement engineering systems are geared toward developing information systems and are not needed for today's world of rapidly changing, app-enabled products. Contribution VI, hence, discusses how RE could benefit from Design Thinking, as well as from software development processes. A better handover from design teams to software development teams is analysed in three different modes (contribution VII). Contribution VIII shows how Design Thinking can foster the business-IT alignment and results in a better integration of IT organization throughout the company. Its contributions for RQ3 are in the form of concept papers. Therefore, limitations exist due to a probable missing relevance for the real-world environment (except in the case of contribution VII, which was ultimately tested in a real-world environment). Another limitation is the narrow focus on a financial services provider, which makes it impossible to generalize the findings to all IT providers.

An antecedent to the state of Embedded Design Thinking is the embedding process of Design Thinking elements. Contributions IX and X deliver insights and address RQ4 by providing in-depth views of which elements are applied. The last contribution (No. X) refers to the main findings of the other contributions and presents an in-depth, six-years case study, which focuses particularly on the embedding procedure within the context of a multi-national financial service provider. An overall limitation exists due to the strong qualitative approach of research through in-depth (expert) interviews as the primary inputs for the database. Research approaches with strong focuses on qualitative data can result in strongly subjective findings.

Overall, it can be said that the leading research question and its constituent research questions RQ1 through RQ4 have been answered. Thus, the requirements of relevance and rigor were fulfilled as well. However, due to the research environment, a stronger focus was reached in terms of relevance.

5.2 Further Research

Parts B and C of this cumulative dissertation presented results from each publication project (contributions I through X), enabling insights into the embeddedness of Design Thinking within organizations. They also provided solid results for practice and academia. The achieved insights provide a very good starting point for future research. Most future research propositions can be derived from the named limitations of each RQ cluster. Specifically, the embeddedness procedure of Design Thinking should be tested in additional variations of single Embedded Design Thinking elements. This will lead to strong findings, especially through the comparison of different embeddedness approaches. By comparing the appliance and impact of those elements in other organisational settings the elements of method in terms of method engineering could be derived. Additionally, the question regarding what kinds of challenges can be addressed by Embedded Design Thinking teams leads to a difference in the challenges pursued for analysis. Furthermore, it would be valuable to analyse whether industry-related factors can be identified by Embedded Design Thinking. Finally, future research can pursue whether findings regarding, for example, application within IT can be generalized to other industries or not. This suggests the question of - if industry does not influence EDT success - what alternative elements exist that could make a difference in sustainable embeddedness.

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Part B Literature Review

Contribution I	
Titel	Embedded Design Thinking in organizations – a literature review
Authors	Christophe Vetterli
Medium	Working Paper, Institute of Information Management of the University of St.Gallen (IWI-HSG), 2015
Status	published
Abstract	Organizations are forced to think about different approaches to gain a competitive advantage Design Thinking addresses the complex environment companies are facing nowadays adequately and therefore has received serious attention from practitioners as well as scholars alike. In comparison to the discourse about design thinking from a designer's point of view, is the managerial discourse about the embedding of Design Thinking still limited. This scant academic foundation is also linked to the fact that a few basic questions remain unanswered, such as what is meant by embedding design thinking in corporations. Therefore the state-of-the-art that remains to be identified. This gap in the literature has provided the opportunity to present this literature review. To foster academic groundedness, the method used to identify, present and analyze the relevant literature is based an established literature review approach. The literature review presented here closes with recommendations for future research.

Institute of Information Management
University of St.Gallen

Embedded Design Thinking in organizations
-
a literature review

Christophe Vetterli

Working paper

Author: Christophe Vetterli

Chair: Prof. Dr. Walter Brenner

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University of St. Gallen

School of Management, Economics, Law, Social Sciences and International Affairs (HSG)

Institute of Information Management
Müller-Friedberg-Strasse 8
CH-9000 St. Gallen

Content

Abbreviations

£	United Kingdom Pounds
CEO	Chief Executive Officer
CIO	Chief Information Officer
DT	Design Thinking
e.g.	exempli gratia (latin: for example)
EDT	Embedded Design Thinking
IWI-HSG	Institute of Information Management of the University of St. Gallen
NPD	New Product Development
RE	Requirements Engineering

1 Introduction

The continuously growing dynamism in highly competitive markets and across-industry competition have forced organizations to think about different approaches to gain a competitive advantage. This new approach should provide the agility required to address continuously changing demands. Companies need to redesign their business models, their processes and their service/product propositions constantly. Moreover, complexity increases not only because companies constantly challenge their value propositions but also because of the two-fold challenge of assuring the efficiency of proven business models and the agility to foster new ideas and businesses. This is a major challenge particularly in large firms. In this regard, design thinking has received much attention because it provides an alternative approach to the complexity of business today. According to the European Design Innovation Initiative, "Design is increasingly recognized as a key discipline and activity to bring ideas to the market, transforming them into user-friendly and appealing products or services". Hence, in 2013, this government-driven initiative at the European level initiated an action plan with the goal of "exploiting the full-potential of design-driven innovation" in order" to reinforce the links between design, innovation and competitiveness" (European Commission, 2013, p. 5). In general, increasing efforts can also be observed at the international governmental level. Policy makers are increasingly investing in creating policies for design-driven cross-boundary innovation ecosystems (European Commission, 2013).

Long before design thinking was recognized as a powerful approach to innovation, Drucker (1954) stated, "It is the customer who determines what a business is, what it produces, and whether it will prosper". In the complex settings of most large organizations, the issue concerns how to design structures to intensify interactions with the customer, involve the customer in innovation processes and give him or her the ability to describe future needs. Every service, product and process involves a customer. The fact that customer-centric organizations have proven to be highly competitive in terms of financial performance and customer loyalty (Shah et al. 2006) demonstrates that companies need to implement innovative customer-oriented structures. Several companies, such as SAP, IDEO, Procter & Gamble, Intuit, Kaiser Permanente and Deutsche Bank, have already begun to implement design thinking as an approach to fostering their innovations (Lindberg et al. 2011; Brown 2008; Vetterli et al., 2012). Procter & Gamble, for example, used design thinking to build their global business services (GBS). The company therefore fully embedded design thinking into the core

processes of its business (Martin 2009). Kaiser Permanente uses design thinking as its core approach to radical innovation. Despite these examples, many organizations are still skeptical about embedding design thinking or design thinking elements. Meinel and Leifer (2013) observed "an almost unfathomable skepticism about the ability of established organizations (corporate, academic, and government) to really adopt the paradigm (Design Thinking). Some argue that the paradigm only works in the world of 'start-ups'" (p. 1). The literature shows that large companies have significant difficulties in achieving a continuous flow of innovations, including breakthrough innovation (e.g., Carlgren et al. 2012; O'Connor 2008). Particularly in highly dynamic markets, it is important to create structures for the continuous delivery of innovation because it is seen as a competitive advantage (Carlgren Paper I: Tushman and O'Reilly, 1996; O'Connor, 2008; Crossan and Appaydin, 2010).

The successful embedding of design thinking promises a significant return on investment. The design council of the United Kingdom calculated, "for every £1 invested in design activities the return on investment is over £20" (p. 9). Moreover, Swedish firms that focused on design showed that investing in design provided an approximately 50% better long-term financial performance than businesses who did not (Whicher, A. 2015). The performance of firms focusing on design over the last 10 years provides evidence that design-led companies have maintained a significant stock market advantage, outperforming the S&P by an extraordinary 228% (see Figure B-1)

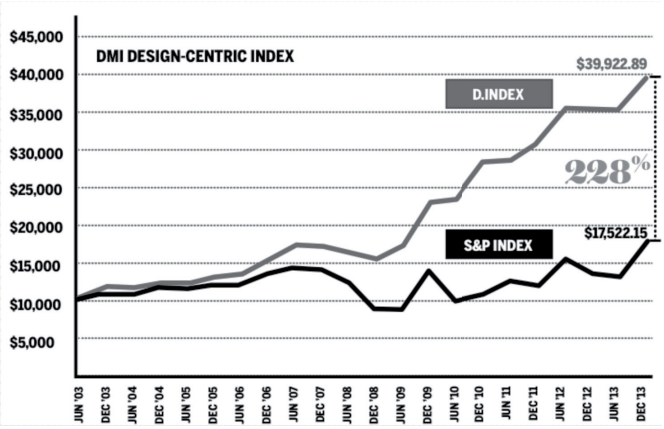

Figure B-1:DMI Design-Centric Index (2013)

The Design Management Institute, which has focused heavily on design thinking re-

search, has committed significant resources to answer the following question: What is the best way to integrate design and design thinking?

Design thinking seems to lead to a highly valuable competitive advantage. Nevertheless, the literature shows that the embedding of design thinking still has a long way to go. According to Liedtka (2014a), scant attention has been paid to the specific mechanisms through which "design thinking" as a problem-solving approach improves business outcomes. Damanpour and Aravind (2011) stated that future research "can advance the development of new managerial tools, techniques and processes" (p. 447). Regarding the literature grounded in science, Liedtka (2014a) stressed that systematic assessment of the utility of design thinking is limited (Cooper et al., 2009; Johansson-Sköldberg et al., 2013; Lindberg et al., 2012) and proposed that further work is required in this research stream. This scant academic foundation is also linked to the fact that a few basic questions remain unanswered, such as what is meant by embedding design thinking in corporations. Therefore, the state-of-the-art remains to be identified. This gap in the literature has provided the opportunity to present this literature review. To foster academic groundedness, the method used to identify, present and analyze the relevant literature is based on the systematic approach of vom Brocke et al. (2009). The literature review presented here closes with recommendations for future research.

2 Method

To identify the state-of-the art of embedding design thinking, we apply a systematic literature review, as suggested and used by many scholars (e.g., Liedtka (2014a) Damanpour & Aravind (2011), Carlgren (2013), Johansson-Sköldberg, Woodilla & Çetinkaya (2013)). In creating validity and traceability, vom Brocke et al. (2009) emphasized rigour in the literature search in order to conduct a quality assessment of the relevant literature. Accordingly, they introduced a five-step framework for the literature review:

I. Definition of review scope
II. Conceptualization of the topic
III. Search and presentation of the literature
IV. Analysis and synthesis of the literature
V. Presentation of the research agenda.

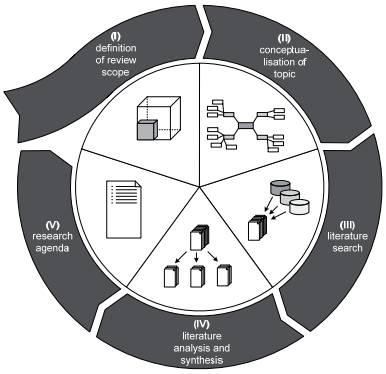

Figure B-2: *Framework for literature reviewing (v*om Brocke et al., 2009, p. 8)

This framework is the underlying framework and structure of the literature review of this paper focusing on Embedded Design Thinking.

3 Definition of the Review Scope

In order to define clearly the scope of the literature review, vom Brocke et al. (2009) recommended drawing on an established taxonomy such as that presented by Cooper (1988). Cooper's taxonomy comprises six constitutive characteristics (table B-1). Each characteristic contains certain categories. Some are mutually exclusive (4 and 6), whereas others (1, 2, 3 and 5) can be independently combined (vom Brocke et al., 2009). In Table 1, the areas shaded in grey represent the areas on which this literature review focuses.

Characteristics		Categories			
(1)	focus	research outcomes	research methods	theories	applications
(2)	goal	integration	criticism	central issues	
(3)	organisation	historical	conceptual	methodological	
(4)	perspective	neutral representation	expousal of position		
(5)	audience	specialised scolars	general scholars	practitioners / politicians	general public
(6)	coverage	exhaustive	exhaustive and selective	representative	central / pivotal

Table B-1: Taxonomy of literature reviews (following Cooper 1988, p. 109)

As the shaded category no. 6 shows, the literature review will consider all relevant resources (see chapter 4 on the conceptualization of the topic), but it will describe the representative sample that provide an overall image of the state-of-the-art in Embedding Design Thinking.

4 Conceptualization of the topic

Defining the scope of the literature review also determined its focus. The second step in vom Brocke et al.'s (2009) framework stresses the need to address "a broad conception of what is known about the topic" (Torraco, 2005). According to Zorn and Campbell (2006), the key terms in the field of research should be defined because a common understanding of basic terms is crucial. Because design thinking has been conceptualized in different ways, a unified understanding of its role in an organization remains to be developed. This missing foundation makes it challenging to conceptualize existing theories and models (Kimbell, 2011, Hobday et al., 2012; Johansson-Sköldberg et al., 2013).

From a management perspective, design thinking, including the embedding of this approach, has a short scientific history. (Hassi & Laakso, 2011). De Waal & Knott (2013) stressed the implied expectation, especially in the innovation literature, that the implementation of design thinking is straightforward. Liedtka (2004) found that this expectation is often unfulfilled (Liedtka 2004). In addition to many other scholars, Carr et al. (2010) therefore called for research and studies of design thinking in organizational settings (Liedtka, 2014b; Damanpour & Aravind, 2011; Johansson-Sköldberg et al., 2013; Liedtka, 2014a, Carlgren et al., 2013a, Martin, 2010).

Thinking with the mindset of a designer is already a well-researched domain outside the field of management. In the 19th century, industrial design evolved into a profession with thinking and practices specific to an autonomous discipline. In the sixties of the 20th century, the beginning of the design methods movement was another key milestone in the development towards design thinking (Mareis, 2011). In this decade, the movement rapidly attracted different disciplines. These were mainly natural scientific disciplines, but researchers quickly recognized that the design process used in different disciplines followed a common pattern of the "design method" (Gregory, 1966).

From the perspective of the design profession, the history of design thinking in the sixties is not the focus of this literature review (see e.g., Simon, 1969; Schön, 1983; Cross, 2011; Rowe, 1992; Kimbell, 2011). Instead, the different definitions of design thinking were taken from managerial discourse (Johansson-Sköldberg et al. 2013). Cooper et al. (2009) clarified the meaning of design thinking from the managerial perspective and how it is linked to design management, that is the "ongoing management—and leadership—of design organization, design process, and design outcomes (that include products, services, communications, environments, and interactions)" (p. 50). Design management has been accredited as focusing on individual design pro-

jects, whereas the implemented developments and improvements are outcomes. Design thinking, in contrast, represents a radical shift in an organization's overall way of doing business. It focuses on the "fundamental assumptions, values, norms and beliefs that make an organization what it is" (Martin, 2010). The Design Management Institute (DMI) sees the term Design Management from a less narrow perspective. The intersection of design, innovation and customers is widely recognized as the discipline of design management (DMI, 2015). Design management ranges from the tactical management of corporate design functions and design agencies, including design operations, staff, methods and processes, to the strategic advocacy of design across the organization as a key differentiator and driver of organizational success. It includes the use of design thinking or design processes to solve general business problems (DMI, 2015). Similarly, the understanding of design as well as design thinking can be discussed from a managerial perspective. Several scholars have shown the link of design thinking from a managerial perspective to the well-known approach to adapting the designer's methods (e.g. Kimbell 2011; Johansson-Skölberg et al. 2013; Liedkta 2014a; D'Ippolito 2014). Carr et al. (2010) explored this link by analyzing the embedding of design thinking in the organization. They found no meaningful distinction between design and design thinking. However, the Therefore, referring to those academic sources, design thinking describes how any firm (or parts of the firm) can use and benefit from the designer's practice (e.g. Dunne & Martin, 2006; Brown, 2008; Martin, 2011, Carlgren et al. 2014, Rauth et al. 2015). The designers literature that is focusing on design only are not in the focus (more on this see e.g. D'Ippolito, 2014; Mareis, 2011).

Embedded Design Thinking can be defined as the concept, which leads to the appliance of design thinking elements (practices, thinking styles and mentalities) within a corporate environment (Vetterli et al. 2012; Hassi & Laakso 2011). Embedding Design Thinking is therefore the process perspective on the procedure how to reach the state of being embedded. Embedded is reached when DT is being used in the daily routine. Currently the term embedding does not fully cover the on-going management discourse of design thinking. The conceptualization of the topic needs to be developed further to provide a better foundation through an iterative keyword search approach, starting with keywords that were derived based on the following main definitions (see the underlined phrases in Table B-2) of design thinking from an organizational perspective.

Year	Authors	Definition	Literature Domain	Publication Type
2011	Dorst	DT is identified as an exciting new paradigm for dealing with problems in many professions, most notably Information	Design	Journal article

		Technology [IT] and Business." (p.521)		
2009	Martin	"The design-thinking organization applies the designer's most crucial tool to the problems of business. That tool is abductive reasoning" (p. 23)	Mgmt	Textbook
2007	Junginger	"[DT] inquires the organization's problems from a user's point of view." (p. 64)	Mgmt.	Journal Article
2014	Liedtka	(…)"a novel problem-solving methodology well suited to the often-cited challenges business organizations face in encouraging innovation and growth"(p. 1)	Mgmt.	Journal Article
2011	Meinel & Leifer	"Design thinking — its human-centric methodology integrates expertise from design, social sciences, engineering, and business. It blends an end-user focus with multidisciplinary collaboration and iterative improvement to produce innovative products, systems, and services."[p. xiv]	Design	Textbook
2011	Lindberg et al.	[...] "grasp multiple knowledge and multiple perspectives of others for the purpose of synthesizing and creatively transforming the knowledge to new service or product concepts." (p. 4)	Mgmt.	Textbook
2007	Beckmann & Barry	Embedding Design Thinking: "Innovation is a learning process" (p. 25)	Mgmt.	Journal Article
2013	Johansson-Sköldberg et al.	"Design thinking' then becomes [...] a way of describing a designer's methods that is integrated into an academic or practical management discourse." (p.123)	Design / Mgmt.	Journal Article
2015	Design Management Institute	[...] "by understanding the tools and methods that designers use to tackle problems, ideate, and create solutions, organizations will be better able to energize their organization and take innovation to a higher level." (homepage)	Design	Practical Source
2009	Cooper et al.	[…] "a more radical shift in an organization's overall way of doing business." (p. 50)	Mgmt.	Journal Article
2014	Rauth et al.	"Design Thinking can be interpreted as a management concept." (p.47)	Mgmt.	Journal article

Table B-2: Definitions referring to managerial discourse of Design Thinking

5 Search and presentation of the literature

The literature search process has been described several times. Vom Brocke et al. (2009) provided a four-step process that is accompanied by the on-going task of search and evaluation (Levy & Ellis, 2006). The four steps are as follows: 1) journal search, 2) database search, 3) keyword search and 4) backward/forward search. The evaluation task transforms the long list of all found articles into a shortlist that contains only articles directly relevant to the review topic. However, both tasks need to be documented for reliability, which makes it possible for other scholars to repeat the process. Besides these four steps, there is an ongoing evaluation of sources (Vom Brocke et al. 2009). Therefore, each step of the four-step process is not exclusive, but complementary.

The first step in the literature search process is the **journal search**. Journals and conference proceedings are peer-refereed, mostly at a certain level of rank. To ensure the high quality selection of articles, it is highly recommended to focus on only highly ranked publications (Rowley and Slack 2004, p. 32; Webster and Watson, 2002; Walstrom and Hardgrave, 2001). There is a plethora of journals in the discipline of design (Friedman et al., 2008; Dubois & Reeb, 2000; and Gemser et al., 2012). Table B-3 lists the top 14 academic journals in the design literature.

Rank	Journal
1	**Design Studies**
2	**Design Issues**
3	Human Factors
4	Journal of Design History
5	Human-Computer Interaction
6	Applied Ergonomics
7	**Journal of Engineering Design**
8	**International Journal of Design**
9	Computer-Aided Design
10	Research in Engineering Design
11	Ergonomics
12	**The Design Journal**
13	Design & Culture
14	**Journal of Design Research**

Table B-3: Top 14 academic design journals (Gemser et al., 2012)

Gemser et al. (2012) highlighted general design journals (*Design Studies*, *Design Issues*, *Journal of Engineering Design*, *International Journal of Design*, *The Design Journal*, and *Journal of Design Research*). These are shown in bold in table B-3. The literature review will be based on these journals because they focus on the general design discipline, whereas the remaining journals focus on the sub-disciplines of design, which are not the focus of this review.

However, Gemser et al.'s (2012) list is focused on design, and it only partly integrates the managerial perspective on design thinking in terms of the evaluated definitions. Friedman et al. (2008) offers a list, which includes also management relevant journals in terms of design. The combined list finally includes the following journals (table B-4):

Journal Name
Design Studies
Design Issues
International Journal of Design
Design Journal
Journal of Design Research
Engineering Design
CoDesign
Journal of Engineering Design
Research in Engineering Design
Design Management Journal
Design Research Quarterly
Journal of Product Innovation Management
Design Management Review

Table B-4: List of Research Journals

The **database search** is the second and partly complementary step from another perspective. There is “no justification for searching by journal instead of searching by topic” (Anonymous; cited in Webster and Watson 2002, p. xvi). The following databases were searched for relevant articles: EBSCOhost, Emerald, ScienceDirect and *Proquest (ABI/INFORM COMPLETE).*

Database Name
EBSCOhost,
Emerald,
ScienceDirect,
Proquest [ABI/INFORM COMPLETE]

Table B-5: List of Scientific Databases

The database search stresses the goal of an exhaustive (and selective) coverage of the literature (see table B-5) within the defined scope.
In the third step, the keywords are used to search through the identified databases. The definition and usage of an exact set of keywords is recommended (Rowley and Slack, 2004), it and ensures the traceability of the results. Exact documentation is also necessary. The selection of relevant keywords follows an iterative prototype approach by starting with the first set provided by the definitions (see Table B-2: Definitions). The keywords are then used in the initial search of the databases as well as the scholarly literature (Figure B-3)

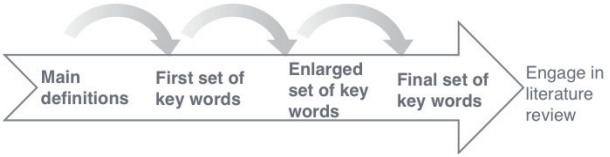

Figure B-3: Iterative keywords definition

The final keyword list (see table B-6) was used to gather the content of this literature review. From an evolutionary perspective, *embedding* and *embedded* represent two different times and maturity phases in integrating design thinking into a corporate environment. Martin (2010) noted the transformation (embedding design thinking) to the state when it is embedded (embedded design thinking). Both are equally important because the journey is unique in every organization. The two terms stand as a representative pair of the other terms, which also represent the process (e.g., “embedding” or “embodying” etc.) as well as the final, mature status (e.g., “embedded” or “embodied”)

Table B-6 shows the keywords and the number of articles that were published from 1990 to 2015. The articles in the long list, which represents the total number of hits (in brackets), were evaluated by screening the title and the abstract to extract only the most relevant (**bold**). Because neither the keywords nor the databases are mutually exclusive, double counts were removed manually in order to obtain the net number of

hits. The keyword search identified 33 (net hits) articles that were within the scope of the review.

	Proquest	EBSCOhost	Emerald	ScienceDirect	Net Hits
Design Thinking' AND embedding OR embedded	**1** (9)	**1** (2)	**2** (11)	**0** (2)	
Design Thinking' AND integrating OR integrated	**1** (9)	**0** (1)	**0** (4)	**1** (21)	
Design-driven AND innovation OR organization	**2** (15)	**2** (9)	1 (8)	0	
Design Thinking' AND organization	**2** (21)	**1** (2)	**2** (16)	**0** (5)	
Design Thinking' AND strategy	**2** (11)	(1)	**0** (2)	**2** (12)	
Design Thinking' AND management	**3** (28)	**1** (1)	**2** (27)	**2** (5)	
Design Thinking' AND adoption	0	0	**1** (5)	**1** (1)	
Design Thinking' AND application	**1** (9)	**1** (1)	**1** (33)	**0** (3)	
Design Thinking' AND implementing OR implemented	**0** (2)	0	**0** (6)	**0** (6)	**Total**
net hits per Database	12 (104)	6 (17)	9 (112)	6 (55)	**33 (288)**

Table B-6: Net hits of journal research articles

Finally, the backward and forward searches provided the fourth step in the literature search process. Webster and Watson (2002, p. xvi) described the process of the backward search as the review of the older literature cited in the articles. The keyword search and scholarly advice yielded an additional eight relevant articles. In contrast, forward search means reviewing the additional sources that have cited the article, which is also derived from the key word search. The backward and forward searches (conducted from the net hits of articles) provided 10 articles, completing the final set of 51 articles.

	Keyword search (longlist)	Evaluation (shortlist)	Scholar Advice	Backward / Forward search	**Net hits (in total)**
Articles	288	→ 33	+ 8	+ 10	**= 51**

Table B-7: Evolution towards net hits of relevant articles

This literature review differs from previously conducted literature reviews because it focuses on journal articles with a specific ranking and conferences proceedings. This review does not include practical sources (except those recommended by scholar advice). The reason for this focus lies in the current missing academic groundedness and transparency of embedded design thinking (Hassi & Laakso, 2011, Johansson-Sköldberg et al. 2013). Therefore, this literature review can be considered a step towards understanding the current academic groundedness of embedding design thinking in large corporations.

In summary, the identified literature showed four main dimensions. Only the bold number if table B-6 is taken into consideration in the next step, which is the analysis and synthesis of the literature. All dimensions represent almost all 288 articles found in the search. Only 51 articles (33 identified articles [bold], 8 scholarly articles and 10

backward / forward searched articles) were considered in this literature review. However, for the transparency of the current research and future research, the dimensions found in the long list should be mentioned on an aggregated level. The following main clusters could be found (only the last cluster was pursued for further work):

1) Research in an isolated research environment (mostly student groups) to learn about singular aspects of design thinking (e.g. framing, brainstorming, verbalization of needs) (e.g., Dow & Klemmer, 2011; Seidel & Fixson, 2012)
2) What effects can design thinking produce (mostly researched in an isolated two-group comparison experiment not conducted in a corporate environment)
3) Management education should integrate more design thinking approaches to facilitate better managers (e.g. Benson & Dresdow, 2013)
4) Embedding elements of design thinking (elements) in corporate environments

6 Analysis and synthesis of the literature

As previously mentioned, the goal is to capture the state-of-the-art in embedding design thinking in a corporate context. A significant and rapidly growing body of literature focuses on the managerial discourse of design thinking (Hassi & Laakso, 2011; Kimbell 2011; Johansson & Sköldberg 2013).

State-of-the-art in management discourse

Johansson-Skölberg et al. (2013) divided the identified literature into two main streams: academic discourse, which focuses on the long history of professional designers' practice (Hassi & Laakso, 2011), and managerial discourse, which has a relatively short history and a strong focus on management. Following Hassi and Laakso (2011), the management discourse of design thinking shows the different periods in which the two discourses are discussed. Design discourse was initiated in the sixties by Simon (1969), through Lawson (1980), Schön (1983), Rowe (1991) and Cross (2001). It is now being acquired by managerial discourse (Cooper et al. 2009), which started with Buchanan (1992) through the IDEOs foundation (Kelley 2001; Brown 2008) and Dunne and Martin (2006). Recent attention has been paid to the embedding of design thinking in large organizations (e.g. Carlgren et al. 2012a; Carlgren et al. 2012b; Chen & Venkatesh, 2013; Rauth et al., 2014; Vetterli et al., 2011; Vetterli et al., 2012). Liedkta (2014) pointed out three main differences in managerial (business) discourses of design thinking: Who is designing (the tools, process and methods are being applied not only by designers but also by managers); the role of empathy, which has gained significant awareness in the business context; and the key elements of visualization and prototyping. The evolution of these three differences from the historical design

discourse to management discourse was argued clearly because the latter has intensified (for the origins of management discourse of design thinking, please see Johansson-Sköldberg, 2013). Collins (2013) demonstrated that critical views could be identified by discussing connecting design thinking with the field of management. She mainly addressed the issue of a missing common link between design and business language and the different results experienced in business. This language issue will be discussed later because it seems to be an important element in the sustainable embedment of design thinking (see the section: WHAT).

The framework used to analyze and synthesize the literature

The review showed that although the management discourse has intensified, it is still highly fragmented because of the isolated, narrowly focused approaches to design thinking (e.g. single tools, process or only mindsets). In order to structure the found literature, a concept matrix (Salipante et al., 1982; Webster & Watson, 2002) is applied. Unities of analysis are created by dividing the most related concepts. The presented framework (Table B-7) contains different dimensions of embedding that on one hand unify the different approaches and on the other hand create the foundation already validated in analytical frameworks (Hassi & Laakso 2011; Carlgren et al 2012b Wicher et al., 2015; Liedtka, 2014a; Rauth et al., 2014).

The aggregated framework (see table B-8) helps to understand the different dimensions found in the literature on embedded design thinking. The fundamental structure (why, how and what) of the framework is based on Sinek (2009).

The first dimension focuses on **why** organizations embed and use design thinking (Carlgren et al., 2013; Rauth et al., 2014; Hassi & Laakso, 2011). The second dimension of the aggregated framework focuses on ***how*** the embedment is pursued—as a tool, as a process or as a strategy (Whicher et al., 2015). These unities of analysis are linked in parallel to the journey towards mature application (Whicher et al., 2015) The logic of the Wicher et al. (2015) is directly linked to Buchanan's matrix (1998, p. 13). Finally, the third dimension refers to ***what*** is being embedded. This dimension integrates the key elements of design thinking (Hassi & Laakso, 2011): practices, thinking styles and mentality. The reviewed elements of Carlgren et al. (2012b) are the core of this dimension. The element of *practices* is closely related to concrete activities involving human-centeredness (Holloway 2009; Ward et al 2009), diversity (Dunne & Martin 2006, Martin 2009) and prototyping in a divergent and convergent approach (e.g. Lockwood 2010, Sato et al. 2010, Drews 2009, Boland & Collopy 2004). *Think-*

ing styles are related to problem framing (e.g., Dorst 2011, Fraser 2009) and abductive thinking and reasoning (e.g., Fraser 2009, Lockwood 2009, Dorst 2011). *Mentality* is related to experimentation (e.g., Fraser 2007, Brown 2008, Junginger 2007), ambiguity, tolerance (e.g. Boland & Collopy 2004, Cooper at al. 2009, Dorst, 2011) and empathy (Liedtka 2014b).

With respect to the background, because the role of design thinking activities in an organizational environment is important (e.g. Skogstad, 2009; Skogstad & Leifer, 2011; Vetterli et al., 2013; Liedtka, 2014) the dimension of ***who*** designs has also been integrated. The characteristics in this dimension are based on the roots of the role and the information regarding whether somebody is grounded in the field of design or in the field of management.

A dimension that has been consciously left out, (even Carlgren et al., 2013) captures its importance) is the origin of the way that design thinking is applied, such as d. schools (e.g. http://dschool.stanford.edu/), universities and in-house workshops, in an organization. First, the focus of this literature review is not to understand where design thinking was learnt but to understand why it is being embedded. Because there is no unified definition among the different professional providers (e.g. Carlgren et al. 2012; Johansson-Sköldberg 2013), the origin of the design thinking approach is covered by the aggregated elements of practices, thinking styles and mentality - the dimension of *what* in the framework.

The numbers in (brackets) indicate articles that refer to a specific characteristic. Because they often integrate several characteristics, the articles can be linked (and therefore counted) to several characteristics.

Embedded Design Thinking – Dimensions of Literature		Categories			
	Why is EDT-being embedded	problem-solving	creating mindset	fostering creativity	strategic differentiation
	How is EDT being embedded	as tool / style	as process		as strategy
	What are elements of EDT	practices	thinking styles		mentalities
	Who is embedding in EDT	designers	managers		

Table B-8: Dimensions for Literature for Embedded Design Thinking

The next section describes the essence of analyzing the identified literature (51 articles) by focusing Embedded Design Thinking.

6.1.1 WHY

The literature review yielded several different reasons that design thinking is being embedded. First, the identified literature focuses on more than its application in the domain of products or services. Instead, it addresses customers' needs (for socio-cultural aspects see Dell'Era & Verganti, 2009) and creates ecosystems for human-centered innovation (Meinel & Leifer 2013). At this point, the definition of classical design (see the review of D'Ippolito 2014) differs from a managerial view of design thinking. The historical view of design limits it to a problem-solving activity, whereas design thinking is now seen as complementary approach to different challenges, as this chapter shows.

The most common reasons for embedding design thinking are linked to the complex situation and open-ended challenges that organizations face nowadays (Dorst, 2011; Beckmann & Berry, 2007). Kotler and Rath (1984) said that design is neglected as a strategic tool, but this has changed with design thinking. It is being credited with providing agility to approaches to meeting customer needs (Carlgren 2014). Design thinking has always been linked to innovation. Cooper et al. (2009) showed that design thinking has contributed significantly to the innovation of new processes, products and services. Liedtka (2014a; 2004) showed that design thinking is being embedded to foster organic growth through continuous innovation. In general, innovation is driven by consumers' requirements (Hall et al. 2013). Carlgren et al. (2014) and Sato (2009) demonstrated that design thinking is applied throughout the complete innovation process. Sato (2009) defined three different levels of innovation in design thinking: design

to innovate, design to differentiate and design to simplify. In the innovation process, design thinking is embedded in new product development (NPD) (e.g. Carlgren et al. 2014b, Chen & Venkatesh 2013), especially in first generation products and services (Ward et al, 2009). In the domain of innovation, the evidence for the utility of design thinking in terms of innovation outcomes is limited (Liedtka, 2014a). However, evidence of its utility rises will emerge during the excitement of the first application of design thinking (Rauth et al., 2014).

The first generation of products and services typically fosters the entrance into new design spaces. Historically, initial problem solving has always been strongly linked to design thinking as a complex problem-solving approach (e.g. Liedtka, 2014b; Rauth et al. 2014; Carlgren et al., 2014b). These problems are complex because they are diverse and heavily interdeterminant and hence have been termed "wicked problems" (Rittel, 1973; Buchanan, 1992). However, why is design thinking often embedded for problem solving when there are many problem-solving methods on the market? The literature review revealed a core reason: design thinking has a strong emphasis on framing problems (Dorst, 2011; Bukowitz, 2013). In combination with abductive reasoning, the reasoning is of "what might be" (Lockwood 2009; Martin 2010). This helps to address nearly every kind of problem adequately (Paton & Dorst, 2011). The categorization of different characteristics of problems helps organizations to determine whether embedding design thinking results in an effective and efficient balance between demand and supply and the attention to complexity. According to Valliere and Gegenhuber (2013), a well-structured problem is not the right context for organizations to embed design thinking because it is waste of resources.

Moreover, design thinking is based on an learning cycle (Meinel & Leifer, 2011; Beckmann & Berry, 2007; Liedtka, 2014a) of quick iterations and testing with customers. A customer-oriented learning culture is also a strong driver in the context of an innovation culture (in addition to high autonomy, risk-taking, tolerance of mistakes and low bureaucracy) (Cohen and Levinthal, 1990; Miron et al. 2004; Steiber and Alänge, 2013). Customers have become increasingly informed, and they demand stronger involvement. The need to interact closely with customers and learn about their needs is predominant in the literature. Liedtka (2014b) demonstrated that organizations embed design thinking because they want to increase their engagement with customers. Sato (2009) stressed the integration of customers into the design process because the success of developing new solutions depends strongly on both the business and its customers. Learning fosters knowledge creation. Martin (2010) stated that

firms need to redefine their way of creating knowledge in order to redesign their business (throughout the organization), and design thinking is the right approach (Boland & Collopy, 2004; Martin, 2009). Moreover, according to Martin (2010), knowledge is gained typically through the analysis of quantitative market research, but design thinking companies that use design thinking successfully handle the intersection of analysis and intuitive thinking through abductive reasoning better than others do. Through his knowledge funnel, Martin (2010) argued that companies could gain knowledge by passing through cycles of mastery, heuristics, and algorithms, beginning again with mastery and so on with the help of design thinking. Cross (2006) talked about the "designerly ways of knowing" and closed the loop in addressing complex, "ill-defined" problems through design, applying a human-centered, "solution-focused" mode through which learning and building knowledge are conducted by design thinking. Hence, organizations that capture design thinking's full potential have adequate organizational knowledge (without describing how they are) (Martin, 2010; Carlgren, 2013).

In much of the literature, the problem-solving approach was the initial reason for applying strategic assignments in design thinking (Clark & Smith, 2008; Liedtka & Olive 2011), including competitive differentiation possibilities (Martin 2010; Beckmann & Berry 2007). Design thinking was credited with having strategic relevance (Liedtka 2014a). In strategic work, the communication of strategies from top to bottom is an intensively discussed issue. The tangible approach of design thinking helps to communicate the strategy by building prototypes of strategic elements (Holloway, 2009). Communication is improved through collaboration and communication between the functions and professions in a design thinking environment (Carlgren, 2013). From a strategic point of view, companies rethink their organizational structure through design thinking because it fosters cross-projects, processes and structural inter-reliabilities (Leavy, 2012, Liedtka, 2014, Brown, 2008, Martin & Dunne 2006).

In summary, the recent development of and advantage multidisciplinary applicability (Leavy, 2012, Liedtka, 2014a, Brown, 2008, Martin & Dunne 2006) were clearly shown to be reasons for embedding design thinking, especially because it is not clearly defined (Leavy 2012, Rauth et al. 2014). Hence, the understanding of design thinking is inconsistent among companies that embed it.

6.1.2 HOW

This dimension provides insights into the state-of-the-art of embedding a tool, a process or a strategy (or a combination). The literature was analysed to determine whether

it provides additional information about the journey of embedding. Sato (2009) stated that design thinking is "systematic" (p. 42), but not "formulaic" (p. 42). This is an important distinction because leaders would typically prefer formulaic solutions to embedding design thinking (Sato 2009). Collins (2013) offered that the designer's capability is built "around harnessing tacit knowledge" (p. 39), which refers to the direct experience of this knowledge. This relation makes it difficult to emulate. This way of working contrasts business, which follows methodologies and processes. The literature shows that business recognizes design as an applied version of its own knowledge instead of as a paradigm shift in its own knowledge (Buchanan, Martin & Dunne 2006; Brown 2008). Business still tries to replicate design by using processes and methodologies. This behaviour is also linked to the danger of crowding out design thinking through the predominant managerial perspective of analytical thinking within organizations (Martin 2004). The development of a corporate culture is essential for the growth of design thinking (Illipinar et al. 2011). An organization needs to understand how analytical thinking and design thinking differ, why and how they come into conflict, and how a culture that appreciates and encourages design thinking can be created (Martin 2004). To change innovation processes (design thinking is well recognized as innovation approach) is a not to underestimate the challenges of embedding design thinking (Moultrie et al. 2006), such as the stereotypical behavior and thinking of the embedding protagonists (Karlsson & Ahlstrom, 1996). Carlgren (2013) also showed the limitations of embedding design thinking throughout the complete innovation process. In the case of Kaiser Permanente, which used a naturalized way of design thinking as part of other innovation approaches, in later stages of innovation, design thinking was declared insufficient, so the company complemented it with improved scientific methods.

Different levels of maturity levels are linked to the Wicher et al. (2015) (on a scale of 1 to 3, 1 is the lowest and 3 is the highest state of mature embedding design thinking): 1) design thinking as a styling kit or toolkit; 2) design thinking as a process; 3) design thinking as a strategic approach. Using the tool of a process to implement strategic embedment requires experience and is not easily replicable (Sato, 2009). This results in a unique journey of embedding in each organization. According to Buckowitz (2013), the specific process to be embedded is good but more important is having flexibility to adjust the embedding process. Especially on the level of tool and process, the embedding of design thinking is suitable for connecting with ongoing procedures because of the modular character design thinking (Carlgren et al., 2014). Cooper et al. (2009) made the interesting point regarding the multiple applicability of design think-

ing. Different maturity levels can be observed in parallel in organizations. To reach different levels of maturity, design readiness is central in sustainably embedding design thinking (Bailey 2012). Readiness is strongly linked with the characteristics of tools, processes and strategies. Carlgren et al. (2013) showed that if there is a strong strategic intention to use design thinking, then it could contribute to long-term innovation in a company by contributing to the three dimensions of resources, processes and mindset. This shows that on any level, readiness needs to be initiated at the very beginning. To foster readiness, some organizations introduced a set of guidelines for the embedding of design thinking (Bailey 2012; Martin 2010). Top management initiated these guidelines, which helped to formalize the embedding of design thinking. However, such guidelines are no longer needed when the organization reaches critical maturity, and the people involved are confident in using design thinking as a tool and a process. They then apply design thinking according to the specific problem (Bailey, 2012). The major design firms (e.g. Procter & Gamble, Intuit, Kaiser Permanente) started by showing the effects of design thinking on leadership events (Leavy 2010a) on a continuous basis and extending the conversation to all employees. The application of design thinking increases the efficiency of the innovation process (Carlgren, et. al., 2013), but it is hard to convince management to invest more time in the early phases of a project (Rauth et al., 2014). Therefore, until design thinking reaches a mature level, it is difficult to maintain the right amount of resources. In addition, the perceived value of design thinking is highly context dependent and focuses on more than the normally cited key performance indicators (e.g., innovativeness and creativity) (Carlgren et al. 2013). Hence, the situation remains twisted because of the rising demand for the tangible proof of the utility of design thinking (Rauth et al., 2014). Alternatively, organizations follow a grassroots approach that pushes their readiness through an in-house design thinking team. This design team builds its own capacity and fosters the organization in building its own organizational readiness (Halvorsen, 2005; Carlgren et al. 2013). In-house teams typically start by applying tools and processes (Vetterli et al., 2011; Vetterli 2012a). Regarding tools, it is known that for sustainable embedment, it is best when team members choose the tools they want to use (Fraser, 2007). The connection of tools and processes to daily business activities can be a huge benefit for in-house design teams (Bukowitz, 2013) that are deeply embedded in a role model, helping to communicate and diffuse the design thinking approach (Vetterli et al., 2013). However, Bailey (2012) pointed out that tools and process are not enough to sustain long-term embedment. The creation of design capability on an organizational level is key. Creating sustainable embedment requires the “ability to compete with systematic

innovation, including the redesign of the firm's resources, processes and values" (Börjesson & Elmquist 2012b).

Moreover, the quality of the generated solution depends on how well it fits the situation and the strategy of the organization. D'Ippolito (2014) showed that the understanding of design thinking as a toolset could serve as an operationalizable way to identify the strategic potential design thinking. However, this is difficult to accomplish without formalized structures (Martin, 2010; Leavy, 2010b). Hence, Chen & Venkatesh (2013) proposed fostering recognition as a strategic approach through its top-to-bottom dissemination throughout the organization. Fraser (2007) connected this top-to-bottom approach to reframing the business "wholly through the eyes of the customer" (p. 68). Both the application of concept visualization to ideation and multiple prototyping and the alignment of strategic concepts with future reality are facilitated by a (prototyping based) strategic business design. The targeted momentum (some discuss capacity; see Carlgren et al., 2013; Börjesson and Elmquist, 2012) of embedding design thinking, needs to be developed continuously (Leavy, 2010a). Procter & Gamble demonstrated how embedment works through demonstrating activities (e.g., prototyping), results (e.g., insights and prototypes) and diffusion (e.g., connection to daily business) in a continuous cycle. According to Leavy (2010a, p. 11), "Everything we've done has been about demonstrate, demonstrate, demonstrate. They've got to see it; they've got to experience it''. Rauth et al. (2014) summarized the characteristics of embedding enablers: convincing through experience in design thinking; demonstrating the usefulness of design thinking; meshing design thinking with organizational culture; and creating ambassador networks.

Although there are some resources in the popular management literature, different approaches to embedding and the relatively new focus on design thinking in academic management discourse (Carlgren et al. 2014; Rauth et al. 2014, Vetterli et al. 2012a, Vetterli et al. 2013b) do not provide enough scientifically analyzed resources. A striking finding is that none of the procedure models (e.g., Discover→Define→Develop→Deliver) (Whicher et al., 2015) has been integrated in the identified literature, except a link to Brown (2008). In the management literature, these procedure models are commonly used to implement design thinking elements within corporate environments. (For more information on these, see e.g. Vetterli et al. 2013, which provides a condensed model of the d. school model and the Stanford University ME310 design cycle).

6.1.3 WHAT

Hassi and Laakso (2011) determined the dimensions of what is embedded are practices, thinking styles and mentality (Table B-9).

PRACTICES	THINKING STYLES	MENTALITY
• **HUMAN-CENTERED APPROACH** E.g. People-based, user-centered, empathizing , ethnography, observation (e.g. Brown 2008; Holloway 2009; Ward et al. 2009)	• **ABDUCTIVE REASONING** E.g. The logic of "what could be", finding new opportunities, urge to create something new, challenge the norm (e.g. Fraser 2009; Lockwood 2009; Martin 2009)	• **EXPERIMENTAL & EXPLORATIVE** E.g. The license to explore possibilities, risking failure, failing fast (e.g. Brown 2008; Fraser 2007; Holloway 2009)
• **THINKING BY DOING** E.g. Early and fast prototyping, fast learning, rapid iterative development cycles (e.g. Boland & Collopy 2004; Lockwood 2010; Rylander 2009)	• **REFLECTIVE REFRAMING** E.g. Rephrasing the problem, going beyond what is obvious to see what lies behind the problem, challenge the given problem (e.g. Boland & Collopy 2004; Drews 2009; Zaccai in Lockwood 2010)	• **AMBIGUITY TOLERANT** E.g. Allowing for ambiguity , tolerance for ambiguity, comfortable with ambiguity, liquid and open process (e.g. Boland & Collopy 2004; Cooper et al. 2009; Dew 2007)
• **VISUALIZING** E.g. Visual approach, visualizing intangibles, visual thinking (e.g. Carr et al. 2010; Drews 2009; Ward et al. 2009)	• **HOLISTIC VIEW** E.g. Systems thinking, 360 degree view on the issue (e.g. Dunne & Martin 2006; Fraser 2009; Sato 2009)	• **OPTIMISTIC** E.g. Viewing constraints as positive, optimism attitude, enjoying problem solving (e.g. Brown 2008; Fraser 2007; Gloppen 2009)
• **COMBINATION OF DIVERGENT AND CONVERGENT APPROACHES** E.g. Ideation, pattern finding, creating multiple alternatives, (e.g. Boland & Collopy 2004; Drews 2009; Sato et al. 2010)	• **INTEGRATIVE THINKING** E.g. Harmonious balance, creative resolution of tension, finding balance between validity and reliability (e.g. Brown 2008; Fraser 2009; Martin 2010)	• **FUTURE-ORIENTED** E.g. Orientation towards the future, vision vs. status quo, intuition as a driving force (e.g. Drews 2009; Junginger 2007; Martin 2009)
• **COLLABORATIVE WORK STYLE** E.g. Multidisciplinary collaboration, involving many stakeholders, interdisciplinary teams (e.g. Dunne & Martin 2006; Gloppen 2009; Sato et al. 2010)		

Table B-9: Three-dimensional frameworks explicating the common elements of design thinking, as depicted in the management discourse. [Hassi & Laakso 2011, p. 7]

The following discussion complements Hassi and Laakso's (2011) elements. Their view is static, and it is not elaborated from an embedding perspective. Therefore, the following explanations do not describe all the elements that need to be embedded. Instead, they highlight the findings from the analysis of the identified literature. Bicen and Johnson (2015) gave another summary of embedded elements. They focused on three main qualities that should be embedded by design thinking: adopting abductive reasoning, embracing a validity-driven approach, and operating in the overlapping spaces of fundamental customer needs, business viability and technological feasibility (see also Brown, 2008). These qualities are particularly helpful in resource-scarce environments because they reconfigure resource in a creative way.

Cooper et al. (2009) showed that the embedment of (elements of) design thinking is difficult for organizations because they are confronted by "fundamental assumptions, values, norms and beliefs that make an organization what it is" (p. 50). A key success factor in embedding design thinking is the focus on what is understood as the object of

embedding. Carlgren et al. (2013) showed in different studies that organizations understand the concept of design thinking differently. Hence, in adapting design thinking, a common language and understanding need to be developed (Paton & Dorst, 2011). The creation of a common language is crucial in embedding, especially its practice (Bailey 2012; Carlgren et al. 2012a; Micheli et al. 2012). The fragmented landscape of design thinking knowledge reveals another important aspect. A strong enabler, such as communication, can only have a significant effect if there is common understanding (Bailey, 2012). Rogers (1986) mentioned the power of communication to diffuse innovations. Paton and Dorst (2011) stressed the need for language co-creation, not an antecedent language. This parallel development needs to be capable of communicating new frames (i.e., the framing aspect of design thinking). Micheli et al. (2012) showed that language should not be a barrier because managers and designers already use a common vocabulary (with add-ons that are specific to each group), at least in NPD. One of the core results is the creation and dissemination of end-user profiles across the organization (Chen & Venkatesh, 2013) by using a common understanding and language.

The question remains of how the different elements interact in terms of embedment. The relation of embedding between practices, thinking styles and mentality is fluid. There is a clear shift away from set thinking styles and mindsets towards practices that emerge during the design process (Kimbel, 2011). These are enabled particularly through the recent developments in design methods, which now can be applied in organizational environments (Hall et al. 2013). However, it is necessary to link design thinking with real business problems (Bailey, 2012). Under such circumstances, design thinking can be embedded as very powerful problem-solving practice (Clark & Smith 2008).

Co-creation is central to design thinking (Liedtka 2014a; Leavy 2012; Chen & Venkatesh 2013), and it is linked to multidisciplinarity in design teams. Although it is difficult for organizations to create multidisciplinarity, it is needed in embedding design thinking (Simons et al., 2011; Vetterli et al., 2013b; Köppel & Meinel, 2014). Multidisciplinarity is difficult to achieve because diversity is hard to manage (Liedtka, 2014a). However, the design thinking approach and its practices leverage the team's differences in positive ways (Liedtka, 2014b). Integrating different disciplines and embedding them sustainably can be enabled through an adequate role model (Vetterli et al. 2013b). To embed this role model, organizational structures need to foster the linking of people (Drews, 2009). Firms with intrafirm structural linkages have the en-

hanced ability to innovate, regardless of the type of innovation (incremental or radical). When there are substantial interdependencies across parts of a firm, intrafirm linkages cut across projects and product lines, providing a free-flowing exchange and cross-pollination of information (Liedtka, 2014a). The fact that some coordinating and integrating mechanisms are needed for innovation has long been noted (Galbraith, 1973). Furthermore, the reward for sharing information and insights needs to be an integrated part of policy (Simons et al., 2011). The reward systems are normally strongly oriented towards heuristics or algorithms and rarely on the mystery level of Martin's knowledge funnel (Simons et al., 2011; Martin, 2010).

Multidisciplinarity ensures easier embedment because it integrates different disciplines from different divisions (Holloway 2009). Another key aspect is prototyping, which provides different effects by embedding. According to Rhinow et al. (2012), "The role of prototypes as a manifestation for user feedback, the role prototypes as a tool to improve team experience and prototypes as a force to converge thinking during design phase" (p.213). Prototyping is best done in teams. Prototyping and testing activities should be used to integrate customers into the framing. Empathy is the basic value and most desirable principle that should be embedded with design thinking (Carlgren et al. 2013; Köppen & Meinel 2014). Prototyping is eased by accurate work places. In-depth studies presented creative laboratories or "war rooms" (Carlgren et al. 2014, p. 27) with flexible infrastructure that provided an environment for prototyping in multidisciplinary teams. Liedtka (2014b) stated that the collaborative working style pushes embedment rather than solution finding (e.g., prototypes). This applies to organizations, which focus mainly on marketable offerings as a primary goal in embedding design thinking (Rauth et al., 2014). The balance between reliability and validity is important in fostering maturity. In the cultural perspective on constraints, design thinking-like cultures see them as opportunities and design thinking-unlike cultures see them as enemies.

The literature does not provide a clear sequence of elements that should be embedded. Instead, the analysis showed that embedment follows an iterative cycle (Carlgren et al. 2013; Rauth et al., 2014), which results in a few central elements, such as co-creation by multidisciplinary teams (Carlgren et al. 2012a; Lindberg, Köoppen, Rauth, & Meinel, 2012), (rapid) prototyping (e.g. Fraser, 2007) and empathy. These elements lead to learning more about the customer (Brown, 2008; Beckman & Berry, 2007; Carlgren et al., 2014). The analysis showed that the identified scientific literature focuses on what is embedded, and it neglects the learning of the embedding elements.

6.1.4 WHO

There are different levels of roles in embedding. The strategic level is involved in embedding design thinking. On the operative level, embedding takes place through concrete activities. The literature does not provide insights into the strategic roles (except that leadership needs to give the responsibility for content and innovation to the people). Instead, it focuses on the role of designers and managers, and it defines some roles in design thinking projects.
There has been a long history of recognizing not only "the gulf between business and design" in a discipline but also the individual profile (Clark & Smith 2008). The definitions of design thinking in managerial discourse clearly indicate that the design profession cannot be neglected, and it needs to be understood by organizations in order to provide a context for applying the elements design thinking, such as abductive reasoning, which is deeply embedded in the design profession (Dorst 2011; Hall et al. 2013). Paton and Dorst (2011) defined four different roles of designers within organizations ("technician, facilitator, expert/artist, collaborator", p. 583), which help to address the different roles of designers who engage in projects and need to sustain design thinking. The distinction between and managers is made while embedding design thinking. It is often strongly disputed because "everybody wants to own design". Therefore, the protection of the design function within the company is discussed (Carr et al., 2010, p. 61). Carlgren et al. (2014) showed that role models depend on the maturity stage of the organization. Collaborative environments seemed less concerned and fostered the embedding of designers within the business itself (Carr et al., 2010, p. 61). In such situations, organizational readiness for design must be clearly fostered through managerial roles (Cerejo & Barbosa, 2012).

However, the literature showed that the background of the design team members does not affect the successful embedment of design thinking (Carlgren et al. 2014). However, Sato (2009) argued that multidisciplinary teams are better guided by designers than by managers in ensuring powerful innovations. Moreover, Design thinking is emerging in both disciplines (Liu & Hinds, 2012). The intensive interaction of designers with their business context fosters profiles with managerial characteristics. In parallel, managers' profiles become imbued with the characteristics of designers (Liu & Hinds, 2012). Therefore, the focus is on which role is suitable for which embedment effort and which characteristic works for which activity.

In the embedment of design thinking, designers are often involved in teams, and they enable the managers and the rest of the organizational staff through projects and meth-

od workshops to create design-thinking capability (Bailey, 2012). At the beginning, a group of "design thinking experts" (p. 28) is often responsible for the in-house design thinking activities. This group has different roles, such as teaching staff to apply design thinking, enabling staff through supporting activities to use design thinking methods, and creating innovation with non-design thinking-experts. The design thinking experts in these roles have two different functions: applying design thinking to business challenges and providing expertise and support in applying design (Sato 2009). In such groups, the members are often non-designers from different disciplines (Vetterli et al. 2012; Carlgren et al. 2014). Skogstad and Leifer (2011) presented an innovation process model, that elucidates the way (engineering) designers and managers interact and the circumstances in which they succeed. In attributing different characteristics to different design thinking activities, Beckmann and Berry (2007) divided characteristics into those that work in a diverging context and those that work better in a converging context. By dividing characteristics, which are likely to be persons in organizations, it is important to guarantee the continuity of the design team members in the innovation process in order to follow the pursuit of knowledge (Holloway, 2009). It is also important to stress that multiple roles are needed in a lasting embedment (Vetterli et al. 2013; Carlgren et al 2014; Rauth et al., 2014) and different roles can be rotated (Beckmann & Berry, 2007).

In summary, the analysis showed that design-thinking experts are in a wide range of disciplines, and they are often non-designers. The discussion of whether a designer or a manager should lead innovation and embed design thinking did not lead to a consensus. Moreover, the process of embedding design thinking and its roles are not yet clear. A role model was provided by Vetterli et al. (2013b) in a specific industry (IT of a financial provider) and could serve as a starting point in future research.

7 Conclusions and outlook

Design companies have successful track records in a complex environment of rapid change and increasingly demanding customers. Design thinking, as the application of practices, thinking styles and mentalities evolved by designers, has been linked with successful outcomes. Previous research has rarely focused on the management perspective on design thinking. Recent research efforts focused on single aspects of embedded design thinking. Their results showed divergent effects of using design thinking within organizations. Furthermore, attitudes towards embedding design thinking remain largely skeptical (Meinel & Leifer, 2013). The fragmented body of knowledge makes it difficult to determine best practices or transparent procedures and strategies to embed design thinking. Johansson-Sköldberg et al. (2013) attributed the missing link of management design thinking to "designerly thinking" ("the academic construction of the professional designer's practice") (p. 123). Hence, cumulative knowledge construction is difficult to achieve.

The literature review provided an analysis of the scientific literature that focuses on how design thinking is embedded in organizations, which then can be defined as embedded design thinking. The literature review followed the method of vom Brocke et al. (2009) in order to ensure the traceability and transparency of the findings.

Fifty-one scientific publications were identified as the current body of knowledge about embedding design thinking. The results of the findings were organized in four main sections, based on previous literature reviews and the relevant publications. The four dimensions are as follows: *Why* design thinking is embedded, *how* is design thinking embedded, *what* is embedded and *who* embeds? The findings refer to the current body of knowledge and the lack of a unified understanding of design thinking: There is no "right" way of embedding design thinking. Design thinking is embedded particularly because of its very wide applicability to solving ill-defined complex problems or strategic assignments. Furthermore, the agility created within design teams is another reason for embedding design thinking. Another reason for the embedment of design thinking is learning more about the customer through its methods and tools to create a sustainable competitive advantage. *How* design thinking is embedded strongly refers to the unique embedment journey that an organization will pursue. Starting with low maturity in using design thinking as a tool, embedding progresses through the process of design thinking until it reaches strategic legitimation. The maturity levels can be observed in parallel in the same organization and even in different approaches. W*hat* is

embedded dominates the need to build a common understanding of design thinking and the key elements that are to be embedded. In addition, the interrelations of the practices, thinking styles and mentalities move towards practices and their subcategories, such as human-centered prototyping, visualization, multidisciplinary collaboration and empathy, which is a core element of embedment. Moreover, the literature focuses on the elements that are embedded instead of how to embed them. The last dimension is *who* embeds, which led to a two-fold discussion about designers, managers and business people. The analysis showed divergent findings regarding whether designers or managers should lead the embedment. Both disciplines take on characteristics of the other in the design thinking context. The different roles depend on the design readiness of the company. Although a role model is provided, it needs further development.

Regarding future research, few previous studies in the literature focused on the specifics of industry. Although industry borders are becoming more flexible, business is still defined by its industry. The embedment of design thinking should be customized to suit specific industries. These could be analyzed from the perspective of the process of embedding design thinking, as well as the embedment of design thinking. This accompanying transformation is as important as the embedded state (Martin 2010). The IT industry is probably the first among the industries that embed design thinking (Dorst, 2011; Brooks, 2010; Martin, 2009, Lindberg et al., 2011). The Hasso Plattner Research Program has invested heavy resources in this field for many years. The question is why IT seems to be a good research area for design thinking. IT uses design thinking in several areas, such as agile developing, venture testing, requirement engineering. IT is seen as a strong driver of business (Österle et al., 2011), and the alignment of business and IT, as well as the software development field (Lindberg et al., 2011), has been identified as interesting field of further research (Vetterli et al., 2012d). Business and information systems engineering (BISE) has been identified as another area worth researching from the perspective of design thinking. The context of BISE has experienced essential shifts and therefore "demands the individual user and his or her needs to be put at the center of all investigations" (Brenner et al. 2014, p. 55). Finally, Weil and Woerner (2013) identified that the CIO and his IT team want to invest more time in end-customers to better understand their needs. The first step towards elaborating the identified field of design thinking within IT has already been initiated.

This literature review is part of the author's dissertation. The author has also published studies on this field of research (Vetterli et al. 2011, 2012a; 2012b; 2012d; 2013a;

2013b; Häger et al. 2015). The focus of future research area should the embedment of design thinking in IT.

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A Reference-Metamodel for Embedded Design Thinking in the Information Technology context

Christophe Vetterli

University of St.Gallen, Institute of Information Management,
Müller-Friedbergstrasse 8, 9000 St.Gallen, Switzerland
christophe.vetterli@unisg.ch

Walter Brenner

University of St.Gallen, Institute of Information Management,
Müller-Friedbergstrasse 8, 9000 St.Gallen, Switzerland
walter.brenner@unisg.ch

Falk Uebernickel

University of St.Gallen, Institute of Information Management,
Müller-Friedbergstrasse 8, 9000 St.Gallen, Switzerland
falk.uebernickel@unisg.ch

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Christophe Vetterli
Institute of Information Management
University of St.Gallen
christophe.vetterli@unisg.ch

Walter Brenner
Institute of Information Management
University of St.Gallen
walter.brenner@unisg.ch

Falk Uebernickel
Institute of Information Management
University of St.Gallen
falk.uebernickel@unisg.ch

The innovation approach design thinking has received much attention from researchers and practitioners alike (Cross, 2001; Cross *et al.*, 1992; Markus *et al.*, 2002, Martin, 2009). In terms of my PhD project design thinking is defined as a human-centred innovation method (Grots & Pratschke, 2009; Dym et al., 2005), based on central elements such as deep customer understanding, structured idea generation, rapid prototyping and iterative learning (Vetterli et al., 2011; Brenner & Witte, 2011). The understanding of design thinking is especially helpful to position the output of design thinking innovation teams. Furthermore it is promising and much recommended to support the creation of innovation from innovation teams in organizations (Sutton and Hargadon 1996, Vetterli et al., 2011).

This PhD project is embedded in an overall Information Technology (IT) context and the consideration of design thinking as an innovation method for this discipline has been done at some points (Schindlholzer et al, 2011; Lindberg et al. 2010). Nevertheless what the IT-Community claims is a unified, abstract understanding on these processes, units, etc. which are being affected by applying the design thinking method within the IT context in a corporate's environment. The IT-orientation of my PhD project leads to the usage of well-established references within the IT body of knowledge. Hence the categorization of design thinking as a method leads to the method definition of Gutzwiler (1994) with the five elements activity, role, result, technique and metamodel that need to be defined in terms of a method. Whereas the element metamodel connects the specific method and its element to a more abstract level. On the metamodel level design objects are being defined, referring to Gutzwiler (1994). In sum a metamodel is a conceptual model of the underlying method and its concept and contains relevant design objects of these methodological concepts which are also defined in there conceptional relations among each other.

Therefore as a first step within this specific research stream the definition of objects that define design thinking and its application in a corporate IT environment, should be captured by a metamodel. This metamodel provides a base for further model creations on a lower semantic level. This reference character can be defined by a reference-metamodel (RMM). Thus the research goal of this subproject is to create a RMM for design thinking within IT on the highest semantic level. Another research goal occurs from the fact that a RMM unifies the terminology around design thinking within IT and hence provides a standard on which the concepts of concrete methods can refer. Therefore the performance of this RMM does not focus on the creation of new methodological concepts, but on the integration of already given

elements (Österle & Gutzwiler, 1992). According to Schütte (1998), Scheer (1999) and Becker et al. (1995) RMMs provide design recommendations and therefore can be consulted for the creation of models for innovation with/in IT.

The creation process of a RMM pursuits different detailed goals (see also Österle & Gutzwiler, 1992):

- **Structural design:** In terms of structural design the RMM should help to better understand the design of design thinking within an IT environment. Therefore it needs to describe the concepts of method and the tools and link them together. As mentioned already the concepts of the method will be illustrated by RMM design objects.
- **Standardisation and comparability:** At the moment there is a broad understanding of design thinking, especially for terms within design thinking. The different understanding is a barrier for the comparability of the models, tools and concepts. A company can understand the same term differently in their context. The RMM will provide a standardized understanding of the content.
- **Positioning of theoretical approaches:** Most of the design thinking approaches within IT environment just affect a small part of the IT. The RMM should help to position specific questions such as e.g. *What does it mean to cancel a certain role within a design thinking project?*

The RMM was designed through Entity-Relationship-Modelling (ERM) and refers to the creation of data models. My PhD project provides an ideal context in terms of combination of scientific environment as well as practical environment. Thus the research paradigm design science (Hevner, 2004) can serve perfectly due to its search to extend the boundaries of human and organizational capabilities by creating and shaping new and innovative artefacts. The process of the design process of the RMM is, accordingly to design science, twofold: The first phase is a sequence of expert activities to produce an innovative design artefact. The second phase is the evaluation of the artefact, which then provides feedback information and a better understanding of the problem, meant to improve both the quality of the artefact and of the design process (March & Smith, 1995). Building and evaluating the artefact takes place in iterative "build-and-evaluate loops" (Markus *et al.*, 2002). The creation context for the RMM unbosomed strong parallelism to the iterative design thinking cycle (Skogstad, 2009).

The seven years long lasting experience in academia and especially practice within the IT environment ensures the adequate creation of this RMM based on first steps in this direction provided by Schindlholzer et al. (2011).

The RMM presented at the D.confestival conference in 2012 was on one hand presented in a pecha kucha presentation at the conference and on the other hand printed on a poster (see complete poster at the bottom of this document). The poster consisted of two different parts: The top part was referring to the publication of Brocke et al. (2012) which outlined the context for building the RMM. The second part of the poster consisted of the RMM itself and included the description of the entities as well as the visualisation of the relations of the entities among each other as shown in the following figures.

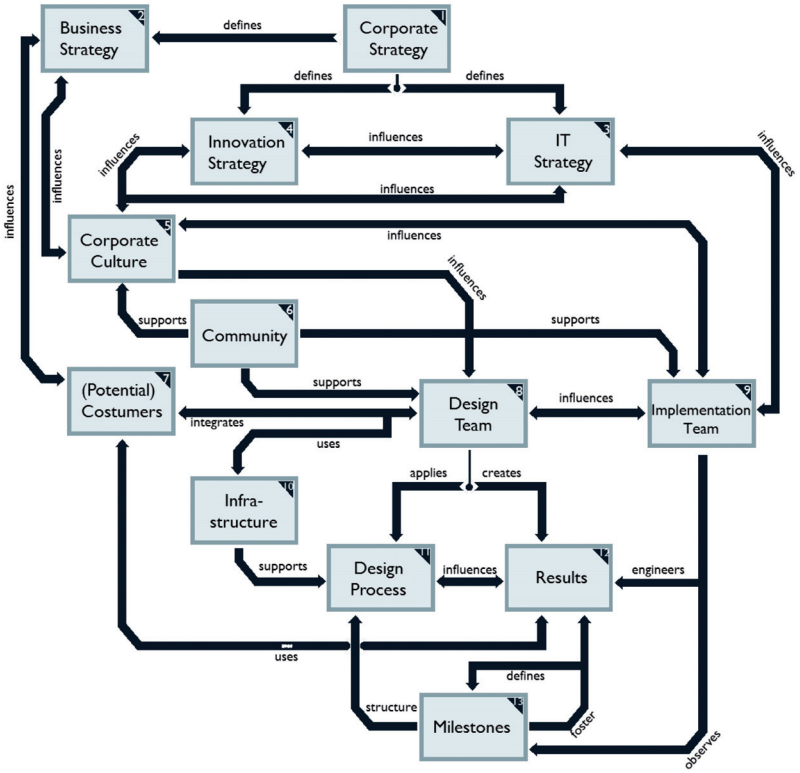

Figure 1: Reference Meta Model on Embedded Design Thinking

Each entity which is part of the RMM is described as single entity and these descriptions are an integrated part of the RMM:

1) **Corporate Strategy**: The corporate strategy defines the strategy for the company, incorporating the business, the IT and the innovation strategy to maximize long-term value.
2) **Business Strategy**: The business strategy defines the business side of the company's value proposition
3) **IT Strategy**: The IT Strategy plans the future development of the IT as integrated part of the overall value proposition
4) **Innovation Strategy**: The innovation strategy defines the corporate's goal in terms of sustainable innovation and has strong impact on resources and project structure for innovation and the understanding of human-centricity
5) **Corporate Culture**: The corporate culture is made and embodied by the company's employees and has strong impact on how the human-centricity is understood
6) **Community**: The community around design thinking within the company is heterogeneous due to its different motivation towards design thinking
7) **(Potential) Customers**: The (potential) customers are integrated within the design process as well as receivers of the final solution
8) **Design Team**: The design team is designing human-centred results based on a corporates strategic relevant challenge
9) **Implementation Team**: The implementation team is leading the follow-up processes, after the design team has delivered its human-centred results, in terms of engineering a market-ready product, service, process or business model
10) **Infrastructure**: The infrastructure is providing the right environment for the design team to apply design thinking
11) **Design Process**: The design process applied by the design team is assuring that key principles of design thinking are being applied throughout the whole process
12) **Results**: The results generated by the design teams are not reduced to a final prototype but rather accompanied by innovation enablers (e.g. specifications, presentations, etc.)
13) **Milestones**: The milestones assure the on-time delivery of the results and enable the commitment from the corporate side towards the results

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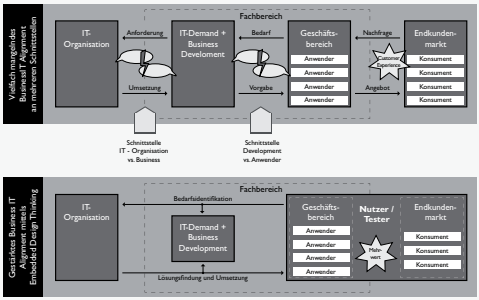
Institute of Information Management
University of St. Gallen

A Reference Meta Model for Embedded Design Thinking



Applikationsentwicklungsprozess

Initierung | Business-analyse | Anforde-rungs-aufnahme | Design | Ent-wicklung | Test | Deploy-ment | Abschluss

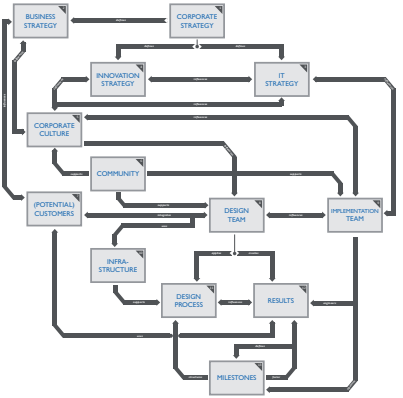
Verortung von „Embedded Design Thinking“

Source: Brocke, Vetterli, Brenner, Uebernickel, 2012

STRUCTURAL DESIGN

POSITIONING OF THEORETICAL APPROACHES

STANDARDISATION AND COMPARABILITY



1 - Corporate Strategy
The corporate strategy defines the strategy for the company, incorporating the business, the IT and the innovation strategy to maximize long-term value.

2 - Business Strategy
The business strategy defines the business side of the company's value proposition.

3 - IT Strategy
The IT Strategy plans the future development of the IT and requires a autonomy to perform.

4 - Innovation Strategy
The innovation strategy defines the corporate's goal in terms of sustainable innovation and has strong impact on resources and project structure for innovation and the understanding of human-centricity.

5 - Corporate Culture
The corporate culture is made and embodied by the company's employees and has strong impact on how the human-centricity is understood.

6 - Community
The community around Design Thinking within the company is heterogeneous due to its different motivation towards Design Thinking.

7 - (Potential) Customers
The (potential) customers are integrated within the design process and receive the final prototype.

8 - Design Team
The design team works on a human-centered solution in accordance with a strategically relevant corporate challenge.

9 - Implementation Team
The implementation team is leading the follow-up processes, after the design team has delivered its human-centered results, in terms of engineering a market-ready product, service, process or business model.

10 - Infrastructure
The infrastructure provides the right environment and enables the design team to apply design thinking.

11 - Design Process
The design process used by the design team is assuring that key principles of design thinking are being applied throughout the whole process.

12 - Results
The results generated by the design teams do not just consits of a final prototype but are rather accompanied by innovation enablers (e.g. specifications, presentations, etc.)

13 - Milestones
The milestones assure the on-time delivery of the results enable the commitment from the corporate side towards the results.

Die Innovationsmethode Design Thinking

Design Thinking ist eine Innovationsmethode, die Kundenbedürfnisse in den Mittelpunkt der Entwicklungsarbeit rückt. Lässt sich diese Methode auch in der IT eines Finanzinstituts erfolgreich einsetzen? Diese Frage untersuchte die Universität St. Gallen mit Hilfe eines Innovationsprojekts in der Deutschen Bank.

In diesem Beitrag erfahren Sie:
- wie Design Thinking in der IT der Deutschen Bank implementiert wurde,
- mit welchen Anpassungen es gelang, den klassischen Design Thinking Prozess hier umzusetzen,
- welchen Business Value die Deutsche Bank durch Embedded Design Thinking generieren konnte.

Christophe Vetterli, Walter Brenner, Falk Uebernickel, Katharina Berger

Einleitung

Der Erfindergeist eines Daniel Düsentriebs ist zwar eine unterhaltsame, aber eher selten zutreffende Erklärung für die Innovationskraft eines Unternehmens. Erfolgreiche Innovationen basieren auf den richtigen Werkzeugen und funktionierender Teamarbeit. Der Kostendruck der letzten Jahre ließ der IT nur wenig Spielraum, um operative Innovationsprozesse voranzutreiben. Der Freiraum für Innovation muss oft den Alltagsaufgaben weichen. Umso wichtiger erscheint das effiziente und effektive Einsetzen der knappen Ressourcen.

Innovationsmanagementprozesse werden heute zwar teilweise implementiert, jedoch mangelt es oft an den operativen Innovationsprozessen und -methoden. Es werden an unterschiedlichen Stellen Ideen entwickelt. Die mit der Umsetzung betrauten Bereiche werden jedoch

nicht systematisch ausgewählt bzw. kontrolliert. Darunter leiden viele Ideen mit Potenzial. Doch für die internen IT-Dienstleister sind Innovationen und der professionelle Umgang damit eine unverzichtbare Voraussetzung für erfolgreiches Bestehen. Innovationen müssen systematisch angegangen und als eigenständige Aufgabe gefördert werden. Das Institut für Wirtschaftsinformatik der Universität St.Gallen hat sich zusammen mit seinem langjährigen Partner, der Deutschen Bank AG, mit diesen Herausforderungen beschäftigt und erfolgreich die Methode Embedded Design Thinking im IT Bereich entworfen und eingeführt. Die Anwendung der Innovationsmethode musste sich innerhalb der organisationalen Strukturen einer IT-Abteilung einer internationalen Großbank bewähren. Dabei wurde

- ein strukturierter Ideengenerierungsprozess, inklusive dem iterativen Bau von Prototypen implementiert,
- eine neue Art von Präsentations- & Visualisierungstechniken für das Nacherleben der Ideen eingeführt und
- ein tiefgehendes Kundenverständnis von Seiten der Design Teams aufgebaut.

Dieser Beitrag illustriert, wie die Design-Thinking-Methode systematisch angewendet wird und beschreibt, welche Anpassungen zur erfolgreichen Implementierung von »Embedded Design Thinking« in der Deutschen Bank notwendig waren, um Wertbeitrag zu erzielen. Aufgezeigt werden darüber hinaus die zentralen Lerneffekte aus dem Projekt.

Ausgangslage

Das Embedded Design Thinking in der Deutschen Bank AG wurde im Unternehmensbereich Group Technology and Operations (GTO) entwickelt und eingeführt. GTO ist ein Zuständigkeitsbereich des Chief Operating Officers (COO). Die Aufgaben von GTO reichen vom Angebot für Infrastruktur und IT-Systeme bis hin zum Betrieb der Arbeits- und Betriebsprozesse, die es dem Unternehmen Deutsche Bank ermöglichen, auf den wettbewerbsintensiven Märkten erfolgreich zu agieren. Somit dient GTO als Katalysator für Wandel innerhalb der

Bank, indem die Prozesse, Systeme und Applikationen zur Verfügung gestellt werden, welche notwendig sind, um die Bank operativ arbeiten zu lassen. Die Bank hatte im Jahre 2010 insgesamt rund 80000 Mitarbeiter. Sie war bereits vor der Entwicklung und Einführung von Embedded Design Thinking hoch professionell im Bereich Innovationsmanagement und bei den Innovationsprozessen aufgestellt. Unterschiedliche Initiativen wie beispielsweise das Betreiben eines Innovationsradars oder unternehmensweite Innovationswettbewerbe wurden seit 2006 systematisch implementiert. Gleichwohl und v. a. mit dem Ziel, die Fachbereiche stärker einzubinden und gleichzeitig den voraussichtlichen Endnutzer in den Innovationsprozess zu integrieren, entschied sich die Deutsche Bank ergänzend die Methode Design Thinking zu implementieren. Die Grundstruktur von Design Thinking wurde auch bei der Entwicklung und Anwendung von Embedded Design Thinking beibehalten, trotzdem waren vor allem auf organisatorischer Ebene Anpassungen notwendig.

Design Thinking

Design Thinking hat erst in den letzten Jahren zunehmend an Aufmerksamkeit erfahren, obwohl es bereits 1962 in den Grundzügen an der Stanford University im Silicon Valley entstand. Heute wird Design Thinking unter dem Synonym ME310 (»Mechanical Engineering 310), die Nummer des universitären Kurses, in Stanford gelehrt. Im Rahmen der Entwicklung entstand über 40 Jahre hinweg weit mehr als nur ein universitärer Kurs. Vielmehr entwickelte sich ein globales Netzwerk mit einer vernetzten Design Thinking Community, bestehend aus Design Thinking Teachern, Coaches, Industriepartnern und Beratungsunternehmen. Die Verbreitung der Methode sowohl durch IDEO, als bekanntestes Design-Thinking-Beratungsunternehmen, als auch die Gründung der sogenannten *d.Schools* (design Schools – Schulen welche sich dem breiten Verständnis von Design widmen) in Stanford und dem Hasso Plattner Institut in Potsdam, halfen ihr, sich über die Grenzen des »Mechanical Engineerings« zu verbreiten. Im deutschsprachigen Raum muss dem Begriff »Design« besondere Aufmerksamkeit

geschenkt werden. Das englischsprachige Verständnis des Begriffs »Design« zeigt, welches Verständnis Design Thinking ebenfalls zugrunde liegt: Das explizite, systematische und planmäßige Erschaffen – designen – von Produkten, Dienstleistungen, Prozessen und Geschäftsmodellen. Typischerweise herrscht in Unternehmen ein rationaler und faktenbasierter Denkprozess vor, bei Design Thinking liegt der Fokus auf den kognitiven, intuitiven Denkprozessen des Designers.

Die Universität St.Gallen und das Design Thinking Netzwerk

Die Universität St.Gallen besetzt im Design-Thinking-Netzwerk eine betriebswirtschaftliche Position und ist seit dem Jahr 2005 fester Bestandteil des globalen Netzwerks. Das Institut für Wirtschaftsinformatik der Universität St.Gallen bietet mittlerweile zwei unterschiedliche Modelle für Design Thinking an. Einerseits wird ein universitärer Kurs auf Master Stufe angeboten, welcher sich über 10 Monate erstreckt und sich am Pendant in Stanford, dem ME310, ausrichtet. Im ME310 Modell werden Problemstellungen durch Partnerunternehmen ausgeschrieben, um sie von studentischen Teams mittels Design Thinking an der Universität bearbeiten zu lassen. Das Institut für Wirtschaftsinformatik konnte im Rahmen dieses Modells seit 2005 in Kollaboration mit der Stanford University Erfahrungen mit insgesamt 11 Partnerunternehmen sammeln. Anderseits bildet der Inhalt dieses Beitrags, das Embedded Design Thinking, das zweite Modell von Design Thinking.

Eine Definition für den Begriff Design Thinking konnte sich bisher nicht durchsetzen. Der amtierende CEO von IDEO, Tim Brown [2], definiert Design Thinking zwar folgendermaßen: »a methodology that imbues the full spectrum of innovation activities with a human-centered design ethos«. Gleichzeitig erwähnt er jedoch, dass das Naturell von Design Thinking keine klare Definition erlaubt. Einer der Hauptbegründer von Design Thinking, Larry Leifer [3] der Stanford University, unterstreicht Browns Aussage und verweist auf das Verständnis von Innovation als Ergebnis und Design Thinking als Methode, um die Erfolgswahrscheinlichkeit eines innovativen Ergebnisses zu erhöhen [1]. Das Institut für Wirtschaftsinformatik der Universität St.Gallen versteht Design Thinking als systematische Vorgehensweise zur Entwicklung von innovativen Lösungen, die auf den drei Kernelementen »tief gehendes Kundenverständnis«, »strukturierte Ideengenerierung«

und »Bau von Prototypen« beruht [1]. Dies stellt eine Arbeitsdefinition dar, die sich in einem dynamischen Innovationsumfeld mit jeder Anwendung weiterentwickelt.

Grundverständnis von Design Thinking

Der Kunde bzw. der Mensch steht im Mittelpunkt – Design Thinking orientiert sich kontinuierlich an den Bedürfnissen des Menschen, welcher sich im Fokus der Problemstellungen bzw. des Design Spaces befindet. Abbildung 1 zeigt das Zusammenspiel der drei zentralen Dimensionen Mensch, Business und Technologie.

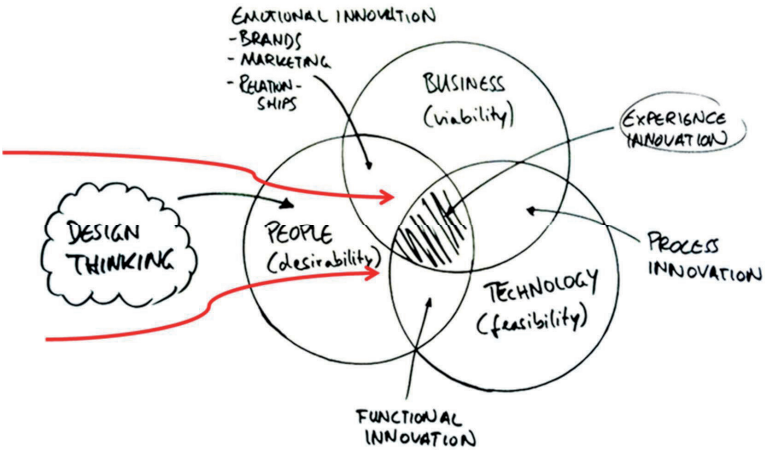


Abb. 1: *Drei Dimensionen für Innovation (Eigene Darstellung in Anlehnung an: IDEO [2])*

Die Methode richtet sich konsequent an den menschlichen Bedürfnissen aus. Dies geht soweit, dass die beiden Dimensionen Business und Technologie zwar zu gegebenem Zeitpunkt einbezogen werden, jedoch zunächst eine sekundäre Rolle spielen. Erfahrungen aus IT-Organisationen zeigen, dass technologie- oder business-orientierte Innovationsprozesse häufig die menschliche Perspektive vernachlässigen. Design

Thinking deckt durch methodische Elemente die Anforderungen und Bedürfnisse des Menschen auf. Technologie sollte dazu dienen, die finale Lösung zu vereinfachen und keine neuen Anforderungen an die Kunden stellen. Die Business-Sicht muss letztlich die Lösung in einem ökonomisch vertretbaren Rahmen abbilden.

Design Thinking Prozess

Design Thinking bildet im Kern einen iterativen Design Prozess, der später genauer erläutert wird (siehe Abbildung 3). Im Rahmen des ME310 Kurses in St.Gallen und Stanford sowie dem Embedded Design Thinking bei der Deutschen Bank wurde der Zyklus auf folgende Zeitachse gelegt und an den darin enthaltenden Meilensteinen ausgerichtet. Die festgelegten Meilensteine ergeben sich aus den unterschiedlichen Prototypenarten, die es im Verlaufe eines Design-Thinking-Projektes zu durchlaufen gilt. Die Einteilung der Meilensteine

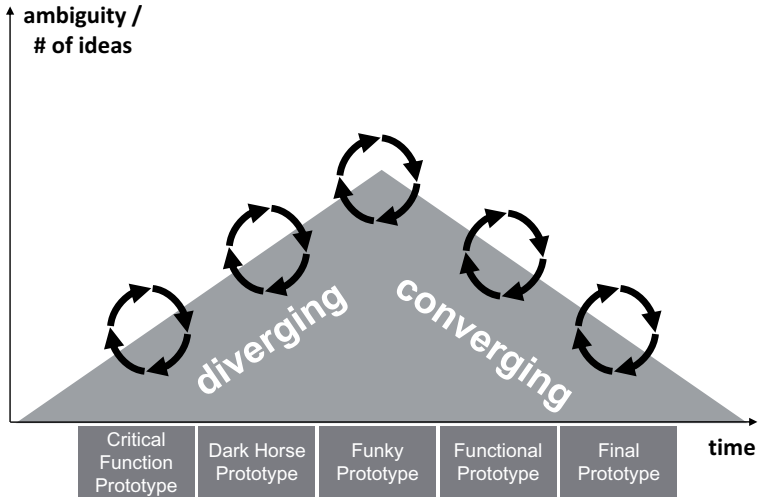


Abb. 2: *Meilensteine eines Design Thinking Projekts (Eigene Darstellung in Anlehnung an ME310 [4])*

erfolgt in zwei Phasen: Die erste Phase unterliegt einem divergierenden Fokus (»Diverging«). In dieser Phase geht es darum, möglichst viele unterschiedliche Ideen einzufangen und dabei das Beobachtungsspektrum möglichst weit aufzuspannen. Die zweite Phase (»Converging«) lehnt sich dem klassischen Business-Vorgehen an und hat konvergierenden Charakter. Dabei geht es um die Konsolidierung der erfolgsversprechendsten Elemente, um gleichzeitig auch die Auflösung der einzelnen Prototypen zu erhöhen und schlussendlich einen möglichst hoch aufgelösten Prototypen zu generieren.

Design Thinking Zyklus

Die folgende Abbildung 3 zeigt das Vorgehen von Design Thinking auf operativer Ebene anhand des Stanford Design Cycles [4]. Sie illustriert wie jede Prototypenart, zwar mit unterschiedlichem Fokus, (vgl. Abbildung 2 – exemplarisch durch Zyklen dargestellt) aber mit Hilfe dieses Zyklus erreicht wird. Der Zyklus ist iterativ zu durchlaufen und führt über jede Iteration zu einem immer besseren Verständnis des Problems und der damit einhergehenden Anforderungen einer Lösung.

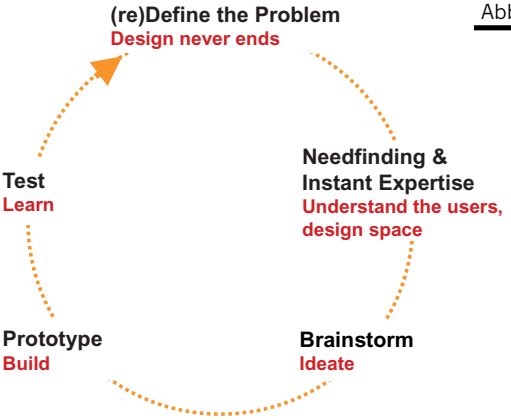


Abb. 3: *Stanford Design Cycle [4]*

Definition der Problemstellung (»Define the Problem«)
Typischerweise wird eine Problemstellung eines Unternehmens an das Design Team herangetragen – etwa die »Verbesserung einer Formularsuche in der Bankfiliale«. Das Design Team erfasst das Problem aus seiner Sicht in einem ersten Schritt des Design Zyklus und versucht die damit verknüpften Probleme zu verstehen und das Problemumfeld abzustecken, indem es ebenfalls die wichtigsten Einflussfaktoren ausfindig macht.

Aufbau Kundenverständnis (»Needfinding and Instant Expertise«)
Im zweiten Schritt geht es in die Verständnis- / Observations-Phase, bei der das Verstehen des Kunden und seiner Anforderungen im Fokus liegt. Hier reichen die klassischen Recherchemethoden, wie Marktforschung, Internetrecherchen, etc. nicht aus. Dem menschenzentrierten Ansatz von Design Thinking geht es darum, mit Personen in Kontakt zu treten, sei es direkt z. B. über Interviews oder indirekt über bspw. Beobachtungen. Die Erfahrung zeigt, dass herkömmliche Befragungen oft Bedürfnisse der Menschen ans Licht bringen, die nur wenig hilfreich sind. Das berühmte Zitat von Henry Ford spricht für sich: »Hätte ich die Leute gefragt was sie wollen, hätten sie gesagt schnellere Pferde.« Bessere Ergebnisse sind hier durch Beobachtungsverfahren möglich. Für das Beispiel »Formularsuche im Beratungskontext einer Finanzdienstleistung«, hieße dies, dass die Beobachter den Beratungsgesprächen möglichst im Hintergrund beiwohnen und genau beobachten, wie die einzelnen Schritte im Formularsuchprozess durch den Berater erfolgen. Die Erfahrung mit Befragten zeigt, dass den eigentlichen Akteuren in einem Ablauf meist nicht jeder beobachtete Prozessschritt bewusst ist. Solche Aspekte würden bei herkömmlichen Befragungen vermutlich unter den Tisch fallen. Zudem können gewisse Lösungshinweise in dieser Phase auch durch das Beobachten von ähnlichen Problemen/Situationen in einem anderen Kontext herbeigezogen werden. Eine wichtige Voraussetzung für das richtige Beobachten ist ein bestimmtes Maß an Unvoreingenommenheit.

Das Dokumentieren aller Eindrücke, Interviews, Beobachtungen mittels adäquater Visualisierungsformen wie Fotos, Videos, Skizzen, Storytelling u. ä. soll die Erlebbarkeit der Ergebnisse aus dem zweiten Prozessschritt ermöglichen und bildet eines der zentralen Elemente des Design Thinking. Die Visualisierung erfolgt meist über das Anbringen an beschreibbare Wände, Flipcharts-, oder Whiteboards.

Kreieren von Lösungsvorschlägen (Ideate)

Der dritte Schritt im Design Zyklus, ist der Beginn der Ideate-Phase [4] und mündet in konkrete Lösungsvorschläge. Bei der Ideate-Phase geht es um einen kreativen Vorgang, der durch ein kontrolliertes Setup ermöglicht wird. Dieses wird durch unterschiedliche Methoden, wie z. B. Brainstorming gestützt. Zentral hierbei ist, dass der Fokus im Design Thinking nicht auf dem eigentlichen Ideengenerierungsprozess, sondern auf den davor- bzw. dahinterliegenden Phasen liegt. Folgende Abbildung soll dies veranschaulichen:

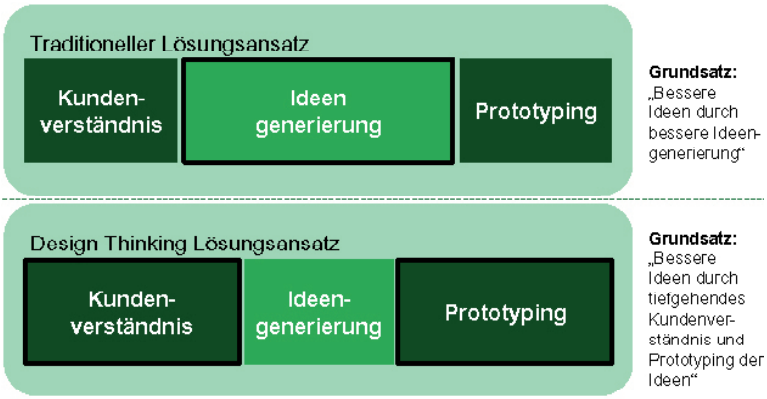


Abb. 4: *Vergleich Fokus Design Thinking vs. Traditioneller Lösungsansatz (eigene Darstellung)*

Prototyping

Das Prototyping ermöglicht die Anfassbarkeit bzw. emotionale Erlebbarkeit generierter Ideen und somit die Basis für weitere Diskussion, Denkprozess und das Testen mit Kunden in der nachfolgenden Phase. Menschen können physisch anfassbare Prototypen besser verstehen und anschließend bewerten. Entscheidendes Kriterium für einen erfolgreich umgesetzten Prototypen ist nicht dessen »Auflösung« – d. h. die Filigranität ist nur soweit auszuprägen, dass eine testende Person die neu entwickelte Funktionalität begreifen und testen kann. In den ersten Iterationen des Design Zyklus können Prototypen aus Pappe, einfachem Papier, Mock-Ups, Wireframes oder speziell im Bereich von Dienstleistungen in Form von Rollenspielen, Storytelling, Videos und Storyboards für Customer Journeys erstellt werden. In späten Phasen des Projekts nimmt die Auflösung der Prototypen bei den einzelnen Meilensteinen zu.

Testing

Beim Testing gilt der Grundsatz, dass Scheitern erlaubt, ja sogar erwünscht ist [3]. Das Scheitern mithilfe bereits erstellter Prototypen ermöglicht es, stärker die grundlegenden Bedürfnisse und Anforderungen der Kunden herauszuarbeiten und das Problem besser zu erfassen bzw. direkt in den nächsten Prototypen einzuarbeiten. Das Ziel liegt anfänglich darin, möglichst viele unterschiedliche Feedbacks anhand von Testings einzuholen. Idealerweise wird ein Testing-Umfeld gewählt, welches dem eigentlichen Problemkontext möglichst ähnlich ist. Eine hohe Anzahl an Iterationen verhindert »Fehlschüsse« in späten Projektphasen, indem neu entwickelte Lösungen frühzeitig getestet werden.

Embedded Design Thinking im CIO-Bereich der Deutschen Bank AG

Die hier ausgeführte Fallstudie entstand im Rahmen der Zusammenarbeit mit der Deutschen Bank AG innerhalb des Bereiches Private und Business Clients (PBC) bzw. innerhalb GTO. Die Deutsche Bank AG

hat als erstes Unternehmen gemeinsam mit der Universität St.Gallen Embedded Design Thinking entwickelt und eingeführt. Die ersten zwei Jahre des Projekts besaßen jeweils einen unterschiedlichen Fokus. Im Jahre 2009 ging es darum, grundsätzlich zu prüfen, inwiefern das Embedded Design Thinking Konzept funktioniert. Nach notwendigen Anpassungen, welche aus dem ersten Jahr resultierten, folgte 2010 ein »Proof of Concept« und eine Aufstockung von einem auf zwei Design Teams, welche unterschiedliche Fragestellungen zu bearbeiten hatten. Im Folgenden werden die zentralen Erkenntnisse des Projektes vorgestellt.

Rollenmodell

Im Rahmen des Embedded Design Thinking wurden unterschiedliche Rollen definiert (Abb. 5):
Die Design Teams standen im Zentrum und waren von den Sponsoren, Professional Coaches (Auftraggeber / interne Spezialisten) und den Experts (zusätzliche Fachexperten) umgeben. Der Bridgehead stellte eine Schnittstelle zwischen Team, Organisation und Method Coaches dar. Die Zur Innovator-Community zählte ein erweiterter Kreis Interessierter aus unterschiedlichen Bereichen der Unternehmen. Die Universität St.Gallen besetzte das Rollenmodell mit zwei unterschiedlichen Rollen. Einerseits waren sie Method Coaches, welche als Unternehmensunabhängige den Teams die Methode beibrachten und anderseits Researcher, welche die Erprobung des Embedded Design Thinking wissenschaftlich begleiteten. Das Research Committee schlussendlich hatte die wissenschaftliche Obhut über das Projekt.

Die in der Abbildung 5 mit einem »*« bezeichneten Rollen werden im Folgenden fokussiert betrachtet, da sie sich bei der praktischen Umsetzung als besonders wichtig herausstellten und somit als Stützpfeiler der Implementierung erwiesen.

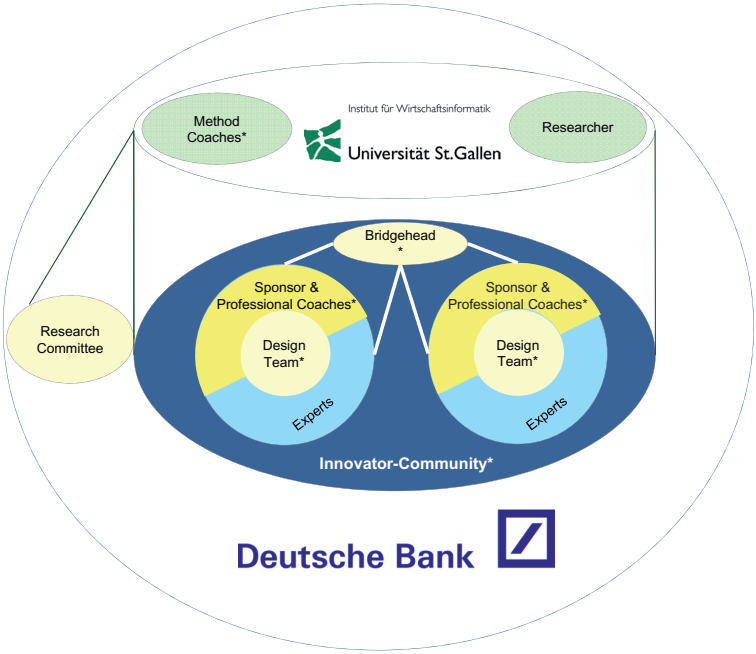


Abb. 5: *Rollenmodell Embedded Design Thinking @ Deutsche Bank (eigene Darstellung)*

Design Teams (unternehmensintern)

Die Design Teams stellten das Zentrum innerhalb dieses Innovationsprojekt dar und jede Rolle stand mit ihnen in Kontakt. Die Teams arbeiteten zwar anhand einer strategisch relevanten Aufgabenstellung des Unternehmens Lösungen heraus, agierten jedoch unabhängig von weiteren operativen Aufgaben der Organisation. Zunächst mussten die Teams rekrutiert werden, eine Herausforderung, weil die Kandidaten nur teilweise ein »typisches« Bankenprofil aufwiesen. Es kamen zwei Tests zum Einsatz, die die Zuordnung der Design Team Mitglieder in die unterschiedlichen Teams ermöglichte: Der Myers Briggs Typindikator [7] identifizierte Persönlichkeitsmerkmale und der Gallup Strengths Finder [5] die besonderen Stärken. Die Teams mussten intensiv Fach-

wissen aufbauen und mithilfe der Methode möglichst innovative Prototypen entwickeln. Eine weitere Aufgabe der Design Teams war es, die eigene Position und Ideen im Unternehmen zu vermarkten, sowie den Bridgehead beim Marketing für die Initiative Design Thinking zu unterstützen. Die Teams definierten im gesamten Verlauf des Projekts nie einen Projektleiter. Somit lagen die von den Design Teams entwickelten Lösungsvorschläge ganz in der Verantwortung des jeweiligen Teams und nicht auf den Schultern einzelner.

Method Coaches (unternehmensextern)
Die Method Coaches vom Institut für Wirtschaftsinformatik der Universität St.Gallen waren hauptsächlich für die Vermittlung der Methode sowie deren korrekte Anwendung verantwortlich. Es galt v. a. aus methodischen Gesichtspunkten darauf zu achten, auch Ideen zuzulassen, welche auf den ersten Blick für eine Bank ungewöhnlich erschienen. Ziel war es, den Teams für die Erarbeitung von Prototypen größtmögliche Freiheiten zu schaffen und in besonderen Fällen Unterstützung anzubieten. Eine zentrale Rolle im Embedded Design Thinking spielte das Coaching hinsichtlich teamdynamischer Aspekte. Die unterschiedlichen Arbeitserfahrungen der einzelnen Mitglieder erforderte zusätzlich regelmäßiges intensives bilaterales Coaching auch hinsichtlich des organisationalen Verständnisses und der Möglichkeiten, Design Thinking in diesen Strukturen optimal anwenden zu können.

Bridgehead (unternehmensintern)
Bevor die Design Teams in der Organisation tätig wurden, war der sogenannte Bridgehead intensiv an der Vorbereitung des Projekts beteiligt und akquirierte u. a. auch die Sponsoren der jeweiligen Aufgabenstellung. Seine langjährige Erfahrung stellte sicher, dass die Teams mit den richtigen Personen im Unternehmen in Kontakt kamen. Der Bridgehead betrieb intensives internes Marketing für die Methode und Prototypen. Dies geschah u. a. über verschiedene Mitarbeiter der Bank, die hinsichtlich ihrer Position oder ihrer Vernetzung für besonders große Hebelwirkungen sorgen konnten. Des Weiteren organisierte der

Bridgehead die Präsentationen der Zwischenergebnisse (Meilensteine). Außerdem hatte er die Aufgabe, das Embedded Design Thinking aus Sicht Bank weiter zu entwickeln.
Die Method Coaches und der Bridgehead stimmten das Gesamtkonzept strategisch ab. Gleichzeitig unterstützten beide Seiten die Unabhängigkeit der Design Teams bei der Entwicklung von Prototypen auch nach außen.

Professional Coaches (unternehmensintern)
Der Auftraggeber der zu bearbeitenden Aufgabe für die Design Teams, der Sponsor, wählte zentrale Mitarbeiter der Bank aus und betraute sie mit der Rolle des Proessional Coaches. Hierbei stand insbesondere die Relevanz des Expertenwissens für die Problemstellung und die spätere Umsetzung einer Lösung im Vordergrund. Mit den Professional Coaches wurde im Vorfeld ein frei einteilbarer Aufwand von ca. 15-20 % der Wochenstunden für die Design Teams vereinbart. Diese hatten die Hauptaufgabe, die Design Teams mit den nötigen Kenntnissen auszustatten. Für eine adäquate fachliche Unterstützung benötigte diese Rolle auch eine methodische Einführung zu Beginn des Projekts und nahm somit an einem boot-camp-ähnlichen Einführungstag mit den Design Teams teil. Die Professional Coaches besuchten zusätzlich methodische Workshops, welche zum Ziel hatten, einzelne zentrale Elemente der Methode zugänglich zu machen. Auch wenn der im Vorfeld vereinbarte zeitliche Aufwand aufgrund des Alltagsgeschäfts nicht immer von allen beteiligten Professional Coaches eingehalten werden konnte, nahmen diese ausnahmslos an den Meilenstein-Präsentationen teil.

Innovator-Community (unternehmensintern)
Die Innovator-Community bestand aus weiteren Innovationsinteressierten der Bank und bildete einen äußeren Kreis um das Design Team und die Professional Coaches. Die Teilnahme an den Meilenstein-Präsentationen gehörte zu den Hauptaktivitäten und diente vor allem dazu, die Ergebnisse möglichst breit in die Bank hinein zu kommuni-

zieren. Diese Rolle war aufgrund der Einbettung des Design Thinkings innerhalb der Deutschen Bank aus Sicht der Innovationsumsetzung besonders interessant und sorgte für eine erhöhte Diffusion der Innovationsideen in die Unternehmung. Die Visibilität des Projekts ließ sich durch eine solche Community signifikant erhöhen und sorgte für eine konstante Neugier unterschiedlicher Seiten der Unternehmung bezüglich der Lösungen des Design Teams. Neben der »Botschafter-Rolle« von Innovator-Community-Mitgliedern wurden diese Personen zum Enduser-Testing eingeladen bzw. für einen fachlichen Austausch von den Design Teams kontaktiert.

Meilensteine

Die Meilensteine der akademischen Variante ließen sich 1:1 in das Embedded Design Thinking überführen. Die Verarbeitungszeit der einzelnen Meilensteine musste jedoch gegenüber der ursprünglichen Planung signifikant verkürzt werden. Die Projektdauer belief sich auf insgesamt 5 bzw. 4 Monate (akademische Variante: 10 Monate). Diese Verkürzung kann die Radikalität der entwickelten Lösung verwässern. Deadlines sind ebenso wichtig wie die Freiheiten, die für Innovation in der Deutschen Bank im Rahmen dieses Projekts geschaffen wurden. Trotzdem zeigte sich besonders in der Design Space Exploration Phase, dass zu knappe Verarbeitungsphasen zu Lasten der Tiefe der später erarbeiteten Lösungen gehen können.

Kommunikation

Die beste Idee nützt wenig, wenn nicht darüber gesprochen wird. Daher war das Kommunikationskonzept, mit dem die Verbreitung von Design Thinking im Unternehmen vorangebracht werden soll, von zentraler Bedeutung.

In Meilenstein-Präsentationen wurden Zwischenergebnisse, Prototypen und methodische Einführungen diskutiert. Workshops für

Interessierte vermittelten die zentralen Elemente von Design Thinking, (Brainstorming, Rapid Prototyping, Visualisieren von Ideen, usw.).

Wichtig für das Projekt war eine Open Door Policy: Interessierte konnten jederzeit die Arbeitsräume der Teams betreten und z. B. Prototypen testen, Feedback geben, ein Gespräch mit den Teammitgliedern führen oder Elemente aus dem Design Thinking Umfeld in ihre Arbeit einfließen zu lassen, entweder in Form von Elementen der Design Thinking Methode oder auch inhaltlichen Lösungen.

Zusätzlich förderte v. a. der Bridgehead einen möglichst intensiven Austausch von unterschiedlichen Rollen und den Design Teams. Zum einen, um das Design Team und die Initiative möglichst breit bekannt zu machen und zum anderen, um auch hier neue Impulse einfließen zu lassen. Flankiert wurde das Kommunikationskonzept durch den Einsatz von Sharepoint, Online-Newslettern sowie Microblogging und ähnlichen Kommunikationskanälen.

Lessons Learned

Im IT-Bereich der Deutschen Bank konnte ein operativer Innovationsprozess auf Basis von Embedded Design Thinking im Verlauf von zwei Jahren etabliert werden. Die Systematisierung und Professionalisierung des operativen Innovationsprozesses führte zu Prototypen und Neuanstellungen vielversprechender Persönlichkeiten aus den ehemaligen Design Teams. Aufgrund von Anpassungen konnte die Anwendung von Design Thinking im Unternehmenskontext optimiert werden.

Rollen

Ein zentraler Erfolgsfaktor war die klare Aufgabenverteilung in den zugeordneten Rollen. Die Innovations-Community rund um das Design Team trug maßgeblich dazu bei, die intensive Vermarktung der Ergebnisse und der Embedded- Design-Thinking-Initiative voranzutreiben. Gleichzeitig gab sie den Teams unerwartete Impulse für ihre Arbeit. Die Rolle des Bridgeheads erwies sich als zentral. Er belieferte die relevanten Stakeholder in der Community sowie die Auftraggeber

kontinuierlich mit den richtigen Informationen. Darüberhinaus verschafte er raschen Zugang zu Ressourcen. Dies förderte die Agilität der Design Teams.

Die Method Coaches setzten wichtige Impulse bei der Vermittlung der Grundprinzipien von Design Thinking in der IT, beim Fördern von teils unüblichen Lösungen der Design Teams in der Bank. Die Method Coaches hatten gemeinsam mit dem Bridgehead zusätzlich die Aufgabe, den vom Management empfundenen Kontrollverlust abzufedern und diesem die mit Design Thinking gewonnenen Erfahrungen zu kommunizieren.

Innovationsdiffusion

Um das Embedded Design Thinking effizient in die Organisation hinein zutragen, waren die Meilenstein-Präsentationen sowie die beschriebene Open Door Policy maßgeblich. Einschränkend ist allerdings festzuhalten, das spontane Besuche von Bankmitarbeitern bei den Teams aufgrund der zeitlichen Beschränkungen durch das Tagesgeschäft eher die Ausnahme war.

Geeignete Recruiting-Kriterien

Nach Leifer [3] verfügt ein Mensch idealerweise über sämtliche Fähigkeiten, die für Innovationen in einem Unternehmen benötigt werden: also strategisches Vorausschauen, Sensibilität für Details, Realisation von Ideen, sowie das Wecken von Begeisterung. In der Wirklichkeit können Personen meist nur in einer Disziplin richtig gut sein. Hierdurch resultierte eine besondere Herausforderung für die Besetzung eines Design Thinking Teams. Die Teams wurden mit Studenten aus unterschiedlichen Fachrichtungen und Denkschulen besetzt, um einem möglichst hohen Grad an Diversität zu erreichen.

Letting it happen

Neben der richtigen Besetzung der Teams, der intensiven Kommunikation mit Stakeholdern der Unternehmung für die Innovationsdiffusion und einer aktiven Community geht es beim Design Thinking v.a. um eines: Letting it happen [3]. Alle Bemühungen sollen den einzelnen Teammitgliedern den Raum lassen, intellektuell wie physisch, innovative Lösungen zuzulassen. Ein gut strukturierter Projektablauf und die optimierte Projektorganisation können die richtigen Rahmenbedingungen für tiefgreifende Innovation nicht kompensieren. Organisatorisch heißt dies eher: Reduzierung von Managementstrukturen. Durch diese Strukturen wird ein Verlust an Kontrolle unvermeidlich und dies führt bei vielen Führungskräften zu Verunsicherung.

Potenziale für die Deutsche Bank AG

Abschließend werden die Nutzenpotentiale des gesamten Projekts für die IT der Deutschen Bank zusammengefasst.

Lösungen

Exemplarisch wird an einem konkreten Beispiel ausgeführt, wie mit Design Thinking Lösungen entwickelt wurden.

Dieses Beispiel, sowie alle anderen im Rahmen des Embedded Design Thinkings entwickelten Prototypen, wurden mit einem menschenzentriertem Fokus und intensiver Einarbeitung von Testing-Feedbacks über eine große Anzahl Iterationen im Design Thinking Zyklus optimiert. Diese mündeten schlussendlich mindestens in einem hochaufgelösten finalen Prototypen.

Erfolgsgeschichte: Die Entwicklung des Zukunftsplaners

Der Auftrag erstreckte sich auf die Optimierung des Kundenkontakts. Das Ziel bestand darin, wieder intensiver eine persönliche Beratung in Bankfilialen zu ermöglichen.

In der ersten Phase analysierten Projektmitarbeiter, wie und wo die Bank mit dem Kunden in Kontakt tritt. Dies geschah anhand von zahlreichen Beobachtungen des Kundenverhaltens in den Bankfilialen, aber auch durch Beobachtungen in branchenfremden Bereichen, in denen Beratungsgespräche stattfinden. Diese Beobachtungen lieferten die Basis für zahlreiche Ideen, inwiefern Dienstleistungsinteraktionen einer Bank persönlicher gestaltet werden können. Die Ideen wurden in kürzester Zeit in Prototypen umgesetzt und durch die Kunden getestet. Ein Beispiel ist ein Prototyp, welcher die persönliche Beratungsleistung einer Bank auf längeren Zugfahrten anbietet. Dies wurde von den Design Teams in Form von Rollenspielen im realen Kontext von Bahnfahrten getestet. Das Feedback aus diesem Prototyp zeigte, dass gerade bei längeren Bahnfahrten die Passagiere ihre Fahrt sehr gezielt planen und ihre Fahrzeit häufig produktiv nutzen. Tests von ganz unterschiedlichen Prototypen an Orten, wie Bahnhöfen und Fußgängerzonen lieferten sehr wertvolle Erkenntnisse, die die Beziehung von Kunden und Beratungsgesprächen rund um Finanzdienstleistungen thematisieren. Ein Hauptaugenmerk lag nach zahlreichen Testing-Feedbacks mit realen Kunden auf dem Problem langfristiger Finanz- und Lebensplanung, das für viele Menschen eine Herausforderungen darstellt. Durch diese Fokussierung entstand die Idee einer »interaktiven Lebenslinie«. Diese bietet dem Kunden die Möglichkeit, verschiedene Ereignisse in seinem bisherigen aber auch zukünftigen Leben darzustellen und die finanziellen Auswirkungen und Anforderungen erlebbar darzustellen. Inspiriert durch unterschiedliche Quellen wie Kino, iPhone oder der Technologie des Microsoft Surface [7], wurde die Vision für eine interaktive Beratungsapplikation entwickelt, die auf verschiedenen berührungsempfindlichen Oberflächen genutzt werden kann.

Die unterschiedlichen Versionen der Lebenslinie entwickelten sich von tiefaufgelösten Prototypen, wie Papiercollagen, über Plexiglas Prototypen und Power-Point Mock-Ups, bis zu hochaufgelösten Prototypen in Form von fertig programmierter Software. Das Projektteam testete jeden Zwischenschritt der Entwicklung mit Endkunden, z. B. in einer Abflughalle eines Flughafens, um sicherzustellen, dass der entwickelte Prototyp genau das Kundenproblem lösen würde. Die Ergebnisse zeigten, wie offen die Kunden gegenüber dem Prototypen eingestellt waren, mit dessen Unterstützung sie ihr Leben finanziell planen konnten. Der finale Prototyp, eine programmierte Software, die das Erarbeiten der finanziellen Lebenslinie auf einem Touch-Bildschirm ermöglichte, wurde in mehreren Tests in verschiedenen Bankfilialen mit Bankkunden eingesetzt. Das Feedback der Kunden bestätigte das Konzept. Das Ziel, einen verbesserten und kundenorientierten Beratungsprozess in der Filiale zu gestalten, konnte durch die Lebenslinie umgesetzt werden. Nur wenige Monate nach der Vorstellung des Prototyps der Lebenslinie und einer Engineering Phase als Vorbereitung für die Anwendung auf einem Microsoft Surface [7], steht sie nun als Beratungsinstrument in der Q110 Bankfiliale der Zukunft in Berlin.

Innovation
Die Öffnung des Innovationszyklus durch die Open-Door Policy ermöglichte es, unmittelbar Feedback von Bankmitarbeitern mit in die Lösung einzuarbeiten und den involvierten Testpersonen das Gefühl zu vermitteln, zu der Lösung etwas beigetragen zu haben. Dies beeinflusste die gesamte Innovationskultur der betroffenen Bereiche der Deutschen Bank positiv.

Recruitment
Durch ein innovatives Projekt konnten High Potentials aus unterschiedlichen Fachrichtungen für die Bank gewonnen werden. Die Bank akquirierte bisher mindestens eine Person aus den Design Teams, nicht zuletzt aufgrund eines sehr nachhaltigen Assessments über den gesamten Verlauf des Projekts.

Image
Mit diesem Projekt konnte nachhaltig das Image als innovatives Unternehmen gestärkt werden. Das gezielte Fördern der Kreativität von Mitarbeitern führte im Rahmen des Embedded Design Thinking Projekts dazu, dass auch neue Kooperationen mit anderen Unternehmen möglich wurden.

Danksagung

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Zusammenfassung
Innovationen bilden die Grundlage für erfolgreiches Unternehmertum – auch in der IT. Dem Chief Information Officer war jedoch in den letzten Jahren durch Kostendruck die Hände gebunden, systematisch und offen an Innovationen für das Geschäft zu arbeiten. Prozesse im Innovationsmanagement wurden zwar angestoßen, relativ selten konnten jedoch operative Innovationsprozesse in der IT effektiv durchlaufen werden. Das Institut für Wirtschaftsinformatik der Universität St.Gallen hat im Rahmen von zwei Projekten gemeinsam mit der Deutschen Bank AG einen operativen Innovationsprozess mit dem Namen Embedded Design Thinking, entworfen und erfolgreich eingeführt. Das Verfahren basiert auf der Methode Design Thinking. Aus dem Transfer einer akademisch entwickelten Methode in den IT-Bereich einer Bank konnten Erkenntnisse für ein Embedded Design Thinking entwickelt werden. Diese leisten einen Beitrag, Embedded Design Thinking erfolgreich aufzubauen und den Business Value eines IT-Bereichs gegenüber den Fachbereichen zu stärken.

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Designing Innovation: Prototypes and Team Performance in Design Thinking

Christophe Vetterli*

University of St.Gallen, Institute of Information Management,
Müller-Friedberg-Strasse 9, 9000 St.Gallen, Switzerland.
E-mail: christophe.vetterli@unisg.ch

Friederike Hoffmann

University of St.Gallen, mcm institute,
Blumenbergplatz 9, 9000 St.Gallen, Switzerland.
E-mail friederike.hoffmann@unisg.ch

Walter Brenner

University of St.Gallen, Institute of Information Management,
Müller-Friedberg-Strasse 8, 9000 St.Gallen, Switzerland.
E-mail: walter.brenner@unisg.ch

Martin J. Eppler

University of St.Gallen, mcm institute,
Blumenbergplatz 9, 9000 St.Gallen, Switzerland.
E-mail: martin.eppler@unisg.ch

Falk Uebernickel

University of St.Gallen, Institute of Information Management,
Müller-Friedberg-Strasse 8, 9000 St.Gallen, Switzerland.
E-mail: falk.uebernickel@unisg.ch

Abstract: This study investigates design thinking innovation teams working on three different innovation tasks: business model innovation, service innovation, and product innovation. Each task involves the generation of many prototypes, one of which needs to be selected as the final prototype. Further, one of the teams collaborated through virtual collaboration. By measuring both subjective and objective performances of the teams, we compared the different innovation tasks and their impact on design thinking teams. Our preliminary study shows that while the generation of many prototypes indeed seems to support the selection of the best final prototype, it is mostly the team process which impacts the quantity of all and quality of the final prototype. Especially the virtually cooperating team working on a service innovation task, experienced major difficulties in the process, while we can report that the business model innovation team generated the most prototypes while working in a rather harmonious team.

Keywords: Design Thinking; Innovation; Prototypes; Innovation Teams; Performance Measures

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1 Problem: What specific problem does the submission focus on?

The study focuses on design thinking teams and assesses their performance when working on product, service and business model innovation tasks by measuring both subjective and objective process and outcome variables.

Design Thinking is an innovation approach that reached much attention, from researchers and practitioners as well (Cross, 2001; Cross *et al.*, 1992; Markus *et al.*, 2002). Design thinking research can be situated in the design-science research, which is one of the research paradigms of the information systems discipline (Hevner et al. 2004). The design science paradigm seeks to extend the boundaries of human and organizational capabilities by creating and shaping new and innovative artefacts (Hevner, 2004), which address unsolved problems. Knowledge and understanding of a problem domain and its solution are achieved in the building and application of the designed artefact (Hevner *et al.*, 2004). The design process is twofold, the first phase being a sequence of expert activities to produce an innovative design artefact. The second phase is the evaluation of the artefact, which then provides feedback information and a better understanding of the problem, meant to improve both the quality of the artefact and of the design process (March & Smith, 1995). Building and evaluating the artefact takes place in iterative "build-and-evaluate loops" (Markus *et al.*, 2002). Cross (2001) defines design science as referring "to that body of work which attempts to improve our understanding of design through 'scientific' (i.e., systematic, reliable) methods of investigation."

The approach is especially promising and much recommended to support innovation teams in organizations (Sutton & Hargadon, 1996). In order to understand how teams work in the design thinking innovation process with different innovation challenges, namely product, service and business model innovation, we provide a preliminary study by analysing teamwork process and outcome by measuring both subjective and objective performance in design thinking teams. Performance assessment of innovation projects is a central issue in innovation management research (Blindenbach-Driessen *et al.*, 2010), and especially the impact of teamwork on success (M. Hoegl & Gemuenden, 2001). However, design thinking as applied in practice, has not yet been sufficiently analysed in this regard.

2 Current understanding: What is known about this problem?

New approaches such as design thinking have received much attention in recent innovation research and practice (Boland & Collopy, 2004; Grots & Pratschke, 2009; Sato, 2009) in order to enable idea generation and selection (Girotra *et al.*, 2010) and to reduce the uncertainty innovation teams face to a large degree (Sicotte & Langley, 2000).

Design Thinking Research

Design thinking is a human-centred innovation method accompanied by a structured process in order to raise the probability of innovation success (Dym et al., 2005; Skogstad, 2009; Vetterli, et al., 2011). Design thinking as applied in our context has its

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roots in mechanical engineering at Stanford University, and is most often applied for product innovation. The main elements of the method are in this order: Needfinding, ideation, prototyping, testing and redesigning (Nussbaum et al. 2005). Typically, design thinking starts with a human centered innovation challenge, or problem statement, such as creating "active packaging". Human centricity is understood as a strong focus to underlying human needs, which are most of the time unarticulated. The elements are implemented by pursuing methodologically and timely defined milestones to ensure the delivery of many prototypes during the project, and in the end the final prototype. Further, the milestones are defined along specific prototype requirements: Critical Function Prototype; Dark Horse Prototype, Functional Prototype and Final Prototype (Skogstad, 2009). Whereas the first two milestones, Critical Functional Prototypes and Dark Horse Prototypes, are meant to foster divergent thinking in the team, the milestones Functional Prototypes and Final Prototypes support converging thinking.

The main outputs of design thinking are developed and tested prototypes. Terwiesch & Loch (2004) see the evolution of prototypes as a learning mechanism in the context of customized design. Prototypes are tangible ideas, which are more and more refined in the course of the process. While in the divergent phase at the beginning of the design thinking process multiple prototypes are developed, the convergent second phase leads the team to focus on finishing one high resolution prototype (Ulrich & Eppinger, 1994).

Team Innovation Measures

Research on innovation teams focusses on both *subjective and objective performance measures* (Girotra et al., 2010).

Objective idea quality measures are based on research on idea generation effectiveness and encompass both idea quantity and quality. The quantity of the idea generation method is identified by simply counting the total number of ideas generated per team. Research argues that by generating many ideas, teams are more likely to generate good ideas (Diehl & Stroebe, 1987; Simonton, 1999). However, researchers have for most parts moved away from counting the total number of ideas to focus mostly on the examination of the average idea quality as well as the quality of the best idea. Girotra and colleagues (2010) rightly point out that it is further necessary to measure if the group is able to select the best idea. In order to assess what the best idea of a group is, many researchers have suggested independent judges to assess the quality of generated ideas (Amabile, 1982; Amabile *et al.*, 1996; Connolly et al., 1990; Girotra et al., 2010; Kramer et al., 1997).

Different operationalization of quality are used in research projects (Faure, 2004). Most commonly, idea quality is defined as a combination of originality and feasibility (Diehl & Stroebe, 1987). Rietzschel, Nijstad and Stroebe (2010: 48) define a quality idea as "both highly original (or unusual) and highly feasible (or useful)". Girotra and colleagues (2010: 593) have suggested broadening the measure based on extreme value theory, which proposes that a group can discern good ideas from bad ideas. The expected quality of the best ideas is driven by the number of ideas generated, the average idea quality, and the variance of the quality distribution (Girotra et al., 2010: 593). The quality measure used in this study reflects the multidimensions of the measure, consisting of 7 different metrics in total: Technical feasibility, novelty, specificity, demand, overall value, creativity, and value for the target group. The first five metrics have been established and verified by Girotra and colleagues (2010); the final two metrics are

derived from the assessment of Kramer (1997). The scale was measured on a ten-point Likert scale ranging from very poor to very good.

The subjective performance measures in innovation teams used in this study are derived from multiple scales. Research has found that teamwork quality (TWQ) is positively related to team performance, as well as success of team members (M. Hoegl & Gemuenden, 2001). Hoegl and Gemuenden (2006) developed and tested a comprehensive TWQ concept, which allows for perceived measure of performance and member satisfaction. Specifically, teamwork quality measures (communication, coordination, balance of contributions, mutual support, effort and cohesion) are combined with team performance measures (effectiveness and efficiency) and personal success measures (work satisfaction and learning). While Hoegl and Gemuenden (2001) differentiate between the effects on managers, team leaders and team members, and report considerable differences regarding the performance ratings, we focus solely on the team as a whole.

Further, research has found that team reflexivity is positively related to effectiveness by supporting the teams in finding better solutions to the problems they are facing (Hoegl & Parboteeah, 2006). We use the scale of Hoegl and Parboteeah (2006) to measure team reflexivity in innovation teams, which is based on West's (1996) work on team reflexivity and effectiveness. Hoegl and Parboteeah (2006) add the dimensions of social skills and project management skills as determinants of reflexivity to the original scale. Measuring team reflexivity may offer powerful insights into areas where innovation teams can be influenced in order to enhance their performance; therefore, it is important to include this measure in our study of examining design thinking innovation team performance.

Anderson and West (1998) suggest the team climate inventory (TCI) to identify factors for innovativeness of teams based on team climate. In our study, we used two facet-specific climate scales of vision (all 12 items) and team participation (9 items) of the original scale.

Finally, we use the scale developed by Blindenbach-Driessen and colleagues (2010) to measure the overall performance of design thinking innovation teams. Performance is defined as a combination of operational, i.e. technical performance and captured knowledge, and product performance, i.e. customer satisfaction and competitive advantage of the developed innovation. Initially, the scale has been developed by the authors to measure the performance of new product and service innovation projects. We apply the scale to measure the performance of a design thinking business model innovation project as well.

3 Research question: What is the submission's goal?

Innovation with the design thinking approach is of much interest for researchers and practitioners (Cross, 2001; Cross *et al.*, 1992; Markus *et al.*, 2002). Further, research on the performance assessment of innovation teams has progressed substantially, as well as on innovation tasks (Shah *et al.*, 2000; Shah *et al.*, 2003), for example product development (Hoegl & Parboteeah, 2006), service innovation (Blindenbach-Driessen et al., 2010), and business model innovation (Eppler, 2011). So far, the impact of design thinking on different innovation tasks has not yet been sufficiently assessed. Specifically, we are interested in gaining a better understanding of which impact team metrics have in

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design thinking innovation teams, working on product, service and business model innovation tasks, on both outcome and process. Our research question is:

RQ: Does a different innovation task influence the objective and subjective performance of design thinking teams regarding outcome and process?

4 Design/methodology/approach: How was the study/work executed?

While research acknowledged the importance of generating and selecting the best idea from innovation processes (Girotra et al., 2010), there is limited evidence on our research question in the existing literature. Thus, we choose an exploratory, data-rich research design to answer our research question (Eisenhardt & Graebner, 2007). Our study is concerned with innovation teams which solve business model, service and product innovation tasks using the design thinking innovation methodology. The final outcome of a design thinking innovation project is one highly tangible prototype. This final prototype has been developed by building, refining, and dropping many prototypes before finally selecting one prototype. It is critical to maintain the real-life context of design thinking innovation in teams, since we do not know ex ante how the teams will perform. A multiple exploratory case study design fulfils these requirements (Eisenhardt & Graebner, 2007; Yin, 2003).

The context of this research was a graduate course at a Swiss University, which focuses on applying design thinking on a real-life innovation challenge, offered by industry partners. The industry partners are from different industries and provide product, service and business model innovation challenges for a 10-month working period before receiving the final prototype as final deliverable out of the project. The design teams consist of graduate students with multidisciplinary backgrounds, as well as prior working experience. The class of 2010/2011 consisted of seven teams with three students each. The design thinking teams started in September 2010 and graduated from the course in July 2011 with no breaks in between. The teams passed the different milestones, described in section 2, in order to finish their projects. During this time the teams went through weekly coaching from experts concerning the methodology and developed their prototypes within intensive teamwork.

In depth, we have analyzed three different teams with three different innovation challenges: Product, service and business model innovation challenges. The teams are anomymized and labelled as follows: Mars (Business model innovation team), Venus (Service innovation team) and Mercury (Product innovation team). The data collection was based on the questionnaire outlined in section 2 to gain more insights regarding performances of each team over the different stages. After every main milestone, every team member received the questionnaire via e-mail and filled it out through an online-platform. Finally, the results of the questionnaire were screened after a descriptive data analysis on team level as well within a cross-team analysis. The final prototypes were assessed and ranked by applying perceived and quality measures provided by team members as well as independent industry experts. Additionally, the team members reflected their progress and outputs on an individually and as a team. The findings were coded and reviewed independently. For a comprehensive overview on both subjective and objective measures, in addition to the quality measures of the study, also the total amount of prototypes were considered generated by each team. .

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5 Findings: What are the main outcomes?

Girotra and colleagues (2010) highlighted the importance of not only generating good ideas, but enabling teams to select the best idea. Design thinking leads teams to develop as many prototypes as possible in the diverging phase, followed by consolidating their ideas and combine most successful elements of prototypes in the converging phase. At the end one single best prototype is developed.

Regarding the *objective measures*, we can report the following results: The seven design thinking teams generated a total *quantity* of between 21 and 44 prototypes, with an average of 34 prototypes per team. The most prototypes have been generated in the first phase, followed by the second phase, as indented in the design thinking cycle. The teams that had both the best objective and subjective performance and process measures also developed an above average number of prototypes. Surprisingly, the team with the business model innovation task developed the most prototypes of the three selected teams with 34 prototypes in total, followed by the product innovation team with 39 prototypes and last, the service innovation team with a total of 21 prototypes. Based on idea generation research (Diehl & Stroebe, 1987; Simonton, 1999), we have expected that the product innovation team would generated the most ideas, followed by the service innovation team and then the business model innovation team.

Hence, in our study on design thinking innovation teams, we can show that the amount of developed prototypes, which is often considered the critical factor for the selection of the best idea (Diehl & Stroebe, 1987; Simonton, 1999), seems to be indeed an indicator for the quality of the best idea. However, as the service innovation team developed the least amount of prototypes, but still a great idea in the end, this finding has to be examined carefully and should be verified by future research.

Furthermore, based on the objective expert rating to measure the *quality* of the developed prototypes, we can show that all design thinking teams managed to select the best idea they developed in the course of the 10 months. However, differences appear for the item of the implementation opportunities of the prototypes. Prototypes which are rated especially high regarding their novelty and creativity appear to be rather difficult to be implemented in a timely manner, as rated in the expert rating in the case of team Venus, the product innovation team.

Regarding the *subjective measures*, we can report the following results: The teamwork quality scale (TMQ) is positive related to team performance in the innovation literature (M. Hoegl & Gemuenden, 2001). While the business model innovation team and the product innovation team both ranked their team work quality as expected with a highly motivated and productive beginning, they reported very low motivation and productivity in the dark horse phase. However, the teamwork improved considerably afterwards until at the end of the project, when the teamwork quality has been rated about as positive as at the beginning of both teams. The service innovation team, however, which was the only team working in a virtual team; reported strong ups and downs, compared to the other teams. Comparing the team work quality ratings and the objective performance ratings, we find that the teams collaborating constantly well over time have better final quality ratings as compared to the team which experienced difficulties. However, as the majority of the seven teams experienced similar difficulties, as intended, in the dark horse phase and only one of the design thinking teams, working in a virtual

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team experienced continuing difficulties, we suggest that this is based on the virtual collaboration and requires further examination in future studies.

Team reflexivity has also been found to be positively related to team effectiveness (Martin Hoegl & Parboteeah, 2006). Again, we have found that team reflexivity was lowest for the service innovation team working in a virtual team, with major ups and downs. Interesting as well is that the reflexivity level of the beginning of the design thinking innovation project is reached again in the functional prototype phase, but not with the final prototype, as in all other teams.

The team climate inventory (TCI) subscales of vision and team participation by Anderson and West (1998) surprised for the service innovation team again, as the team started with a rather pessimistic vision, which improved and remained constant for the dark horse and functional prototype phase, while again lowering for the final prototype. Similar curves are observed for the participation scale. All other teams started with high ratings and reported strong decreases of vision and participation safety in the dark horse phase which went up for the functional prototype phase and continued to reach the level of the first phase with the final prototype.

The overall innovation team performance of Blindenbach-Driessen and colleagues (2010) continued to support the findings of the above described scales: While the business model and product innovation team reported insecurities regarding the quality of their performance and the likelihood of success especially in the dark horse prototype phase, the service innovation team started not very optimistic, but reported confidence in the dark horse phase and ended with below average performance ratings.

Overall, the following findings could be verified: Industry experts confirmed that the best ideas were selected in all design thinking teams as final prototypes out of all prototypes generated. The subjective measures from the teams confirm that the teams were satisfied as well with selection as the quality of ideas developed at the end. We have found that the service innovation team working in virtual collaboration mode had difficulties for the majority of the project. Additionally, this team had generated the smallest amount of prototypes and experienced low satisfaction with process, team communication, and team work quality in the divergent phase compared to the other teams. Surprisingly, the final prototype was assessed and determined as in the top quartile of all the final prototypes delivered. Both the team with the product innovation task and the business model innovation team have been among the most stable teams, nevertheless the product innovation team was not assessed as one of the best teams of the year.

6 Contribution: What does the submission add to current understanding?

Design thinking is a human-oriented innovation method, which has originally been used for innovation in mechanical engineering and is now applied to a much wider field, especially business administration environment. So far, there has been no test of the effects of design thinking in this environment. We have applied team innovation process and outcome scales to compare how design thinking teams are affected by different innovation tasks.

The study provides a preliminary overview on design thinking teams working on different innovation tasks and reports effects of the innovation task on both outcome and

process. We have analyzed how design thinking teams work when they are not, as previously often the case, composed of mostly mechanical engineers (Skogstad, 2009; Dym et al. 2005) but business students, for which generating prototypes is an unusual activity..

In our preliminary study we report that the three innovation types have been mastered, with the final prototypes from all teams receiving high independent quality ratings. Also, the innovation type did not impact the total number of ideas, or prototypes, generated by the teams.

Specifically, we have found that the subjectively measured output ratings support very much the objectively measured output ratings, with the only exception being the service innovation team, which collaborated as virtual team. The difficulties the team reported impacted the subjective ratings to a great extent. However, although the team was not overly satisfied with its performance, the industry partners of the team expressed great satisfaction in their quality ratings. Virtual teams are of much research interest (Linda & Charles, 2007), which most focus on how collaboration and communication can be facilitated. In practice, virtual teams are a reality in the globalized economy for many firms. In our research, we observed that the virtual collaborating team experienced significant difficulties in the innovation process. However, the impacts on the final prototypes have been marginal. Thus, we would recommend that future research could focus on comparing virtual and traditional design thinking teams working on a comparable task, for example, working all on service innovation tasks.

Girotra and colleagues (2010) have argued that the most important step in idea generation is the selection of the best generated idea, not just the generation of many ideas. Contrary to our initial expectation, it was not the product innovation team that generated the most ideas. Instead, the business model innovation team with the most complex and abstract innovation task developed more prototypes than the product innovation task team. As our sample is small, we may not generalize from our findings and recommend instead further research endeavours do enlarge the sample.

Future research may also focus on the impact of coaching in the process, especially in the dark horse prototyping phase, which caused the most difficulties for almost all teams across all measures. Another interesting research focus could be in the shift from diverging to converging thinking. In design thinking teams, the conversion of the insights and learning's takes place in the converging phases towards the creation of the final prototype.

7 Practical implications: Who will gain why and in which way from the findings?

The findings of this study are especially relevant for practitioners thinking about changing or adapting current innovation processes. First of all, we report first evidence that design thinking can be applied for more complex and abstract innovation types such as service and business model innovation, although it has so far mostly been used for product innovation.

Design thinking has received much attention and we could show in our preliminary study that generating many prototypes by following the design thinking milestones, which facilitate the generation many as well as of rather distinct prototypes, leads to the generation and selection of the best prototype and therewith idea. This is an important finding according to Girotra and colleagues (2010), as the selection of the best idea is a

crucial step for firms. Even the teams which have experienced major difficulties in the process, as the virtual service innovation team, have developed a good quality final prototype which has been valued by the industry partner.

Further, the creation of many prototypes does supports the selection of the best ideas, however, even when the total number of prototypes falls below the average of number of prototypes for the service innovation team, the final prototype has been rated just as good. Design thinking fosters the creation of many and distinct prototypes in the different prototype phases, which provides an opportunity for teams to improve the overall performance through continuous testing and learning and therewith enhances the chances of selecting the best idea in the end.

Finally, as an anecdotal note on how to gain ownership on outsourced idea generation: The early and constant involvement and at the same time relative distance to the industry partners who sponsored the design thinking project facilitated the innovation process, as the input helped to guide the team, as well as it facilitated the transition of the idea and implementation in the firm, with the industry partner gained continuously ownership of the idea.

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A Design Thinking Role Model Enables Creativity in IT: Case of the Financial Industry

Christophe Vetterli
University of St.Gallen, christophe.vetterli@unisg.ch

Walter Brenner
University of St.Gallen, walter.brenner@unisg.ch

Falk Uebernickel
University of St.Gallen, falk.uebernickel@unisg.ch

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Christophe Vetterli
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christophe.vetterli@unisg.ch

Walter Brenner
University of St.Gallen,
walter.brenner@unisg.ch

Falk Uebernickel
University of St.Gallen,
falk.uebernickel@unisg.ch

Abstract
The challenge banks face to gain advantage over their competitors is being placed under pressure by the ever increasing speed of development which arises from the pace of innovation in computer technology, rapid changes in industry regulation and fast-changing customer needs. Banks have creative heads but the pursuing of efficient customer-centric creative work within an organization is often challenging. This paper presents a design thinking role model which was iteratively designed over nine projects within a period of four years and implemented in an IT department of two leading multinational banks. It analyzes the different roles of the design thinking role model and its multidisciplinary elements to enable creativity within these IT departments. It could be shown that creativity was enabled in this corporate IT context through the design thinking role model and thus a good base for the overall innovation process could be reached.

Keywords
Design thinking, creativity, role model, multidisciplinarity

1. Introduction
New technological advances in the 21st century have heightened customer expectations and increased competition (Alam & Perry 2002). The existing development processes were inefficient because there was too little consumer involvement. The importance of a systematic customer-oriented development process was acknowledged (Alam & Perry 2002). In the banking industry in particular there is a strong need for innovation due to the high level of commodities they offer. Pressures for increased speed of development arise from the pace of innovation in computer technology, rapid changes in industry regulations and fast-changing customer needs (Puschmann et al. 2012, Drew 1995). Enabling creativity in their IT departments is crucial for banks and their future development. Development of new solutions requires people and their creativity and hence research on creativity in particular has received strong attention in recent years (Amabile & Khaire 2008, Miron et al. 2004,). In terms of rapidly changing customer needs,

design thinking, as a human-centered innovation method, was accounted for being accurate of involving the targeted human being (Brenner & Witte 2011, Lockwood 2009, Plattner et al. 2009). The selection of personnel that can act in a creative environment increases the creativity of products and services (Sagiv et al. 2009, Amabile 1996). Research shows that separate units for innovation initiatives, using employee and customer suggestions and hiring new skills, can enable creativity with a high probability of innovation success (Drew 1995).

Design thinking was accredited for unleashing creativity (Skogstad 2009, Dym et al. 2005). Creativity can be seen as the first stage in the innovation process, where ideas are developed (West 2002). Research has given much attention to the rise of innovation processes but comparatively little research has addressed the different roles within design thinking projects in terms of enabling creativity. In summary, there is a general understanding of the method of design thinking (Brenner & Witte 2011, Plattner et al. 2009, Dym et al. 2005), but there is no clear understanding of which roles are needed in a corporate environment to support creativity. So far, no scientific study of implementing design thinking over a longer period of time within an IT context exists. The authors have led the implementation of design thinking in the IT departments of two leading banking institutions for nine projects over the course of five months each since 2008. This allowed analyzing the following research question: *How can a design thinking role model enable creativity in the IT environment of a banking institution?*

A role model that enables a sustainable way of implementing design thinking projects results from research on the one hand. On the other the design thinking role model enables creativity in this corporate context to establish a strong base of idea generation. In previous research the authors have described the role model as one corporate need for the implementation of design thinking (Vetterli et al. 2012b & Vetterli et al. 2011). In this specific research paper the design thinking role model is based on the previous findings to further evaluate the enabling of creativity in the IS environment. The element of multidisciplinarity is strongly linked with creativity and therefore explicitly focused within this research.

2. Research Method

The research efforts are part of an ongoing holistic research project which focuses on the question of how design thinking can be successfully embedded in an IT environment of a multinational financial institution. The role model was iteratively developed during nine projects and the embedding process was accompanied by 53 in-depth interviews with people from different hierarchical levels from business units and IT departments over four years. The overall paradigm was provided through design science research with its central goal to design an artifact that provides utility (Hevner et al. 2004). To reach this utility knowledge and understanding of a problem domain and its solution are achieved in the building and application of the designed artifact. The process of constructing and exercising innovative artifacts enable design-science researchers to understand the problem addressed by the artifact and the feasibility of their approach to its solution (Hevner et al. 2004). The artifact which was designed for this concrete research paper was the role model, implemented to assign tasks, competencies and responsibilities to specific parties in the IT and business departments. A previous literature review showed a gap in the literature which was addressing a suitable role constellation to provide creativity and finally innovation in a corporate environment. First ideas for this role

model has already been evaluated within academic settings and provided a suitable starting point for the design of the corporate context (Carleton & Leifer 2009). The final validation of this artifact in terms of design science was made during the implementation.

3. Creative Context for Implementation of the Role Model

The context of appliance of the design thinking role model was on the one hand an IT innovation department of a multinational European leading bank and on the other hand a Swiss-based bank with international impact. Both banks had about one-third of their headcount positioned in the IT department. The headcount of the international bank is about 60,000 employees and the Swiss-based institution had about 5,000 employees in total. By reflecting on IT departments in banks there is a common pattern, that IT departments are service suppliers for business units. The business units are typically in direct contact with the bank's customers (Brocke et al. 2012). IT-driven innovation has become more and more part of people's everyday lives: Not only have the demands on usefulness and usability been growing continuously, but the IT departments take control to develop highly competitive consumer markets, for example retail banking, in which successful innovations are defined by the user's point of view rather than by technical perfection (Lindberg & Meinel 2010). The main challenge occurs when classically educated IT staff needs to deliver innovation for a customer-centric, highly dynamic environment. The educational background of hardware and software engineers has a strong influence on mindset building and decision-making and, as a result, IT development has the tendency to take place within an "exclusive" experts' world (Lindberg & Meinel 2010). Multidisciplinary IT teams can incorporate more than functional requirements to develop but capture non-functional requirements and therefore provide a more adequate and holistic customer-oriented view for creative processes. It helps to bridge gaps that result from disciplinary specialization, helps to integrate results from different disciplines, and allows issues to be addressed that lie beyond the disciplinary skills of individuals (Vissers & Dankbaar 2002)

3.1 Creativity and Innovation

Creativity is the production of novel and useful ideas in any domain (Amabile 1996). Organizations and IT departments have to rely on highly creative individuals for different types of innovation. Creativity can only be fostered indirectly, by influencing the working conditions of the creative individuals (Vissers & Dankbaar 2002). Creativity processes mostly take place in the so-called fuzzy front end of innovation (Koen et al. 2001, Reinertsen 1999, Amabile 1996). An innovation can only be called so if it reaches at least the stage of successful market introduction (Becker & Whisler 1967). The authors focus mainly on service innovation since the characteristics of the analyzed creativity context demanded services and only in a second step perhaps process innovations or even business model innovations. These differences pertain mainly to the specific characteristics of services, i.e. their intangibility, co-production with customers, simultaneity, heterogeneity and perishability (Fitzsimmons & Fitzsimmons 2000), which affect the development process of services and make them to a certain degree unique (Nijssen et al. 2006).

3.2 Design Thinking in the Context of Information Systems

Design thinking is especially promising and much recommended to support innovation and innovation teams in organizations (Sutton & Hargadon 1996). Also, in terms of service

innovations which typically are intangible, the tangible approach from design thinking improves the understanding and recognition of creative ideas (Vetterli et al. 2012a). Design thinking is a human-centered innovation method, based on central elements such as deep customer understanding, structured idea generation and rapid prototyping (Vetterli et al. 2011). This working definition can be integrated in the understanding of Leifer (1997), who shows that design thinking is the method that brings along the innovation itself as output. As applied in the context of this study, design thinking is the method which establishes an iterative design process of the creation, evaluation and selection of physical artifacts, so-called prototypes at the very beginning, creative front end of innovation.

In the field of software engineering, for example, prototypes are used as well, but mostly to converge on one specific idea and eliminate inconsistencies. Creative development in IT classically asks for clear development goals, milestones, along with considerable uncertainty regarding the process by which those goals are met (Cooper 2000). For design thinking prototypes are a tool to diverge and learn about the design space. Multidisciplinarity and diversity in teams are positively associated with divergent thinking.

Design thinking projects, as they were embedded in the researched corporate environment, provided clear milestones, which stem from the different prototyping phases. These milestones provided several benefits in terms of frame of reference and structuring of the overall project (McDonough 2000). They were integrated in a diverging phase followed by a converging phase. The project integrates these two main phases for five months. The diverging phase targets the maximization of ambiguity through the amount of prototype created (all low-resolution prototypes). Flynn et al. (2003) showed that "the greater the number of ideas at the start of the new product development process, the greater the probability of successful products" (p. 416). Diverging activities are followed by the converging phase which reduces the amount of prototypes and at the same time raises the resolution of a small amount of final prototypes. These final prototypes should include the most successful elements of the diverging phase matching the identified human needs.

Organizationally, design thinking, as it has been implemented in the analyzed banks, was embedded as an incubator in the IT innovation departments. The goal was to provoke market-ready innovations as well as serve as a pool of creative ideas/artifacts for following projects. Of course, applying design thinking to IT development pursues the vision of setting up a complementary thinking style, which extends the problem-solving abilities of IT development teams with the purpose of making their outcomes more user-friendly and creative (Lindberg & Meinel 2010). To achieve this, roles around the design thinking projects acted strongly autonomously. Research has already shown decades ago that in the very early stages of innovation processes this autonomy, in terms of fluid job description, high communication and few rules, all incorporated in a loose organizational position, is needed (Burns & Stalker 1961).

3.3 Design Cycle to Foster Creativity

Within the design thinking method the roles that will be introduced followed two main paths. The design team followed in their daily work a design cycle which had formerly proven to unleash creativity (Skogstad 2009, Dym et al. 2005). Additionally, the design cycle was integrated in the milestone path that should help the design teams to get a holistic view on their

problem involving different perspectives on their challenge that they had received from the company. Creativity is greater under conditions that restrict the scope of the problem in a way that leads individuals to focus on a manageable number of core elements (Sagiv et al. 2009).

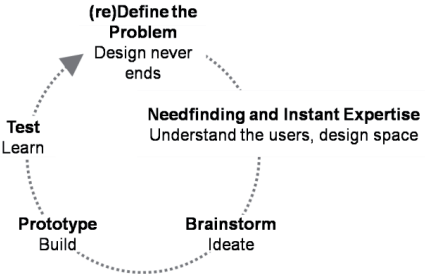

Figure 1: Design cycle
Source: Stanford University 2012

The design cycle fosters the consistent focus on human needs, on a number of iterations (see Figure 1). It results in an improved understanding of the problem from a customer perspective for solving the associated requirement that eventually has to be developed (Vetterli et al. 2012b). Brown & Eisenhardt (1995) have already shown that iteration is a success factor in terms of speed for innovation. Teams who iterate more frequently, do more testing, have frequent milestones and are supported by a powerful leadership in terms of procedure (coaching) develop more quickly (Brown & Eisenhardt 1995).

4. The Design Thinking Role Model

The authors understand role models as models that show the role formalization. Formalization refers to the "degree to which rules or standard operating procedures are used to govern the interaction between individuals" (Ruekert & Walker 1987). Formalized procedures can regulate the tasks people perform in the development process or the role responsibilities granted to specific persons in the creativity process. Facets of formalization, regulation and role specification may influence integration. Role formalization clarifies responsibilities and the dependencies between them (Ayers et al. 1997). The creation of an adequate role model should protect the design teams from being limited in their creativity within the corporate structures by politics or hierarchy and enable them to fully unleash the potential of design thinking. The role model should thus provide the creation of creative solutions and facilitate the innovation process. Nevertheless, the focus of this research was clearly on effects in terms of creativity at the beginning of the innovation process. The role model that served as the base was implemented in an academic surrounding and had just one connection point of the design teams with the corporate side (Carleton & Leifer 2009). Therefore in terms of recognition of innovation, heavy communication and enabling creativity within the IT department towards customer-oriented innovation, the original role model was modified for the corporate environment. The following explanation focuses on the description of the single roles. As it has already been shown that multidisciplinary teams enable creative processes, the description of the roles should incorporate the multidisciplinarity at different levels related to the different roles. Multidisciplinarity is

understood as setting environments that provide interesting frameworks to enhance fuzzy front-end creativity and thus generate opportunities for idiosyncratic innovation (Alves et al. 2007).

4.1 Roles within the Design Thinking Role Model

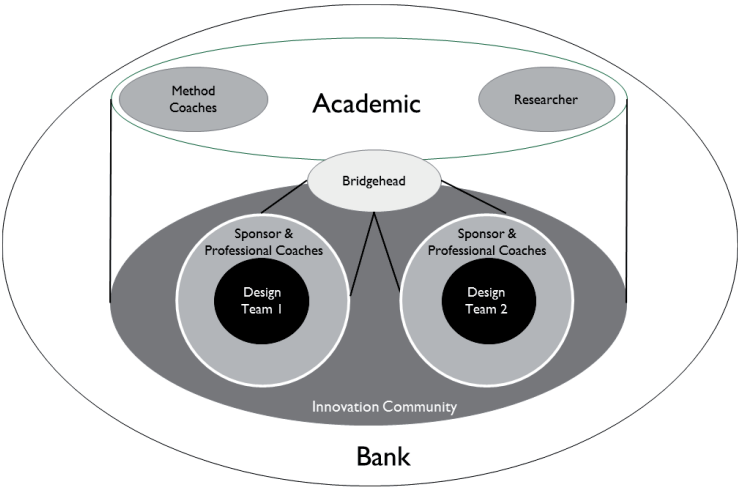

Figure 2: Design Thinking Role Model

Figure 2 shows the complete role model and which roles are involved in design thinking projects.

The **"Design Teams"** acted as the heart of the project and especially as the main driver for the innovation. They worked on different predefined design challenges, autonomous from other operational tasks. The Design Teams had to initiate and fulfill the assignments for the solutions of the given design challenges and regularly presented their prototypes to the Innovation Community regarding the milestones in the milestone paths. The four Design Team members were mainly new in the organization (except one former employee), which was crucial to creativity, because it appeared that peripheral individuals may feel freer to develop unusual ideas gleaned from connections outside (Perry-Smith 2006). Using individuals who are newer to the company results in faster product or service development (McDonough 2000). The team members had a multidisciplinary background to foster the creative potential (Plattner et al. 2009). Groups composed of people with differing professional backgrounds, knowledge, skills and abilities will be more innovative than those whose members are similar, because they bring useful differing perspectives on issues to the group (Paulus 2000, West 2002). In addition to staffing the Design Team in terms of psychological preferences in how people perceive the world and make decisions, the candidates were assessed with the Myers-Briggs Type Indicator (MBTI)[1] (Wilde 2008).

[1] MBTI: For further information on the Myers-Briggs Type Indicator, consult the bibliography of Wilde (2008).

The following figure shows an example of how the different teams over the years were diverse. Figure 3 shows one team from year 2012:

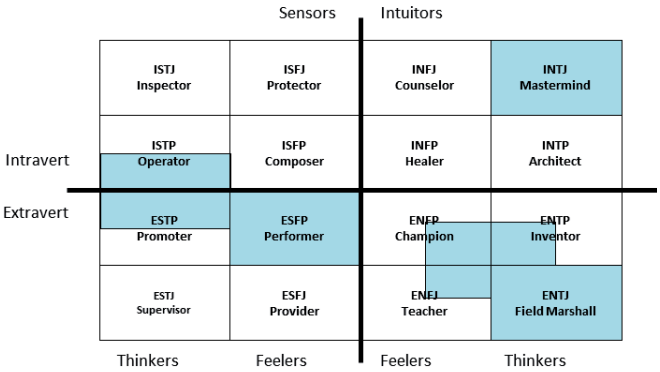

Figure 3: Exemplary MBTI of one team from 2012

The **"Bridgehead"** is operationally assigned to the initiation and the implementation of the project and also creates physical as well as virtual space for creativity even before the project has started. Additionally, this role includes the coordination of the communication as well as the interlinking of the design teams with the organization. The communication included the definition of the milestone deadlines. Comparing this role with networks, it serves as a hub and gives the design teams a maximum of inputs through corporate stakeholders or even from external sources, which overall enriches the creativity potential (Amabile 1988). In particular, creative infrastructures (rooms and IT tools) helped the teams to leverage their creative potential throughout the different milestones (Plattner et al. 2009).

The **"Sponsor & Professional Coaches"** is the role that defines and frames the strategically relevant design challenge which is per se an important step for creativity (Dorst & Cross 2001). The Sponsor also consigns the Professional Coaches to share their expert knowledge with the teams. In the diverging phase in particular it was important to implement a pull effect from a design team perspective: the professional coaches could give relevant expert know-how if they were asked to do so by the design teams. This ensured that the Professional Coaches did not have a negative impact on the creativity of the teams as they were from the company itself (Perry-Smith 2006). The Sponsors served as innovation drivers and cultural change enablers (Vetterli et al. 2012b). In addition, they were informed regularly about the ongoing process and the milestones. These raised the recognition of the novelty and the creative ideas that were produced.

The **"Innovation Community"** consisted of a wide field of innovation-interested employees and built an outer circle around the design team and the professional coaches. They had a common interest that was connected through a common idea or the need to solve the same kinds of assignments; that's why they were willing to share their knowledge, as stated in the numerous interviews. They acted as a diffusion partner for the innovation and gave the team unexpected

impulses for their tasks. In addition, they contributed the commercialization of the results and the promotion of the design thinking method. Interestingly, the Innovation Community members enjoyed being taken out of their daily work to experience a creative surrounding during the milestone presentations of the design teams and stated that it helped prepare organizational stakeholders to initiate first implementation steps for the upcoming solutions from the design thinking projects.

The **"Methods Coaches & Researcher"** were staffed from a university institute and this role fulfilled two different tasks: on the one hand they enabled the knowledge transfer and correct implementation of the method, and on the other hand they contributed to the project with their research. The role as enabler was crucial to the success of the project. This role, as the only external academic role, was responsible for giving the biggest possible scope for development to create diverging prototypes. Research has demonstrated that groups with members with diverse educational majors experience more difficulty defining how to proceed than groups in which members have similar educational backgrounds (Jehn et al. 1999), and therefore the method coach offered intensive weekly methodical coaching. Method coaches optimized the team through coaching of team dynamics based on the fact that diversity can threaten the group's safety and thus creativity could start to suffer (West 2002). Diversity of knowledge and skills is a powerful predictor of innovation, but the method coaches needed to integrate the team dynamics in their daily work. In addition their competencies were needed to enable the harvesting of the fruits of diversity within the design team (West 2002). They could take the pressure away from the Design Team and foster their intrinsic motivation to be creative (Zhou 2003). Additionally, they had a strong position, as externals, as they could interrupt throughout the whole project phase if it seemed that creativity could be in danger through corporate influences.

5. Conclusion

The following research question was addressed in this paper: *How can a design thinking role model enable creativity in an IT environment of a banking institution?* The authors developed a design thinking role model within the IT department of two leading banking institutions. The first part of the research question, *which concerns the design of such a role model for IT departments*, could be answered by the presented role model based on the design science research approach. The role model was successfully applied over the last four years in nine projects with duration of five months each and iteratively improved in practice until today. The second part of the research question concerns the enabling of creativity through the design thinking role model. Two findings could be derived: On the one hand, multidisciplinarity which focuses only on the design team does not suffice alone to provide creativity, by means of new ideas being recognized, in a corporate environment. Multidisciplinarity and diverse characteristics between all assigned roles were crucial as well to understand corporate processes and mechanisms and to unleash the full potential of design thinking in terms of creative solutions. Hence, on the other hand the assigned roles overall ensured the appliance of design thinking within the IT department in the two banks and led to the targeted creative environment. The role model consists in its core of Design Teams which are responsible for creating the ideas. They are surrounded by an Innovation Community that transports the creativity into the company. Additionally, the Bridgehead role provides the right environment for creativity by infrastructure and network in- and outside of the company. The Sponsors (and the Professional

Coaches) define the design challenge for the design teams in a suitable way to enable creative work within the defined design space. Finally, the Method Coaches, as only an external role, provide experience in creativity and the design thinking method to ensure the right appliance of design thinking and therefore generally to set up for creativity through design thinking in IT divisions.

The actual research of role models of design thinking in corporate environments, especially to enable creativity, has lacked in the literature. Hence, both practice and science can benefit from this research. For practice, it provides a role model which enables banks to unleash the creative potential of internal design thinking projects. For science, the theoretical considerations and the role model show different aspects of creativity in a corporate IT environment and provide a first step towards unleashing and protecting the central paradigm of design thinking in banks.

Further research could apply this design thinking role model to other industries. As for this paper, the role model as a whole was shown to enable a creative environment from an organizational and staff point of view. Additional research could distinguish the different impacts of the different roles and then probably reduce the amount of resources that need to be invested for such an implementation. The goal of appliance of this role model was not only to provide a creative environment but also to facilitate the overall innovation process. Nevertheless, the focus of this research was clearly on effects in terms of creativity at the beginning of the innovation process. Now research should focus on how the creative solutions that were developed at the beginning can be transported throughout the complete innovation process in order to offer a customer-oriented innovation.

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Editor: Charles Petrie • petrie@stanford.edu

From Palaces to Yurts

Why Requirements Engineering Needs Design Thinking

Christophe Vetterli, Walter Brenner, Falk Uebernickel, and Charles Petrie • *University of St.Gallen*

The German saying "von Palästen zu Zelten" compares different systems to different levels of flexibility and agility — that is, "from palaces to yurts." Requirements engineering systems are geared for developing information system palaces and aren't what's needed for today's world of rapidly changing, app-enabled products. These Web and mobile apps are small, require rapid development, must closely fit customer needs, and change often. Requirements engineering for these would greatly benefit from *design thinking* — that is, a human-centered, rapid-prototypying method for innovative design.

All house construction requires a solid basement, a supporting infrastructure that provides efficiency in maintenance, and some adjustable elements that will be continuously updated for the house's lifetime. Large, complex houses provide more comfortable living space, but more groundwork is needed if any changes are necessary. IT systems are similar. To meet today's challenges with small, easily changed systems that are more function than infrastructure, we need more that are like yurts rather than palaces.

Evolving Apps

In the first phase of Internet application development for products and services, such applications used the Web to provide a front end to simple functions, such as looking up stock quotes or current weather. In the second phase, the Web acted as a front end to large, integrated back-end systems. These systems require the typical requirements engineering approach — long, careful study and development. However, the new generation of apps is loosely bound to back-end systems, if any, and employs algorithms that can easily run on mobile devices as well as the Web.

One example is the Azumio Stress Tester, which uses a sophisticated algorithm to measure variations in pulse to determine stress or conditioning (see https://play.google.com/store/apps/details?id=com.azumio.android.stresscheck&thl=en). The PeakFinder uses GPS and compass data to determine a person's position and his or her relation to mountains (www.peakfinder.org). Such apps also connect to back-end systems on the Web, but only loosely, and they can run without a connection.

Although large back-end systems will continue to be needed, an emerging trend is that of app-enabled products. Increasingly, many products, both software and tangible, are released and accompanied by Web or mobile apps that add value. Even taxis benefit from today's apps, which we can use to look for parking spaces or share cars. One example originates from Nobel Biocare, a dental solutions company: OsseoCare Pro is a tablet-based app that lets a dentist control his or her drill motor and work with the patient to plan and set up the treatment sequence prior to surgery; it also enables multiple user logins for sharing treatment data between different clinical partners (see www.nobelbiocare.com/en/campaigns/osseocare/default.aspx). Even these complex apps are small and run on small mobile devices independently of larger systems such as databases that might be sporadically reachable on the Web for updating and sharing.

We can expect apps to become more integrated with future products. Imagine, for example, drones that make small deliveries, homing in on the smartphone requesting them. These apps would be small programs, often updated via cellular marketplaces, that provide limited

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functionality and connect to larger systems on the Web asynchronously, perhaps connecting to other users' similar apps while adding value to mobile devices and tangible products. The apps might exchange data over various channels and push data as well as make connections. These apps won't be at all like the big back-end systems that current requirements engineering supports.

Requirements Engineering Approaches

The primary measure of an information system's success is the degree to which it meets its original purpose. We can define requirements engineering as the process of initially discovering and defining that purpose.[1] As Pamela Zave states,

> "Requirements engineering is the branch of software engineering concerned with the real-world goals for, functions of, and constraints on software systems. It is also concerned with the relationship of these factors to precise specifications of software behaviour, and to their evolution over time and across software families."[2]

Thus, we can view requirements engineering as inherently difficult. Betty Chen and Joanne Atlee state that requirement analysts start with ill-defined, and often conflicting, ideas.[3] By simplifying this problem space, we can constrain the environmental conditions in which the system or applications should operate. The requirements engineering procedure is more iterative and involves many more players with different backgrounds than other software engineering activities. Besides this complexity, requirements engineering needs more extensive analyses of options and must call for more complex verifications of more diverse components, such as technological, human, legal, and cultural. In the app context, which changes rapidly, the challenge will be to redefine this process.

We've observed many global companies educating their developers to devote all their efforts toward those aspects of software development that are intended to last for eternity, such as achieving the highest possible security capability and being available 24/7. Such back-end systems are based on big data models, have a long-lasting life cycle, and assume that users are technical. The goal is to develop a system as complete as possible and integrate all possible functions to kill two (or more) birds with one stone. The result is something like a palace, built on a strong foundation with a large fixed infrastructure where everything works together and would be difficult to change.

The neighborhood has changed, however, and the concrete and crane that were used to build palaces are no longer needed to build the mobile and agile community of apps that are more like yurts. It isn't that some large back-end systems aren't needed or that they won't connect to apps, but rather that app development isn't supported by the requirements engineering process used to develop these large systems.

Look at your own experience in downloading an app from any smartphone app marketplace. It installs within minutes, its focus serves exactly what you were looking for, and, if not, you download another one. Moreover, you can set the app for automatic updating, and probably will, given that many apps are updated frequently. App users require speed, frequent change, convenience, and limited functionality. The game has changed, and the rules are different. Apps are small, stand alone with few intertwining functionalities, and run quickly on small computers. These changing demands are critical for business. If companies don't catch up with the new app environment, their back-end software house will be a lonely palace standing somewhere hundreds of miles away from the next palace with hardly any connection to users.

Today, users expect a wide selection of apps that they can integrate into their daily lives and behavior. Developing such apps requires flexibility, agility, and strong customer orientation. Companies now face the challenge of producing app-enabled products — such as OsseoCare Pro or PeakFinder — that have a few integrated functions that are highly relevant to the user's life.

The problem the software engineering community has been trying to solve from its beginning is how to go from the problem space (user requirements) to the solution space (design and implementation) with a methodological guidance. Requirements engineering processes usually include following steps — elicitation, analysis and negotiation, specification, and validation — as a standard way to solve this problem.

The IS community has already recognized that for a changing world and fast development — which apps take to an extreme — this approach isn't sufficient, resulting in so-called *agile development* approaches. These alternative processes certainly have advantages, but they tend to throw out the baby with the bathwater, especially for apps that need to connect to back-end systems.

Agile development tends to focus on code traceability rather than the documentation characteristics of large system development. It involves the customer in interactive prototypes throughout the development process, whereas requirements engineering tends to drop customer involvement after initial elicitation. Agile development is driven by customer descriptions of what they require, but captures these from a functional requirements perspective only. Even with a strong customer

orientation and good developers, the distinction between functional and nonfunctional requirements is difficult to catch and needs other perspectives. For apps that connect to back-end systems, combining the two approaches is especially crucial because the same developers working on the palace of software comprising the company's operations are often the ones assigned to develop the mobile app yurts. So, the question is how to improve requirements engineering to incorporate agile development's useful features in a way that supports app development, perhaps in concert with large system development. We need a method that combines the best of both approaches.[4]

Design Thinking

Design thinking provides a methodology for eliciting customer needs, rather than requirements, and producing a series of fast and simple prototypes that eventually converge on innovative solutions. Researchers at Stanford University have been studying, testing, and modifying this methodology in product design for the past 40 years. The methodology has been abstracted and has spread to other universities, such as Aalto, Potsdam, and St. Gallen. It's been incorporated into practices at large companies such as Deutsche Bank, Proctor and Gamble, and SAP. Design thinking is consistent with the initial elicitation practices of requirements engineering and the rapid prototyping and customer involvement of agile development methods. It offers a consistent methodology for doing both as well as documentation, consistent with requirements engineering, and team management, a focus of agile development.

Design thinking emphasizes the human perspective. We apply this human-centered innovation method to ill-defined problems within a real-world context, which is characteristic of apps for mobile phone users. Creating desirability for potential customers drives design thinking activities and captures potential customers' needs. Unlike requirements engineering, design thinking aims to fail early in order to succeed sooner. This learning process doesn't focus on searching for requirements specifications even in terms of agile methods. Rather, it involves quickly learning from early errors how best to articulate and solve human needs.

Starting with quick, low-resolution prototypes helps design teams diverge within the design space to avoid settling on solutions that might only be local maxima in the solution space and might not actually meet human needs. Design thinking moves from such intensive learning phases toward higher-resolution prototypes that converge on novel solutions.

Such prototypes help concretize different ideas without simplifying the environment, while focusing on specific and important needs within the design space. Although agile development and requirements engineering use prototypes as well, these mainly help converge and eliminate technical inconsistencies as fast as possible early in the process. Although it involves the customer throughout the process, agile development has no methodology for eliciting needs that might be other than the stated requirements and, again, tends to focus on code consistency and traceability. Design thinking offers an additional elicitation methodology.

Design thinking is also about changing the involved parties' mindsets – that is, keeping ambiguity high during the projects' early stages until developers are certain of identified needs and desires. Thus people are needed that can handle this ambiguity and have empathy for their potential customers. This requires an environment that supports a collaborative, engaging working style with customers as part of the team. At Stanford, this team makeup aspect is already being employed in design thinking research, with a working environment often characterized by substantial collaborative space, including discussion-enabling areas as well as quickly reachable prototyping space. One recent result from Stanford indicates that teams function better without a designated leader and with certain personality types and particular documentation styles over others.

We can illustrate industrial experiences with customer-centric design thinking via two successful examples. First, one credit-card company from Switzerland solved a customer relationship management problem by using design thinking to produce a novel tablet app for its customers. Second, a major automobile manufacturer wanted to rethink mobility and used design thinking to develop a tablet app that helps move customers from one location to another with different forms of transportation. Neither requirements engineering nor agile development were well-suited to these tasks, although some form of each was naturally used to develop the software. It was the holistic approach that was successful.

Apps are a major new type of software component, especially as the Internet of Things becomes the app-enabled world. Companies that wish to play in this world must establish the right environment for their workforce. Merging design thinking with requirements engineering and agile development will let them consider the strongly diverging human-oriented working mode as well as the more technically driven perspectives of the other two methodologies. The HPI in Potsdam is already researching combining design and engineering by injecting design thinking into

requirements engineering, and at St. Gallen, we're beginning a major initiative in this area, focusing on app development and management. We're aware that we have an intensive and exhausting journey ahead, and we invite others to join with us in this exciting exploration.

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Christophe Vetterli is a research associate at the Institute of Information Management at the University of St. Gallen (HSG). His PhD research is in embedding design thinking into the corporate IS environment. Vetterli has an MA in business innovation from HSG. Contact him at christophe.vetterli@unisg.ch.

Walter Brenner is a professor of information management and the managing director of the Institute of Information Management at the University of St. Gallen (HSG). His research focuses on the intersection of business and information technology at the executive level. Brenner has published more than 25 books. Contact him at walter.brenner@unisg.ch.

Falk Uebernickel is an assistant professor at the Institute of Information Management at the University of St. Gallen (HSG). His research focuses on business innovation and information management. Uebernickel has a PhD in business administration from HSG. Contact him at falk.uebernickel@unisg.ch.

Charles Petrie was a guest professor at Karlsruhe University, Germany, in 2012, and at the University of St. Gallen, Switzerland, where he will be continuing in 2013. He retired as a senior research scientist from the Stanford University Computer Science Department. His research topics are concurrent engineering, enterprise management, and collective work. Petrie has a PhD in computer science from the University of Texas at Austin. He was a founding member of technical staff at the MCC AI Lab, the founding editor in chief of *IEEE Internet Computing*, and the founding chair of the Semantic Web Services Challenge. He teaches and coaches in innovation via design thinking. Contact him at petrie@stanford.edu.

DT@Scrum: Integrating Design Thinking with Software Development Processes

Franziska Häger, Thomas Kowark, Jens Krüger, Christophe Vetterli, Falk Übernickel, and Matthias Uflacker

Abstract Design Thinking has shown its potential for generating innovative, user-centered concepts in various projects at d.schools, in innovation courses like ME310, used by design consultancies like IDEO, and recently even in projects at large companies. However, if Design Thinking activities are not properly integrated with production processes, e.g. software development, handovers become necessary and potentially prevent great ideas from becoming real products.

To reduce the perception of these handovers as acts of "throwing a wild idea over the fence," different integration approaches have been proposed. A seamless integration of Design Thinking into the regular development processes of software development companies, however, is still subject to research.

In this chapter, we present DT@Scrum, a process model that uses the Scrum framework to integrate Design Thinking into software development. Three operation modes, which differ in the ratio between software development and Design Thinking activities, form the foundation of our approach. Development teams chose their respective operation mode after each sprint based on how well the requirements of the product are understood. We present initial applications of our approach in two university courses, and preliminary results of an experiment that tests if and how Design Thinking can benefit from Scrum's planning techniques. The chapter concludes with an outline of future applications of our process model in industry scenarios and experimental validations of further techniques that supplement DT@Scrum.

F. Häger (✉) • T. Kowark • J. Krüger • M. Uflacker
Hasso Plattner Institute for Software Systems Engineering, University of Potsdam, 14482, Potsdam, Germany
e-mail: franziska.haeger@hpi.uni-potsdam.de; thomas.kowark@hpi.uni-potsdam.de; jens.krueger@hpi.uni-potsdam.de; matthias.uflacker@hpi.uni-potsdam.de

C. Vetterli • F. Übernickel
Institute of Information Management, University of St. Gallen, St. Gallen, Switzerland
e-mail: christophe.vetterli@unisg.ch; falk.uebernickel@unisg.ch

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1 Introduction

Design Thinking has shown its value as a viable approach for creating innovative, user-centered ideas in projects at d.schools, in innovation courses like ME310, used by Design consultancies like IDEO, and, ever increasingly, during internal projects at major companies. Its core strength is the constant striving for user feedback on prototypes in order to iteratively shape a final solution that provides the maximum benefit for the end user. But good ideas are only half the battle. Turning those ideas into products, may it be physical items, services, or software, requires further efforts that should not be underestimated in their extent. So how do we "bring the prey home" and avoid letting great ideas go to waste?

1.1 Integration Challenges

The key enabler for a transition from idea to product is an effective connection between the idea generation process and product development. Ideally, the two are seamlessly connected, since every piece of information that is lost during handovers reduces the potential for success of the product realization project (Khan and Kajko-Mattsson 2010).

Another factor is the transparency of Design Thinking activities. From a management point of view, it needs to be clear what is being done during Design Thinking projects and how the output can be transformed into a product. From an implementation point of view, developers need to be able to comprehend how ideas have emerged through user research, ideation, prototyping, and testing of prototypes (Katz and Allen 1982). Furthermore, communication between implementation and Design Thinking teams should start early during the projects in order to allow for a realistic assessment of the feasibility of ideas.

The aforementioned challenges might be solved by putting strong regulations on Design Thinking activities. Defining output formats, creating a reporting system for the teams, or extensive planning of all activities throughout the project would come to mind. However, if such bureaucracy hinders the success of relatively straightforward software implementation projects (Beck et al. 2001), what effects could it have on innovation projects? These observations and various ongoing research activities in this area (Vetterli et al. 2012; Lindberg et al. 2012; Hildenbrand and Meyer 2012) show that a balance needs to be found between corporate requirements and creative freedom.

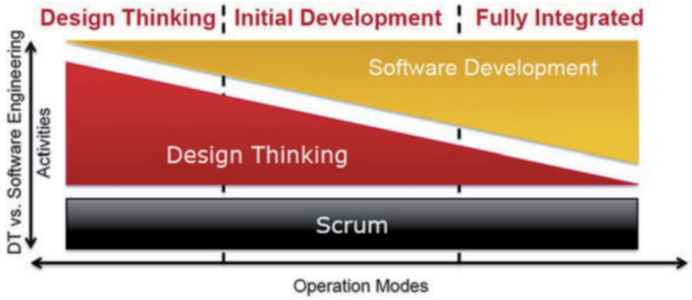

Fig. 1 Integration of Design Thinking into the development process during the different phases of DT@Scrum

1.2 Outline

In this chapter, we present DT@Scrum, an approach that combines Design Thinking and Scrum in order to create an agile software development process that can deliver the innovative customer-oriented products and services required by competitive companies.

Scrum provides the overall framework for both development and Design Thinking activities. As presented in Fig. 1, the ratio between the two differs within the three proposed operation modes (*Design Thinking*, *Initial Development*, and *Fully Integrated*). The better the requirements of the product are understood, the more activities are biased towards straightforward implementation tasks. The iterative nature of Scrum allows readjusting the direction of the project and the resulting operation mode in overseeable intervals. A detailed description of the process model along with the included roles, activities, and techniques can be found in Sect. 2.

One of the core techniques of our process model is the so-called Design Planning. This technique adapts Scrum's sprint planning sessions to Design Thinking activities, thereby, potentially allowing for increased structure and transparency of Design Thinking activities. In Sect. 3, we present an experiment that evaluates the effects of Design Planning on the design process and its outcome.

The chapter continues in Sect. 4 with experience reports from two applications of the process model in two university courses. Section "Conclusion and Future Work" summarizes and closes the chapter.

2 DT@Scrum

In our white paper, "Jumpstarting Scrum with Design Thinking," we introduced DT@Scrum, a process framework that aims at seamlessly integrating Design Thinking and Scrum (Vetterli et al. 2013). This section will give a brief introduction to DT@Scrum and our main ideas.

As described in Sect. 1.2, Scrum provides the overall process framework for all activities. This means that teams working with DT@Scrum will use sprints to structure their activities not only during software development but also during design activities, which are often new to team members. In order to let design teams get a feeling for the duration and value of Design Thinking activities, and to enable them to better structure their creative work, DT@Scrum introduces Design Planning. Design Planning adopts planning methods already known from Scrum, e.g. Swim Lane Sizing (Agilepirate 2011) or Planning Poker (Grenning 2002; Cohn 2005), to Design Thinking activities. It includes creating a backlog for design activities, the planning of sprints upfront and an evaluation in a retrospective meeting afterwards.

Additionally, DT@Scrum proposes three different operation modes or phases: the *Design Thinking Mode*, the *Initial Development Mode* and the *Fully Integrated Mode*. The main difference between the phases is the ratio of Design Thinking and development activities. While the *Design Thinking Mode* emphasizes Design Thinking and the *Fully Integrated Mode* focuses on software development, the *Initial Development Mode* aims at balancing the two kinds of activities, thereby allowing the team to gradually move from Design Thinking to software development. With an increasing understanding of the problem and the requirements for a solution, the team decreases Deign Thinking activities and increases software development. The *Design Thinking Mode* explores the problem and the solution space. When the team has formed a product vision that solves the problem, it can start refining the concept in the *Initial Development Mode* by implementing UI concepts, technology tests and first features. After the product vision has been refined and tested with regards to feasibility, viability, and desirability, the team can move forward to the *Fully Integrated Mode* in which the product vision is gradually developed until the software system is fully implemented. Depending on the team's activities, different techniques and roles are needed in each operation mode.

2.1 Design Thinking Mode

The *Design Thinking Mode* depicted in Fig. 2 uses Design Thinking techniques to explore the projects' problem statement and the solution space. During this mode, the project team will refine the problem and develop a product vision. The development of low-resolution prototypes, a set of basic User Stories and a clear product vision are the main outputs.

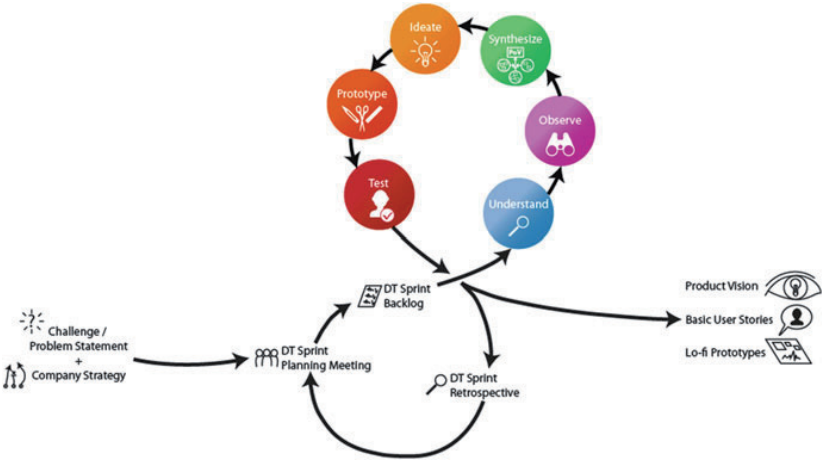

Fig. 2 Overview of the Design Thinking Mode

2.1.1 Prerequisites

The following Prerequisites should be present before starting sprints in the *Design Thinking Mode*:

- Company strategy and a problem statement
- Access to potential users and other stakeholders
- Design Thinking training for the team members

2.1.2 Activities

The activities during this mode follow a basic Design Thinking process, but use Scrum as a process framework. The team starts with a general problem statement and an initial *Understand* phase that helps in collecting information about the project, its goals, constraints, and environment. During the following *Observe* phase, the team gets acquainted with the problem domain, investigates existing solutions, and interviews and observes users and stakeholders. All the information gathered during the first two phases is *synthesized* into the team's *Point of View* on the problem. Based on this *Point of View,* the design team *ideates* aspects of a possible solution. The generated ideas will then be *prototyped* in a rapid fashion that focuses on transporting the main idea instead of creating beautiful artifacts. Each prototype will undergo *testing* with target users. The information gained by *testing* the ideas needs to be *synthesized* again. Depending on the outcome of this *Synthesis* phase, the team will start a consecutive iteration in which it will move on with further *ideation* to refine the idea or, go back to *Understand* and *Observe* phases to answer open questions and investigate new aspects of the problem.

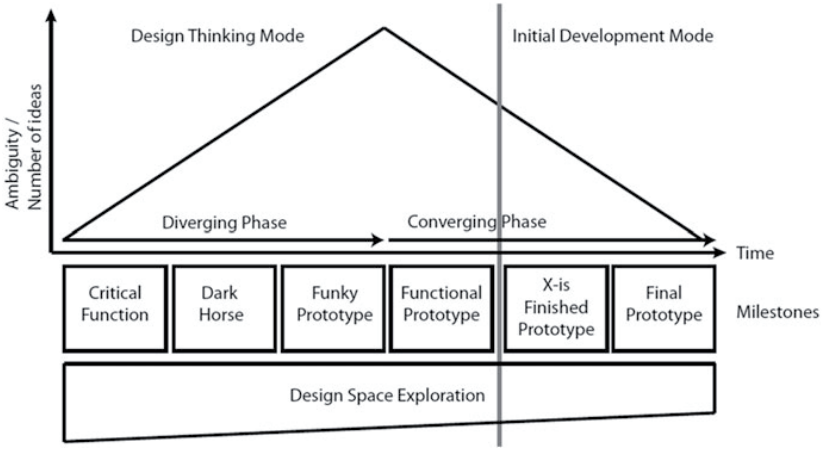

Fig. 3 Milestone concept during the Design Thinking and the initial Development Mode

In order to further structure this operation mode, the milestone concept that is being applied in the global ME310 projects or Embedded Design Thinking (Vetterli et al. 2012) can be adapted by the design team. The following Fig. 3 visualizes a possible distribution of the Milestones to the *Design Thinking Mode* and the *Initial Development Mode*.

2.1.3 Techniques

Design Thinking knows several techniques that help to understand the project environment, the stakeholders, the users, and the design space: 360° research makes it possible to quickly become well-versed on a topic, while user observations and interviews enable the team to understand the user needs and pains. Extreme users (d.school Stanford 2010) can help the design team to get a different perspective on the challenge. Stakeholder maps (Freeman 2010; Thinking.designismakingsense) enable the team to grasp who is involved in the topic. When team members work on different tasks or different activities, short Stand Up Meetings (Yip 2011) help to keep everybody up to date. If it is necessary for other team members to get a deeper understanding of what was achieved or to prepare a synthesis after research interviews, observations, or user testing, storytelling (d.school Stanford 2010) is a potential technique that can be used. Afterwards, different synthesis techniques, like clustering or creating a Persona, a Point of View Madlib, or a 2-by-2 Matrix, can help to discover or convey insights and findings (d.school Stanford 2010). When the team has found its current point of view on the challenge, brainstorming possible solutions generates ideas, which can then be prototyped. During this phase, prototyping is used to understand the users and the challenge, as well as to quickly validate ideas and possible solutions.

Therefore, rough prototypes that are fast and easy to build work best for this purpose. These include cardboard or paper prototypes of, for example, hardware components, sketches of user interfaces, or even role plays of a situation. Testing the prototypes with actual users is essential to understand flaws of the current solution and discover further user needs and pains. Testing can be done by observing users while they are trying everything out and then interviewing him afterwards.

2.1.4 Roles

The *Design Thinking Team* is responsible for planning and executing the Design Thinking sprints. A design team will usually consist of three to six people from different areas of expertise as needed for the software under development, e.g. accounting, sales people, UI designers, developers and consultants.

The main task for the *(Potential) User* is to provide input on the topic and his problems and to give feedback on ideas, prototypes, and the direction of the project. Potential Users will be interviewed and observed by the design team. In the beginning a broad range of users will be interviewed, but after the team reaches a decision about a target user or user group, it tries to secure users of that target group for constant testing and feedback cycles.

The *Corporate Liaison/Project Sponsor* has a strong interest in the project as he represents the group that defined the initial challenge. He serves as a contact person for the team. The responsibilities of this team member include providing interview partners and introductory material for the challenge, facilitating communication with other sections of the company to avoid duplication of efforts, enabling synergetic effects between teams, and allowing reuse of existing software. Additionally, he provides feedback on ideas and prototypes in a way that is similar to the users. In a corporate setting, this role can be taken over by a customer representative and/or a manager.

In Design Thinking processes, teams are often supported by *Design Thinking Coaches*. The responsibility of the coach is to introduce useful techniques, moderate discussions, ensure that the team is focused on its task, and to moderate team dynamic issues, such as conflicts or motivational issues. The *Scrum Master* in Scrum projects makes sure that the Scrum team follows the process structure and moderates discussion during planning and reflection meetings. In our merged process these roles could be merged into one: the *Process Master (PM)*. The person in this role would be responsible for the team's adherence to the overall process and moderate team discussions.

2.1.5 Deliverables

This mode generates different low-resolution prototypes as well as one more sophisticated solution prototype. The solution prototype together with insights gathered throughout the *Design Thinking Mode* should generate a clear solution

vision and elaborate why all the aspects of the prototype have been designed in a specific form. Additionally, non-functional requirements for the development of the product, and an initial set of high-level User Stories that describe the core functionality of the intended system need to be created. Documentation of the learnings and insights, which led to the functional prototype, should be created, to be able to trace back decisions made within this mode.

2.2 Initial Development Mode

The *Initial Development Mode* shown in Fig. 4 focuses on further exploring the product vision created during the previous operation mode. The main goal of the team during this mode is to start implementing, testing, and refining different aspects of the solution. A set of mid to high resolution prototypes, refined user stories, and non-functional as well as technical requirements are the targeted outcomes of this mode.

2.2.1 Prerequisites

In addition to the prerequisites described in Sect. 2.1.1, the following prerequisites should be present before starting sprints in the *Initial Development Mode*:

- Clear product vision
- Initial set of high-level User Stories
- Functional prototype that resulted from the Design Thinking phase
- Pool of low resolution prototypes
- Initial list of non-functional requirements

2.2.2 Activities

The main activity of this mode is to refine the solution prototype and the product vision. This is achieved by identifying features or design aspects of the solution prototype that need further clarification and testing with regard to feasibility. These can then be prototyped in the form of user experience (UX) prototypes, a proof-of-concept feature implementation, an implementation that tests technical feasibility or an implementation that explores possible technologies. All prototypes will be developed within Scrum sprints. Prototypes that provide a user interface should be tested with target users for maximum user satisfaction. The information gained from prototyping and testing can then be used to further refine the implementation in the next sprints and to refine the user stories and add additional non-functional and technical requirements. In addition, the system architecture and the integration concept should be prototyped.

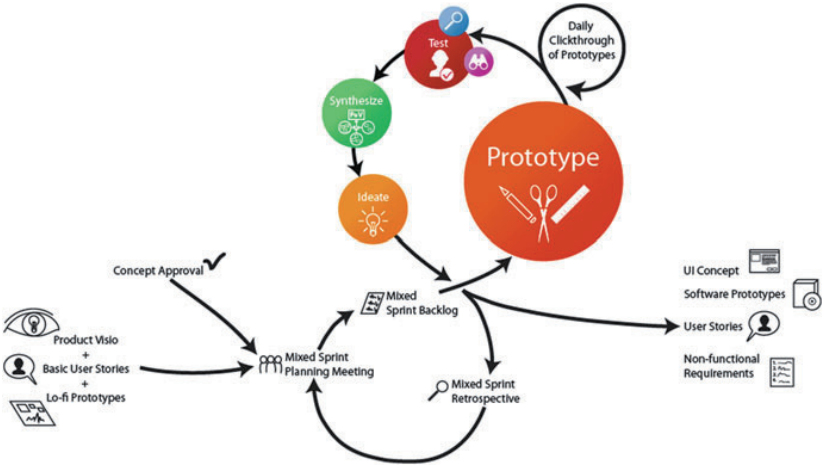

Fig. 4 Overview of the initial Development Mode

2.2.3 Techniques

Core techniques needed during the *Initial Development Mode* include low- and mid-fidelity UX prototyping, user story mapping, and programming.

Simple sketches on paper provide a great low-fidelity UX prototyping tool to create fast UI prototypes. They can be used to test different arrangements of the content, the navigation between different pages or interaction concepts. Paper prototypes can also be "interactive" during user testing if one person in the design team manually changes the UI by drawing additional content or adding and moving pieces of paper around.

Wire framing is a mid-fidelity UX-prototyping technique that uses simple sketches like widgets and controls to build a user interface prototype. Various tools like pidoco[1] or gomockingbird[2] exist, that provide the user with a variety of building blocks to build screens or even clickable prototypes. In cases where a more sophisticated or hi-fidelity UI prototype is required (e.g. to discuss progress with management) tools like Keynotopia,[3] which enable click-able Keynote/PowerPoint UIs or fast HTML prototypes can be used.

User story mapping is a technique that helps teams to understand the functionality of the system under development, identify holes and omissions in a backlog, and plan releases that deliver value to user and business. The User Story Map (Patton 2009) arranges the main activities from left to right in an order that makes

[1] https://pidoco.com/

[2] https://gomockingbird.com/

[3] http://keynotopia.com/

sense, e.g. in a workflow. Task centric User Stories are also arranged from left to right under the activity they belong to. Tasks that can occur in parallel will be placed vertically under one another.

A daily clickthrough of the current prototypes ensures that everyone in the team is up to date on the explored concepts and findings.

2.2.4 Roles

The *Scrum Team* is responsible for the planning and execution of the development sprints. A Scrum team usually consist of eight to ten developers drawn from the design team of the former mode and additional developers from areas of expertise as needed for the software under development, e.g. back end developers, front end developers, database experts, UI developers, etc.

The main task of *(Potential) Users* during this mode is to test the different prototypes developed and give feedback.

The main task of the *Corporate Liaison*/*Project Sponsor* during this mode is to give feedback on the developed prototypes and the general direction of the project. Additional responsibilities are facilitating communication with other sections of the company and advertise the project progress.

The *Product Owner* is the representative of the customer. He is responsible for filling the backlog with user stories and for prioritizing them. In our combined process model, the product owner can be one of the members of the design team from the previous mode, e.g. a user researcher.

The *Process Master* has the same responsibilities as defined in Sect. 2.1.4.

2.2.5 Deliverables

The deliverables in this mode are mainly the created prototypes and the results from testing them. These include end-user tested UX prototypes that led to further functional and non-functional requirements, and back end spikes to show the feasibility of required functionality and technical requirements. With the insights gained from developing and testing the prototypes, the user stories can be further refined and new user stories can be added. Finally, a clear specification of integration within the company context needs to be created. This includes identifying interdependencies with other, already existing systems or potential for reuse of existing software components in the final implementation.

2.3 Fully Integrated Mode

The *Fully Integrated Mode* illustrated in Fig. 5 mainly complies with a Scrum development process, enabling the team to work towards a final product in

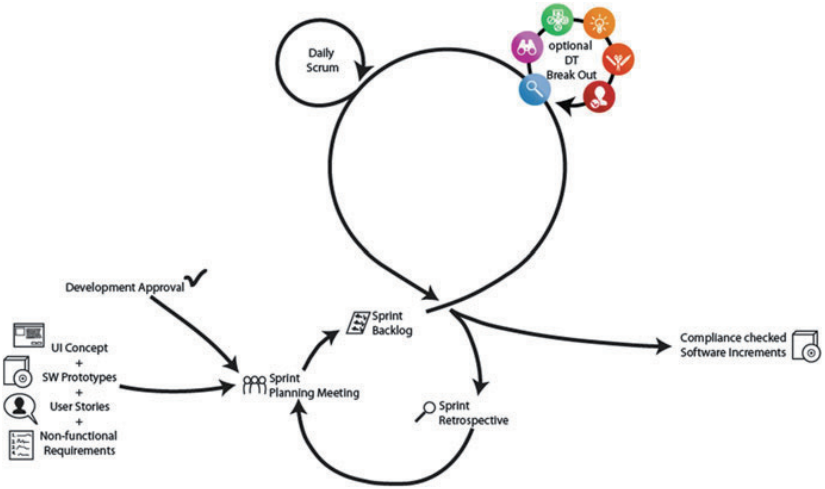

Fig. 5 Overview of the fully Integrated Mode

incremental steps. In case of blockers in the development process, Design Thinking tools will be initiated, hence the Design Thinking application is ad-hoc. A close observation of the development process is needed to quickly react to blockers with the adequate Design Thinking tool.

2.3.1 Prerequisites

In addition to the prerequisites described in Sect. 2.2.1, the following prerequisites should be present before starting sprints in the *Fully Integrated Mode*:

- List of technical requirements
- Prioritized list of detailed user stories
- Set of Proof-of-concept implementations
- Set of UX Prototypes

2.3.2 Activities

The activities during this mode follow a basic software development approach using Scrum as a process framework. The team or teams focus on development of software increments as well as deployment and maintenance concepts. In case features are not defined well enough or problems arise, the team can choose to include short Design Thinking bursts in the activities to refine a feature idea or find solutions to the problem. Thus, Design Thinking in this mode, compared to the other two modes, does not focus on creating insights prior to the software

development process. It is rather creates ad-hoc insights and different solutions to overcome some impassable blockers.

2.3.3 Techniques

This mode is completely dedicated to turn the product vision into a fully functioning piece of software. Thus, the entire spectrum of software engineering techniques can and should be used. For example, the practices proposed by Extreme Programming (Beck 2000) are very well suited for Scrum projects. They include test-driven development, continuous integration, and different review techniques to maintain code quality, collective code ownership, and continuous customer testing.

2.3.4 Roles

The responsibilities of the *Scrum Team* during this mode are similar to the preceding mode. They plan and execute the sprints implementing functional software increments. If needed, additional Scrum teams can be added to allow for parallel development.

The main task of *(Potential) Users* during this mode is to test the software increments and give feedback.

The main task of the *Corporate Liaison*/*Project Sponsor* during this mode is to give feedback on the developed software increments. Additionally, this team member should still facilitate communication with other departments of the company and promote the project progress.

The *Product Owner* has similar responsibilities as described in Sect. 2.1.4.

During this mode the *Process Master (PM)* has the same responsibilities as during the other modes. In this mode it is of special importance that the PM can quickly react if blockers are stopping the development process and provide the team with the right Design Thinking tools to help them.

2.3.5 Deliverables

The *Fully Integrated Mode* focuses on creating tested, working software. Hence, all developments should be potentially shippable by the company. This means that the software adheres to certain product standards and is deployable. The teams should therefore also create, or at least keep in mind, a strategy of how their software can be delivered to the end user. This is rather straightforward in the case of mobile apps, but when developing on-premise software that integrates with existing landscapes the team needs to explicitly reserve time to create a deployment strategy. Finally, developers should not only blindly implement the given stories but be open-minded about potential improvements. Hence, they should also capture their

own ideas or suggestions, and, if applicable, transform them into user stories for upcoming sprints.

2.4 Large Scale Projects

Larger software projects, like the development of a complex ERP solution, require a large number of developers possibly split into several development teams. Solutions to solve this problem already exist, for example the Scrum of Scrums or Meta Scrum. In this technique, the individual Daily Scrum of all Teams is followed by a Daily Scrum of Scrums with an ambassador from each team, who will give a progress report from his team and take back important information to his team members. If necessary, this technique can be used on multiple levels. Ambler (2009) or Larman and Vodde (2008, 2010) present examples and case studies on how agile processes can be scaled for large project teams and explain appropriate techniques. We believe that a similar scale up of design teams for the *Design Thinking* and *Initial Development Modes* would not be helpful. Instead, we proposed that a regular design team of four to eight people will work on the project during the *Design Thinking Mode*. During the *Initial Development Mode* the team can split into multiple mixed teams and work on different projects that follow a product idea from the *Design Thinking Mode*. As an alternative, the design team can split into multiple sub teams and work on parts of the product vision created during the *Design Thinking Mode*. The teams or sub teams will then evolve even more fully into development teams, who will perform the sprints in the *Fully Integrated Mode*. Figure 6 illustrates the flow of project teams during the modes.

2.4.1 Summary

In this section we presented DT@Scrum, our initial concept to seamlessly integrate Design Thinking and Scrum. It comprises three operation modes, which provide a different ratio of Design Thinking and software development activities. We presented the general activities of each mode, supporting activities and the involved roles. We want to invite researchers and practitioners to give us feedback on our ideas and try out DT@Scrum. We would gladly support projects that want to try out DT@Scrum, e.g. with training and coaching.

3 Design Planning

As described in Sect. 2, Design Planning is an important concept for the DT@Scrum approach. We want to ensure that these techniques are adaptable to Design Thinking and help to estimate workloads and durations in order to be able

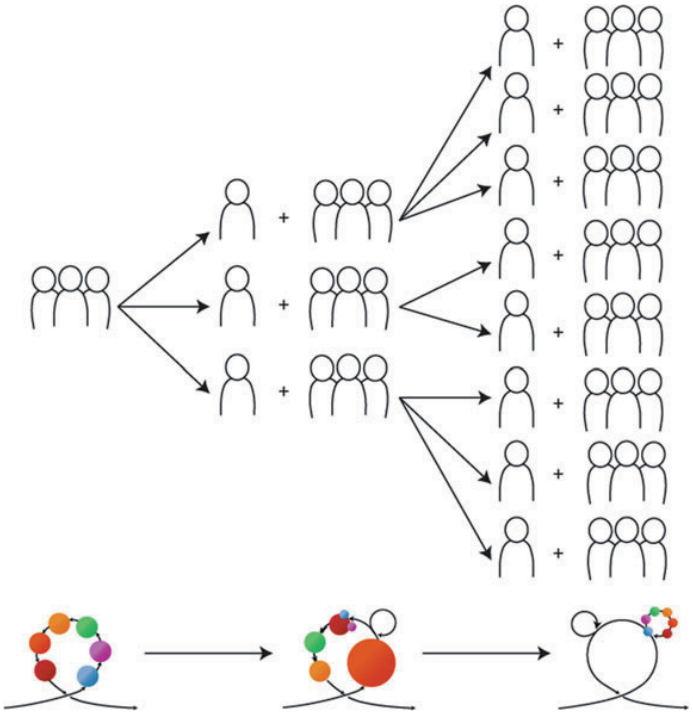

Fig. 6 Team scale up during operation modes

report them to the management but also help the teams to organize themselves. The hypothesis underlying this concept is as follows:

Running design tasks in sprints, estimating and planning them accordingly, and using a regular retrospective can help the team to better understand their process and get a feeling for design tasks.

However, introducing a constraint like planning and following the plan could negatively affect the outcome of the design process as it limits the team's creative freedom. Therefore we aim to answer the following research questions with the help of a 3 h experiment:

- How does planning affect the team's design process?
- How does planning affect the design team's view of their process?
- How does planning affect the outcome of a design task?

3.1 Experiment Setup

The experiment is comprised of two design challenges, each 1 h long, and a series of questionnaires. In one challenge, the team can decide how to use the hour themselves. In the other challenge, the team is required to use some time at the beginning of the hour to collect all tasks they want to do, assess them, and plan the course of the remaining time. The two design challenges are similar in terms of complexity. One challenge asks the students to design the perfect transition from work to free time for a specific user. The other challenge asks the team to design the perfect start into the day for a specific user. The user is available throughout the experiment for interviews and testing sessions. After each challenge the participants are asked to fill out questionnaires asking them to reflect on their process, rate the innovation potential and desirability of the created solution, and rate the value of planning tasks upfront. After the experiment the participants are asked to fill out another questionnaire asking them to compare the two challenges and how they would run a third similar challenge.

3.2 Preliminary Results

We initially ran the experiment with teams of former ME310 projects. In those experiments, we first ran the challenge without asking for a plan. The teams did not decide to plan anything upfront and ran into problems in the second half of the hour realizing they did not have enough time. Most of the time was spent on interviewing the user. This amounted to between 13 and 15 min. Prototyping was rather short and very ad-hoc, it started after minute 51 and took about 3–4 min. Testing, accordingly, started after minute 54 and took 3–5 min, basically the remaining time. Interestingly, one team managed to do a 2 min iteration on their prototype and test it again. In the questionnaires it shows that the teams experienced time pressure and moments of chaos when it was unclear how to proceed. It was mentioned that planning or better time management would make sense. However the teams felt productive and were satisfied with the solution with regards to the available time.

In the first version of the second challenge we requested the teams spend 15 min planning using swimlane sizing as a planning tool. In this test we also used “design the perfect wallet for a specific user” as the design challenge. When setting this challenge, we got the feedback that the wallet exercise was already done several times by participants. It also asks for a specific product instead of addressing a general user need. Thus, the team focused on improving the wallet itself rather than creating the most desirable solution with regards to the user’s needs. Furthermore, 15 min of planning for a 45 min challenge was seen as much too long. The introduction of a new tool was also perceived negatively as it takes several attempts to fully comprehend a new tool.

In the second version of the planned challenge, we simply asked the teams to take some time in the beginning to plan the hour. This allows the team to choose freely how much time to spend on planning and what techniques/tools they want to use to plan. We also changed the challenge to "design the perfect transition from work to free time for a specific user", because it is closer to the unplanned challenge and allows a product or a service as solution.

In these planned challenges, teams placed the greatest importance on interviewing and prototyping by allotting the most time for these activities. They used between 10 and 18 min for interviews and 6–12 min for prototyping. Testing again took 3–4 min, which was the remaining time of the challenge. The team that managed an iteration in the first run decided not to do one in the second run even though there were still 2 min left. In the questionnaire it showed that the teams still experienced time pressure, some of them even more than in the first challenge. This is probably due to the fact that none of the teams used buffer times in their schedule, and thus missed the chance of adopting the schedule while working. It also showed that the process and the steps to take during the challenge were clearer. While overall the teams found planning useful for longer challenges, they also felt that it was too time consuming when 1 h was allotted. They found it good to decide on tasks, but forgot to include buffers. The value of collecting tasks was rated an average of 2 on a 1–5 scale (1 = very good, 5 = very bad). The value of estimating and ordering the tasks was rated an average of 2.5 on a 1–5 scale (1 = very good, 5 = very bad).

Figures 7 and 8 show the timelines for the first and second run from two of the participating teams. Comparing the course of the two challenges, we found that in the first challenge tasks tend to get shorter towards the end of the challenge, probably due to the fact that time was running out. On the second run, with planning, the team chose which tasks needed the most time and the timeline reflects these choices. Another interesting observation that can be seen in the timelines is that the teams tended to do further interviews, ad-hoc during clustering or synthesis during the unplanned challenge. This behavior was decreased in the planned challenge. While the experiment setup allows and encourages the team to ask the user further questions, we believe, that the decline in follow up questions can mean one of two things. Either the teams are more focused on the task they are currently working on or they stop challenging their thoughts and ideas in the planned challenges. This fact should be further observed with other teams in order to evaluate which of the possible explanations is correct.

Further comparing the outcome of both challenges we found that the prototypes in the second challenge were more tangible and self-explanatory, probably due to the longer time taken for prototyping. Figures 9 and 10 show the prototypes from teams A and B for their first and second challenge.

Comparing the ratings for desirability and innovation potential of the solution, teams rated the desirability of the solution higher in the second challenge. A rating of the solutions through the users and our Design Thinking coaches also found the solutions from the second challenge to be more desirable. The innovation potential was rated the same for both challenges by nearly all participants.

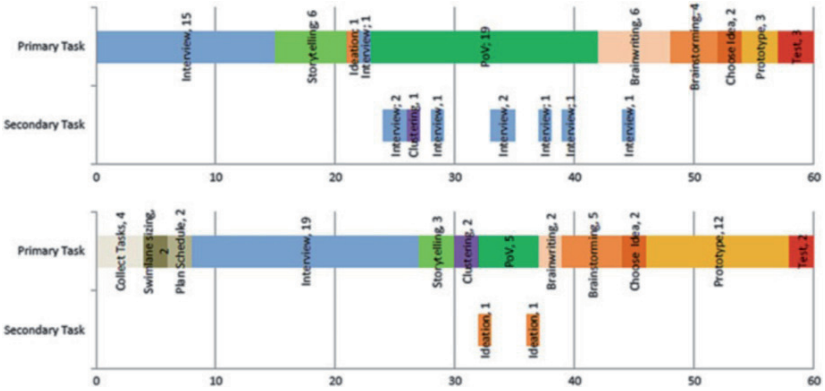

Fig. 7 Comparison of timelines for both challenges—Team A

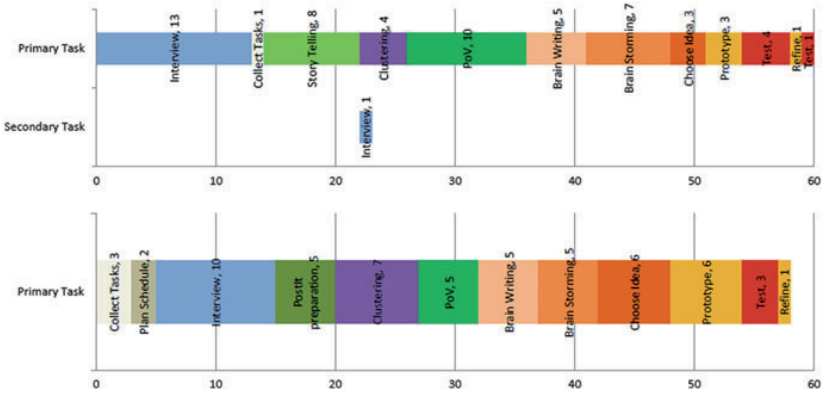

Fig. 8 Comparison of timelines for both challenges—Team B

Comparing ratings for stress, teams found the first challenge to be less stressful. From their explanations we could see that they felt time pressure mainly at the end, when there was no time left for prototyping and testing. While in the second challenge there was time pressure felt throughout as the team tried to keep the schedule. The first challenge was rated to be more successful.

When asked how the participants would run a third similar challenge, all participants wrote that collecting tasks and ordering them helps and, thus, would be included. However, the addition of buffers to the general plan was requested to allow for changes during the challenges.

To sum up our findings, planning created more time for prototyping, which again led to more tangible and self-explanatory prototypes. Keeping the schedule was experienced as stressful by the teams. In a third one hour challenge, teams would

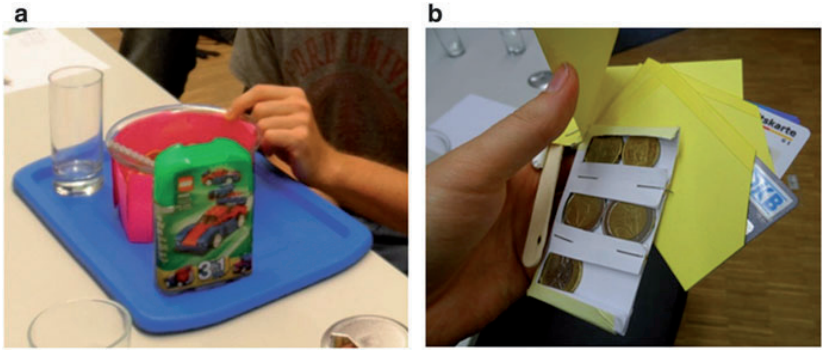

Fig. 9 Prototypes of Team A. (**a**) Prototype from unplanned challenge, (**b**) prototype from planed challenge

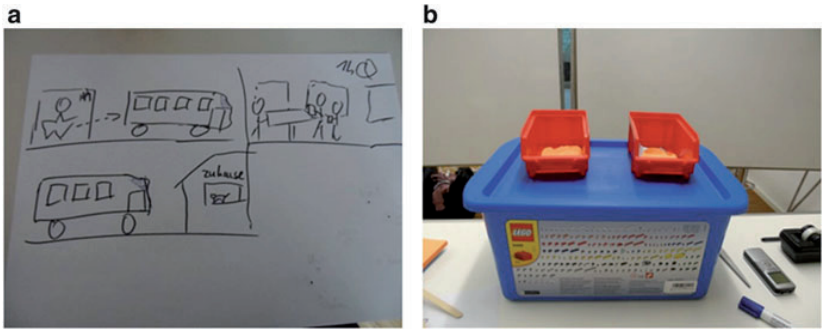

Fig. 10 Prototypes of Team B. (**a**) Prototype from unplanned challenge, (**b**) prototype from planed challenge

make a plan but use buffers. When rating the planned challenge, the teams mentioned that it provided a better overview about the required tasks and helped in comprehending the process. Overall, the preliminary results are in favor of our hypothesis.

3.3 Outlook

From the experience of our first experiments we decided to request buffers when planning. We also decided to randomly switch planning between the first and the second challenge in order to analyze how teams use the second challenge when planning was introduced before beginning. With these changes we aim to conduct

the experiment with further teams. In this way, we will have a broader range of teams to analyze and verify the preliminary findings.

To further evaluate planning during design activities in general, we want to observe and interview ME310 and d.school teams that use long and/or short term planning tools (e.g. Kanban Board, day plans) and investigate their motivation and strategies when planning. Further interviews, with d.school teams that do not use planning, will help to reveal problems with existing techniques and obstacles for planning activities in design teams.

Planning for challenges that only take an hour to complete, as done in our experiments, has a bad ratio between planning and actually working. Planning upfront, therefore, "steals" working time in such overseeable settings. On the other hand, if planning is implemented for longer time frames it gets harder to keep an overview of all the necessary steps, make detailed estimates, and foresee problems and changes in the project. Therefore, Scrum suggests planning sprints of 2–4 weeks for software engineering activities. With longer running observation of ME310 teams that use design planning, we want to determine the optimal sprint size for Design Thinking activities. Additionally, these observations could reveal insights on the usability of Design Planning over the course of a project. These insights will then be validated with a quantitative questionnaire. To test Design Planning in a setting with a useful planning to working ratio, we are also investigating the possibilities of a longer running Design Planning experiment, e.g. 1 or 2 day, which would also allow us to introduce additional planning tools.

4 Application in Software Project Courses

In order to test our ideas and gain first-hand knowledge about using DT@Scrum, we started testing it in project based software engineering courses. These courses provide a low consequence environment in which we can easily observe and interview the participants and adapt the process and the used techniques as needed. Additionally, we can ask the participants to test various Design Thinking and Scrum techniques, thus allowing us to identify those that are best suited for software focused projects. In the following we introduce the two courses which we adapted for that purpose, their general setup, the participants, as well as first observations.

4.1 Bachelor Projects

In order to acquire a Bachelor degree in IT Systems Engineering at the Hasso Plattner Institute students need to take part in a bachelor project. The main goal of the bachelor project is to prepare the participants for their work in the software industry and allow them to apply the knowledge and skills learned during their studies.

Over the course of two semesters, teams of four to eight students will solve a real life challenge provided by their project partner, the associated chair, or a company requiring a software solution to their problem. The team will be supervised by a professor and up to three research assistants. The project is composed of two parts, the research phase and the implementation phase. During the first semester the students will work on the project 2 days a week. As projects come from various industries, e.g. healthcare, or automotive, this time is typically used to get to know the industry partner and the challenge. The students learn about the problem domain, learn specific skills needed for the project, and come up with requirements for their software solution. During the second semester, the students work on their projects 4 days a week. This semester is used for the actual implementation of the software solution. During this phase, Scrum is a popular process framework as most bachelor students at HPI already know it from former courses.

In 2013/2014 we are offering two bachelor projects at our chair. The first project (BP1) focuses on managing the life cycle of data, a very technical problem, while the second project (BP2) focuses on the development of tools in the area of computer aided software engineering.

4.1.1 DT@Scrum in Bachelor Projects

As described, bachelor project teams often use Scrum as a process framework during their projects. So far, requirements for the solution are mainly given by the project supervisors or the industry partner, who serves as the product owner. Because the first semester of a bachelor project already aims at understanding the challenge, the environment of the challenge, and collecting requirements for the software solution, this semester is ideal to integrate Design Thinking into the team's processes. Design Thinking is an optional course for bachelor students at HPI, so we cannot assume that all students are familiar with the process and its ideas. Therefore, we introduced an initial Design Thinking workshop 3–4 weeks into the project, which also serves as a first synthesis point for the team.

Before the workshop, both teams focused on researching their topic by reading papers and benchmarking existing solutions to their challenges. Additionally, the team from BP2 was introduced to techniques for performing observations and interviews. They conducted several interviews with software developers employed at the project partner. After this initial research, we held a 1 day Design Thinking workshop with each team, in which we briefly introduced Design Thinking and DT@Scrum. The workshops aimed at bringing the team together, forming a joint understanding of the problem, and building initial prototypes. We introduced personas, brainstorming, UI paper prototyping, and storyboards during these workshops. The next steps for both teams will now be to start prototyping their initial ideas and verifying them with their end users or project supervisors, and to start ensuring the technical feasibility of features and the applicability of the chosen technology with software prototypes. During these steps we will support the teams as Design Thinking coaches and introduce them to further Design Thinking

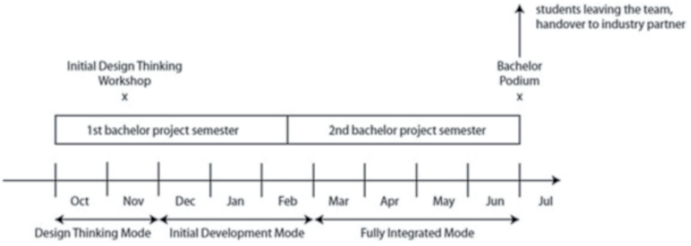

Fig. 11 Timeline of the DT@Scrum during the bachelor projects

techniques suited for their project and progress, such as storytelling, different types of prototypes, or user testing.

Nevertheless, as the projects are focused on producing a functional software system, the *Design Thinking Mode* and the *Initial Development Mode* will take place this first semester, while the second semester is reserved for the *Fully* ***Integrated*** *Mode*—the actual development. The following Fig. 11 illustrates the expected timeline for DT@Scrum in the bachelor projects.

4.1.2 Initial Observations

The Design Thinking workshops provide a good way for the teams to summarize their learnings so far and start moving towards a solution. Brainstorming and prototyping initial ideas help them to form a joint point of view on the project and possible solutions. Participants experience the workshop as a good introduction and a means to get to know each other better. Especially prototyping is experienced as useful, because it helped participants to realize what they usually do not think about/forget when working on software, and because it helps to come up with new ideas along the way.

Beyond the initial workshops, rapid prototyping with paper prototypes or storyboards remains an asset for the teams. It allows them to externalize their ideas, discuss them with the project supervisors, and their external partners. They use an accompanying wiki system to store pictures of all prototypes in order to increase traceability of their ideas and permanently capture the feedback. Based on the prototypes, technical challenges were identified (e.g., prediction of query runtimes for large database systems) and captured as tasks within the ticket system. These challenges are prototypically solved in the second project phase and then combined to create the final prototype in the third phase.

4.2 Global Team-Based Product Innovation and Engineering

The course "Global Team-based Product Innovation and Engineering" is a joint course with international universities. It originates in a course called ME310 (Carleton and Leifer 2009), where mechanical engineering students collaborate with students at international partner universities, like the Hasso Plattner Institute, to work on innovation challenges posed by global corporations. Over time, the partner universities have started to cooperate with each other, allowing them to run more than one project in their course, thus creating a large and active network of universities, professors, and research and teaching assistants interested in Design Thinking and its application to various fields of studies, e.g. mechanical engineering, industrial engineering, product design or business administration. Over the course of 9 months, a team of six to eight students from two universities, with three to four students each, work together on the challenges presented by their industry partner.

As depicted in Fig. 12, the 9 months are split into three phases with different goals. In the first phase the team concentrates on understanding the challenge, exploring the problem domain, and researching existing solutions. During this phase the team observes and interviews end users, benchmarks existing solution and analog situations, and creates first low-fi prototypes. During the second phase, the team starts investigating possible solutions with different prototypes. Finally in the third phase the team works towards a final, sophisticated, product-like prototype of their solution. An additional challenge for the teams is managing the dialog between the globally distributed sub teams and their industry partner. All three phases are structured by milestones in the form of weekly meetings and assignments handed out roughly every 2–3 weeks, similar to the milestone concept described in Sect. 2.1.2.

In 2013/2014 we are running the course at our chair with three projects of which two have a challenge that involves software engineering. A total of 12 students on the HPI side work on the projects and are supported by a team of 6 coaches.

4.2.1 DT@Scrum in ME310

As described before, the course setup follows the Design Thinking process, additionally structured by various prototype milestones. The milestones prescribe a form of pulsing by requiring a prototype as deliverable every 2–3 weeks. Additionally the weekly meeting of all teams and coaches provides a sprint-like timeframe that requires reporting of finished and ongoing activities. Reflection sessions, one with the coaches and one team internally, allow the team to recapture the week's activities. However, planning tools and planning sessions are not required so far. Additionally, the ME310 projects end with a product-like prototype but miss actual productization.

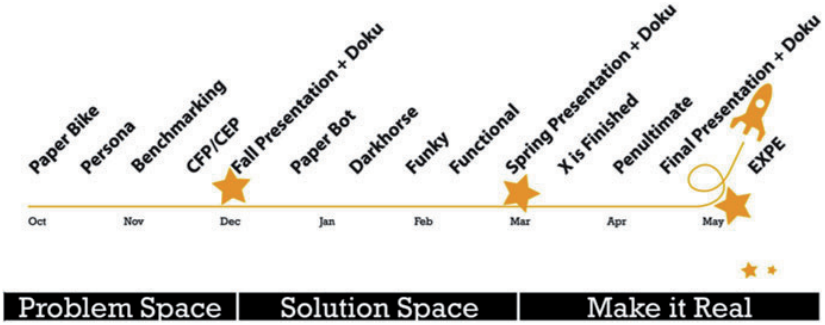

Fig. 12 Timeline of the course global team-based product innovation and engineering

With the ongoing projects we implemented a 2-day Kick-Off workshop that included short experience projects, like the Wallet Project (d.school Stanford), to teach the concept of a Design Thinking project in 1 h. The second workshop day was comprised of a 1-day design challenge to apply the concepts learned on the first day. Throughout the projects we are planning to implement different workshops to introduce or refresh Design Thinking techniques. We will also implement further short experience projects, e.g. the Lego Exercise that teaches the concepts of Scrum in a few hours (HPI 2011). Furthermore, we will introduce coaching sessions by ME310 alumni to gain experiences with knowledge transfer between teams. By applying these different coaching and teaching strategies, we hope to provide our students with a positive learning experience and create valuable coaching guidelines and teaching techniques to enhance our process proposal.

We will also introduce Design Planning to the students of the current projects and let them plan their prototype sprints, to gain experience with the technique over a longer period of time.

4.2.2 Initial Observations

With a first software engineering focused ME310 project, which took place from October 2012 until June 2013, we tried to test some of our DT@Scrum concepts. Since ME310 is a course for mechanical engineering students, it focuses on prototyping and creating physical products, where software artifacts are merely a byproduct, a fact that frequently became a problem in the project. The prototypes of ME310 build on each other and support the refinement and reuse of components. For software prototypes this is harder to achieve. A modular approach to a software system that is integrated later in the project requires decisions on system architecture, interface concepts, technology to use, and so on. A sound decision on fundamental concepts cannot be made early in the project as only vague knowledge has been acquired. On the other hand, if teams start coding too late, the given timeframe is not sufficient to implement the full functionality. Except for

wireframing and UI prototypes there seem to be few tools that allow fast and simple software prototyping. Thus the teams frequently struggled to create the requested prototypes and test them in time.

4.2.3 Outlook

Based on these observations we decided to refrain from implementing DT@Scrum with software only projects in our ME310 course. Instead we aim to collect experience with those aspects of DT@Scrum that make sense in the ME310 context and evaluate possibilities for a software-based global Design Thinking course.

With the two ongoing projects that involve software engineering, we will further observe how software engineering activities can be supported in an ME310-like context, evaluating which prototypes make sense and how software prototyping can be better supported. Additionally, we consider the possibility of launching follow-up projects that aim to implement a software solution based on the outcome of the ME310. This would allow us to gain experience with the *Fully Integrated Mode* and test different handover and knowledge transfer concepts.

In the future, we strive to apply this knowledge by setting up a course resembling ME310 with multiple teams that will use Design Thinking to tackle software engineering challenges. Within such a course, henceforth called CS310, we would be able to test DT@Scrum in a suitable context. We could compare different tools and techniques, team setups and coaching strategies by comparing multiple teams that, for example:

- Apply different tools and techniques to the same process steps,
- Experiment with the integration of Design Thinking and other software engineering processes,
- Or test different team setups, e.g. using someone from the design team of the *Design Thinking Mode* as a Product Owner in the following modes.

To allow us to test all three operation modes of DT@Scrum, we plan to setup CS310 as follows. The CS310 design team normally starts off investigating the design and solution space and forming a solution idea. When it comes to implementing functional prototypes the team will be assisted by a team of additional student developers. After a final product prototype has been developed, the additional developers will take over the project and further implement a product-like version. In addition to ensuring the projects run through all desired modes, this setup also ensures that team members will join and leave the project. This will give us an opportunity to test concepts for transition workshops between modes. The following Fig. 13 outlines the timeline for DT@Scrum in such a CS310 project. As can be seen, we plan a setup of three transitional workshops. The Kick-Off Workshop will inform all team members about the project and its goals. The Idea Handover Workshop will help transfer knowledge from the first *Design Thinking Mode* into the *Initial Development Mode* and bring new team members up to date. Finally, the Product Backlog Creation Workshop will transfer the knowledge from

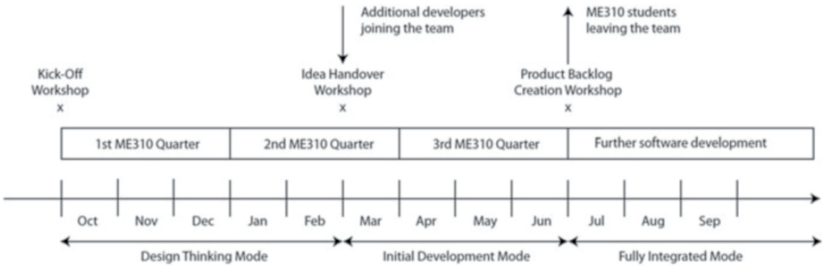

Fig. 13 Timeline of the DT@Scrum during the CS310 projects

leaving team members and from the *Initial Development Mode* to the *Fully Integrated Mode*. It also ensures that all team members help to create the Product Backlog necessary for the Scrum development sprint.

5 Conclusion and Future Work

DT@Scrum is an approach that integrates Design Thinking with Scrum in order to provide a process that seamlessly connects the generation of innovative ideas and their implementation. At the core of DT@Scrum are three operation modes. The *Design Thinking Mode* allows the project team to transition from exploring the problem and possible solutions. The chosen solution is refined and initial coding efforts verify the technical feasibility within the *Initial Development Mode*. Finally, in the *Fully Integrated Mode* the proposed solution is implemented as a product. To achieve its goals, each mode prescribes activities, the roles involved in these activities, and supporting techniques.

Another core element of DT@Scrum is Design Planning, the application of planning and reflection techniques from Scrum to Design Thinking activities. With this concept we hope to achieve a greater transparency of Design Thinking activities for management and team members. We will test the concept and evaluate its effects on design teams and the outcome of design tasks with the help of Design Planning experiments.

In order to gain experience with the implementation of DT@Scrum we partially implemented it in bachelor projects and the ME310 courses at our chair. With the experience and feedback gained in those courses, we plan to create a course that adapts the concept of ME310 to a software engineering focused course, CS310. The course will then serve as a testbed for DT@Scrum, helping us to validate our ideas and improve DT@Scrum.

Apart from the future activities described in Sects. 3 and 4 we want to run additional test projects with partner companies to further evaluate our process model. Such on-site projects at one of our industry partners will help us to test our process with teams in actual enterprise settings, allowing us to identify

enterprise specific challenges and opportunities for DT@Scrum. Therefore, we would like to invite you to try out our approach and give us feedback. We would gladly support your efforts by providing workshops, coaching, and teaching materials.

Furthermore, we want to open a discussion with practitioners and researchers on the concepts of DT@Scrum in general, their own ideas and experiences with implementing Design Thinking in a software engineering context, and the possible adoption to different company settings.

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ZUM ANFASSEN Arbeiten IT-Entwickler und Mitarbeitende aus dem Fachbereich zusammen, erwachen neue Ideen.

Bild: Getty Images / RunPhoto

Brücken schlagen

Mit der Innovationsmethode Design Thinking wird das Business-IT-Alignment nachhaltig verbessert und damit die IT-Organisation erfolgreicher ins Unternehmen eingebunden.

HENRIK BROCKE, CHRISTOPHE VETTERLI, WALTER BRENNER UND FALK UEBERNICKEL

Für den Geschäftserfolg ist es entscheidend, dass die Informations- und Kommunikationstechnik auf die Ziele und den Bedarf der Fachbereiche eines Unternehmens ausgerichtet ist und die Geschäftsprozesse der Fachseite kontinuierlich und bestmöglich unterstützt. Die dahinterstehende Herausforderung – seit den Achtzigerjahren unter dem Schlagwort Business-IT-Alignment bekannt – zählt zu den wichtigsten Themen von IT-Führungskräften.

Als besonders herausfordernd stellt sich dabei die Flexibilität zur ständigen Innovation und schnellen Anpassung der IT-Unterstützung an das sich dynamisch ändernde Geschäft der Fachseite heraus. Wo die IT-Organisation nicht hinreichend schnell innovativ agiert, finden Fachbereiche ihre eigenen Wege. Als typische Auswirkung ist in den letzten Jahren ein Wachstum der sogenannten Schatten-IT zu beobachten. Mit dem Blick auf die gesamte Organisation, also auf den IT-Bereich und den Fachbereich, rückt die kontinuierliche Kundenorientierung zu einem immer entscheidenderen Wettbewerbsvorteil auf.

Kundenbedarf identifizieren | Eine massgebliche Ursache für mangelndes Business-IT-Alignment liegt in organisatorischen Brüchen, die vielfach an gleich zwei Punkten entstehen (vgl. Grafik 1 auf der rechten Seite, oberer Teil): Zum einen besteht eine Herausforderung in der Kommunikation zwischen technisch orientierten IT-Organisationen und dem geschäftsprozessfokussierten Fachbereich. Zweitens gilt es, innerhalb des Fachbereichs den Bedarf der Anwender zu identifizieren und passende Lösungen zu finden. So ist es möglich, den Endkonsumenten ideal zu bedienen. Folgendes Szenario verdeutlicht diese Situation: Aufgrund der zunehmenden Vielzahl an Finanzprodukten stehen die Kundenberater einer Bank immer öfters vor der Herausforderung, in Kundengesprächen die geeignetsten Finanzierungslösungen ad hoc zu offerieren. Das Management stellt dieses Problem erst anhand jahrelang rückläufiger Umsätze fest. Schliesslich beauftragt es die IT-Abteilung, ein Knowledge-Management-System einzusetzen, um damit die Kundenberater zu unterstützen. Nach der Umsetzung zeigen Zugriffszahlen, dass das System kaum verwendet wird, da es nur in der Nachbereitung, nicht aber während des Kundengesprächs nützlich ist. Der originäre Bera-

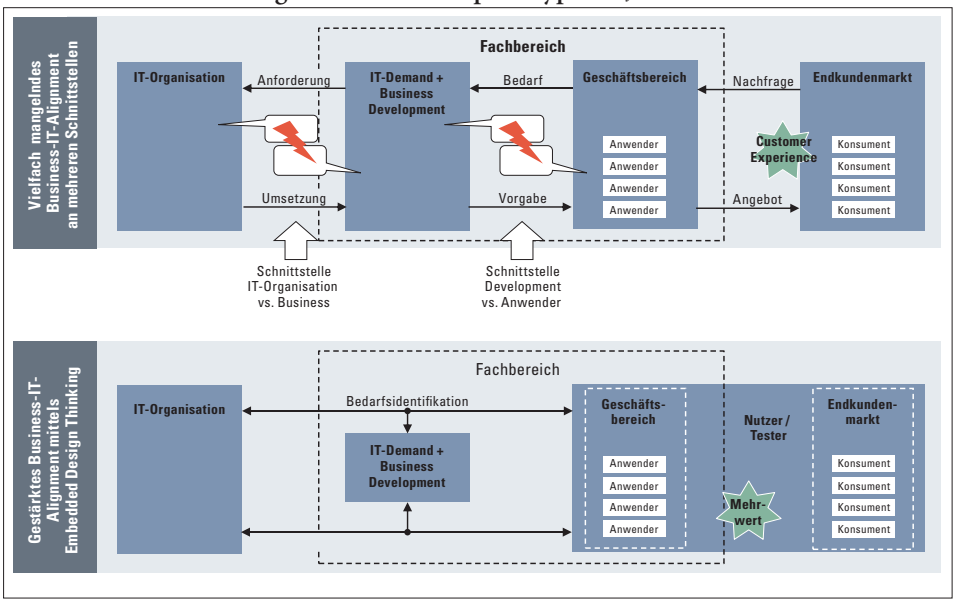
tungsbedarf des Endkunden wird in diesem Szenario jedoch zu keinem Zeitpunkt analysiert.

Insbesondere bei traditionellen ingenieurhaften Applikationsentwicklungsvorgehen wie dem Wasserfallmodell oder dem V-Modell können diese skizzierten Effekte eintreten: Starre Pflichtenhefte reduzieren zwar Projektrisiken in Zeitaufwand, Budget und juristischer Erfüllung, nicht jedoch das Risiko, den erhofften Nutzen im Einsatz zu erzielen oder das Bedürfnis des Anwenders überhaupt zu erfassen. Das Problem erkennend, versuchen jüngere, agile Ansätze der Anwendungsentwicklung, solche Auswirkungen durch kürzere Feedback-Zyklen und früheres Integrieren von Testphasen zu vermeiden. So setzen beispielsweise SCRUM-Projekte auf die enge Kundeneinbeziehung durch zweiwöchentliche Meetings (Sprints), in denen man den aktuellen Stand vorstellt und die nächsten Umsetzungsschritte abstimmt. Damit beginnt man jedoch erst in der Entwicklungsphase eines Projektes.

Die kürzeren Zyklen können zwar im Fall von Fehlentwicklungen den Umfang der Auswirkungen und der Sunk Costs verringern, setzen jedoch nicht bei der Vermeidung der Fehlentwicklung selbst an. Um das Kundenunternehmen mit innovativen Lösungen zu unterstützen, schalten fortschrittliche Unternehmen der Entwicklungsstufe eine Innovationsstufe vor. Darin erfasst, priorisiert und evaluiert man, welchen IT-Unterstützungsbedarf die Fachbereiche benötigen. Nur wenige Unternehmen ziehen dabei auch bereits den eigentlichen Endkundenbedarf mit ein, den es durch die Mitarbeiter des Fachbereichs zu bedienen gilt. Solche Unternehmen streben damit explizit an, die Customer Experience mithilfe von IT-Lösungen im Fachbereich zu verbessern.

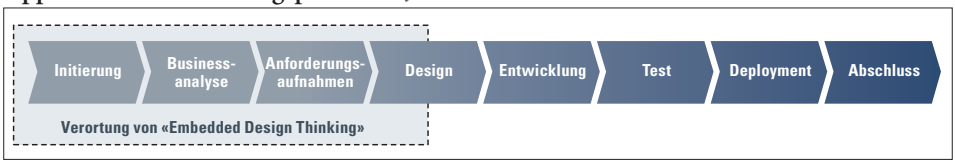
Organisatorische Brüche überwinden | Einen ganz anderen Weg der Interaktion von IT-Organisation, Fachbereich und Anwender zur Entwicklung innovativer Applikationen schlägt das In- >

Gemeinsame Erarbeitung von Innovationsprototypen *Grafik 1*



Das Embedded Design Thinking überbrückt die Schnittstellen des Business-IT-Alignments. Quelle: Brocke, H.; Vetterli, C.; Brenner, V.; Uebernickel, F. (2012)

Applikationsentwicklungsprozess *Grafik 2*



Embedded Design Thinking ist in der ersten Hälfte des Prozesses der Applikationsentwicklung einzusetzen.
Quelle: Brocke, H.; Vetterli, C.; Brenner, V.; Uebernickel, F. (2012)

DIE AUTOREN

***Henrik Brocke**, Dr., ist als Senior Consultant bei der IT Management Partner St.Gallen AG tätig.*
henrik.brocke@itmp-sg.com

***Christophe Vetterli**, M.A. HSG, ist wissenschaftlicher Mitarbeiter am Institut für Wirtschaftsinformatik an der Universität St. Gallen.*
christophe.vetterli@unisg.ch

***Walter Brenner**, Prof. Dr., ist Direktor des Instituts für Wirtschaftsinformatik an der Universität St. Gallen.*
walter.brenner@unisg.ch

***Falk Uebernickel**, Prof. Dr., ist Assistenzprofessor und Projektleiter am Institut für Wirtschaftsinformatik an der Universität St. Gallen.*
falk.uebernickel@unisg.ch

> stitut für Wirtschaftsinformatik der Universität St. Gallen in Zusammenarbeit mit einigen Unternehmen und der Spin-off-Beratung IT Management Partner St. Gallen AG ein, die sich auf organisatorische Design-Thinking-Integration in Unternehmen spezialisiert hat. Die menschenzentrierte Innovationsmethode Design Thinking eliminiert die organisatorischen Brüche, um das Business-IT-Alignment zu sichern. (vgl. Grafik 1 auf Seite 37, unterer Teil).

Im obigen Bank-Szenario würde dies wie folgt ablaufen: Ein im Design Thinking geschultes, heterogen aufgestelltes Team aus IT-Entwicklern und Mitarbeitern aus dem Fachbereich beobachtet die Kundenberater, identifiziert daraus die Endkundeninteraktion als kritische Funktion und entwickelt unterschiedliche Ideen. Diese Ideen werden in Form von «erlebbaren» Prototypen umgesetzt, die Kundenberater der Bank testen. In einer zweiten Phase stellt das Team implizite Annahmen stringent in Frage und baut Prototypen, die den Bankkunden selbst als Produzenten der Beratungsleistung positionieren. Die anschliessende konsolidierende Phase fokussiert auf die zentralen Erkenntnisse und die Beraterinteraktion via Tablets. Einige Prototypen schlagen zunächst nur Finanzierungsangebote entlang von Kundeneigenschaften vor. Diese werden zu einer Applikation weiterentwickelt, die auf einem Lebenszeitstrahl des Kunden die finanzierungsrelevantesten Entscheidungen wie Hausbau, Geburt von Kindern und Renteneintritt verortet. Entlang dieser individuellen Kundensituation schlagen die Kundenberater Finanzprodukte vor. Diese Applikation wird schliesslich entwickelt und erbringt in der Kundenberatung und im Kundenerlebnis einen beachtlichen Mehrwert.

Das beschriebene Szenario skizziert ein reales Projekt, das eine namhafte deutsche Bank gemeinsam mit dem Institut für Wirtschaftsinformatik der Universität St. Gallen durchgeführt hat. Die darin angewendete Methode Design Thinking ist praxiserprobt und unterstützt die Berater darin, kundenorientierte Services und Produkte zu entwickeln. Dafür orientiert sie sich konsequent an den Bedürfnissen der Anwender und stellt durch ein schrittweises Vorgehen die kontinuierliche Berücksichtigung des Anwender-Feedbacks sicher. Laut Larry Leifer von der Stanford University, einem der Begründer von Design Thinking, begreifen Menschen Innovation besser, wenn sie das Neue im buchstäblichen Sinn begreifen. Diese Prototypen zum Anfassen erstellt idealerweise ein multidisziplinäres Team, damit unterschiedliche Perspektiven in die Lösung einfliessen.

Phasenweise vorgehen | Zunächst wird der Bedarf der Anwender durch unterschiedliche Techniken wie etwa die Anwenderbeobachtung (Shadowing) ermittelt. Dabei berücksichtigt man auch die durch den Fachbereich adressierte Nachfrage des Endkonsumenten, um Potenziale zur Verbesserung der Customer Experience durch entsprechende IT-Unterstützung zu erkennen. In einem anschliessenden Brainstorming werden Lösungsideen entwickelt und in rudimentären (Low Resolution) Prototypen umgesetzt, die anschliessend direkt mit den Anwendern und gegebenenfalls in der Interaktion mit Endkonsumenten getestet werden. Diesen Zyklus durchläuft man nach einem stringenten Phasenvorgehen mit festgelegten Ergebnis-Prototypen mehrere Male, bevor der Prototyp, der den grössten Nutzen stiftet, in einen etablierten Implementierungsprozess mündet.

Dieses methodische Vorgehen entwickelte die Stanford University in Palo Alto, Kalifornien. Das Institut für Wirtschaftsinformatik der Universität St. Gallen erforscht den Einsatz im Unternehmensumfeld als «Embedded Design Thinking» und führt es in Organisationen ein. Ein wesentlicher Gestaltungsaspekt liegt in der organisatorischen Aufstellung der Teams und Verantwortlichkeiten: Sie bindet erstens die IT und den Fachbereich in den Innovations- und Konzeptionsprozess ein. Zweitens gilt es, einer Community den idealen Nährboden zu bieten, um sich zu entwickeln, um Key Users einzubeziehen und um die Verzahnung des Teams mit der Organisation forcieren zu können. Den dritten zentralen Aspekt bildet die Begleitung des Embedded Design Thinking durch Methodencoaches, um das Innovationspotenzial der Methode im hierarchischen sowie politisch beeinflussten Unternehmen auszuschöpfen.

Anwendernutzen sicherstellen | Die Forschungs- und Beratungsergebnisse zeigen, dass die Kombination aus organisatorischer Aufstellung und methodischer Stringenz in der prototypbasierten Entwicklung die typischen Herausforderungen im Business-IT-Alignment mindern konnten. Durch den direkten und kontinuierlichen Endanwenderkontakt der IT-Anwendungsentwickler, beginnend mit der eigenständigen Identifikation des Bedarfs, kann die IT-Organisation gemeinsam mit dem Fachbereich direkt in die Lösungsfindung integriert und der Anwendernutzen sichergestellt werden. Anwender validieren oder falsifizieren sofort die Ideen und Prototypen in ihrem Nutzenpotenzial. Erst dann nimmt die IT-Organisation ihre traditionelle Aufgabe der Implementierung wahr. Damit gliedert sich Embedded Design Thinking im etablierten Prozess der Applikationsentwicklung in die initialen Phasen der Business-Analyse, der Anforderungsaufnahme und der Konzepterstellung ein und revolutioniert in diesen Phasen die Integration des Anwenders (vgl. Grafik 2 auf der linken Seite).

Das Institut für Wirtschaftsinformatik der Universität St. Gallen hat Embedded Design Thinking bereits in neun Projekten mit multinationalen Unternehmen eingeführt. Bei allen wurden wegweisende Verbesserungen im Business-IT-Alignement erzielt. Der Embedded-Design-Thinking-Ansatz hat also das Potenzial, die Strukturen in der Zusammenarbeit von IT-Organisationen und Fachbereichen nachhaltig zu verändern. <

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Initialzündung durch Embedded Design Thinking – Ein Fallbeispiel aus der Finanzindustrie

… und wie dadurch ein Wandel in der Innnovationskultur einer IT-Abteilung eingeleitet wurde

Durch die Einbettung von Design Thinking entstand das so genannte Embedded Design Thinking – ein Konzept, das die Kernelemente von Design Thinking im Unternehmen anwenden lässt. Basierend auf erfahrenen Lerneffekten zeigt die Fallstudie, dass die Implementierung Zeit braucht und durch eine geeignete Projektkonstellation, beispielsweise Business-IT-Alignment, erreicht werden kann.

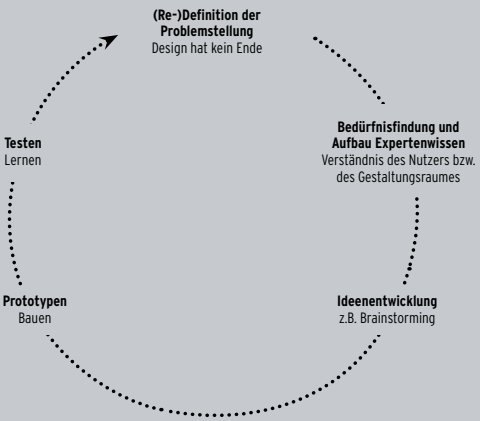
Kundenorientierte Innovation

Wie können die Banken das Kundenerlebnis in einer Beratungssituation verbessern? Als menschenzentrierte Innovationsmethode unterstützt Design Thinking Veränderungs- und Innovationsbemühungen in Organisationen durch vielfältige Methoden, Maßnahmen und Meilensteine. Die IT-Abteilung einer der führenden europäischen Finanzinstitutionen hatte sich zum Ziel gesetzt, diesen Endkundenfokus zu nutzen. Im Rahmen eines Design Thinking-Projektes sollten die Innovationen aus der IT forciert werden.

Durch den Einsatz von Design Thinking sind in der IT-Abteilung der Bank zahlreiche Prototypen und einzelne marktreife Produkte mit starkem Endkundenfokus generiert worden. Gleichzeitig wurde aber auch methodisches Wissen für die Organisation absorbiert. Als Startpunkt für die Ausführungen des vorliegenden Beitrages stand die Schaffung eines neuartigen Konzepts, das so genannte Embedded Design Thinking. Dabei wird die Design Thinking Methode innerhalb des Unternehmens eingesetzt. Die auf dieser Basis entstandenen Projekte werden seit 2009 durch das Institut für Wirtschaftsinformatik der Universität St.Gallen zusammen mit der Bank erfolgreich durchgeführt. Das Konzept beinhaltet ein Rollenmodell, das in den Projekten das Design Thinking-Team, welches die Innovation entwickelt, ins Zentrum stellt. Gleichzeitig soll ein Meilensteinplan die Visibilität der generierten Prototypen und des Konzepts Embedded Design Thinking erhöhen, aber auch das Design Thinking-Team dazu motivieren, eine finale Lösung zu entwickeln. Aus organisatorischer Sicht hängen die Projekte von Embedded Design Thinking an der IT-Abteilung der Bank, welche die Ressourcen dafür frei stellt. Die zu bearbeitenden Problemstellungen (wie z.B. Formularsuche der Zukunft, Beratungsgespräch der Zukunft etc.) für die jeweiligen Projekte werden auch aus den Fachbereichen der Bank identifiziert. Auf diese Weise entsteht eine Projektkonstellation, die nicht zuletzt das Business-IT-Alignment stärkt.

Innerhalb der Embedded Design Thinking-Projekte wurde der Wandel in Richtung einer kundenorientierten Innovationskultur analysiert. Die Lerneffekte sind als Momentaufnahme im Rahmen des kontinuierlich entwickelbaren Embedded Design Thinking zu verstehen. Sie basieren auf drei Jahren Projekterfahrung und auf insgesamt fünf abgeschlossenen Projekten. Begleitend wurden zahlreiche Interviews mit Personen unterschiedlicher Managementstufen durchgeführt und einige Umfragen lanciert. Es wird aufgezeigt, wie Design Thinking in die Strukturen integriert und wie viel Zeit benötigt wird, um einen Wandel im Innovationsverhalten beziehungsweise -verständnis der betroffenen Bereiche innerhalb der Bank zu erreichen.

Abbildung 1
In Anlehnung an Stanford/IDEO Design Cycle (Stanford University, 2011)



Design Thinking als Methode

Design Thinking versteht sich als praxiserprobte und in der Wissenschaft erforschte Innovationsmethode, die kundenorientierte Innovation erbringt und das Unternehmen dabei unterstützen soll, ihre Innovationsprozesse zu verbessern sowie neue Produkte und Dienstleistungen zu entwickeln (Brenner & Witte, 2011). Die konsequente Orientierung an den menschlichen Bedürfnissen, wie bspw. Individualität in der Lösung, basiert auf einem mehreren Iterationen durchlaufenden Zyklus. Dies resultiert in ein aus Kundenperspektive verbessertes Problemverständnis, um die damit verbundenen Lösungsanforderung zu entwickeln.

Im ersten Zyklusschritt erfolgt die Erfassung/Definition der Problemstellung, damit die Teams ihren eigenen Kenntnisstand erhören können. Der nächste Schritt, der Aufbau des Expertenwissens, geht gezielt auf Bedürfnisse innerhalb der Problemstellung, wie beispielsweise Sicherheit oder Transparenz, ein. Die Erfahrung zeigt, dass herkömmliche Befragungen meist Bedürfnisse an die Oberfläche bringen, die nur inkrementelle Innovationen erlauben. Das berühmte Zitat von Henry Ford unterstreicht dies: «Hätte ich die Leute gefragt was sie wollen, hätten sie gesagt: schnellere Pferde.» Die mit anderen Methoden, wie zum Beispiel Shadowing, gewonnen Erkenntnissen bilden dann die Grundlage für die Ideenentwicklungsphase. In dieser Phase werden die Ideen mittels Prototypenbau haptisch umgesetzt. Danach erfolgt das Testen der Prototypen, um diese zu validieren. Die Erkenntnisse des ersten Zyklusdurchganges fließen in das Problemverständnis ein und ermöglichen ein verbessertes Verständnis des Problemkontextes entsprechend des hermeneutischen Zirkels. Das heißt, der Zyklus wird iterativ mehrfach durchlaufen (Vetterli et al., 2011).

«Innerhalb der realisierten Embedded Design Thinking-Projekte wurde der Wandel in Richtung einer kundenorientierten Innovationskultur gezielt analysiert.»

Embedded Design Thinking Fallstudie

Die IT-Abteilung der Bank hatte das Ziel, die Fachbereiche stärker einzubinden und gleichzeitig den voraussichtlichen Endnutzer in den Innovationsprozess zu integrieren. Für die Einbettung waren vor allem auf organisatorischer Ebene Anpassungen notwendig, wie die Implementierung eines Meilensteinplans und des Rollenmodells.

Das Embedded Design Thinking-Projekt

Das in der hier vorgestellten Fallstudie angewandte Embedded Design Thinking-Konzept hat gezeigt, dass die Wahrscheinlichkeit einer Überführung von finalen Prototypen in die Organisation hoch ist. Damit diese Innovationsdiffusion vom Design Team in die Organisation erfolgen kann, wurden spezifische Rollen, wie Brückenkopf, Methoden Coaches, Sponsoren, Professionelle Coaches, Innovatoren-Community und das Design Team selber geschaffen. Diese hatte zum Ziel, die Kommunikation und den Wissenstransfer in die Unternehmung zu unterstützen. Gleichzeitig garantieren sie auch die Ermöglichung der Anwendung von Design Thinking im Unternehmen.

Pro Embedded Design Thinking-Projekt bekommen ein oder zwei Design Teams je eine Problemstellung von einem firmeninternen Sponsor, die innerhalb von 4,5 Monaten zu bearbeiten ist. Die Design Team Mitglieder sind zu 100 Prozent für die Bearbeitung der Problemstellung angestellt und arbeiten in hierfür eigens eingerichteten Räumlichkeiten. Ein klar vorgegebener Meilensteinplan hält die Design Teams zur Entwicklung zahlreicher Ideen und Prototypen an. Daraus resultieren schlussendlich ein bis zwei hochaufgelöste finale Prototypen pro Team.

Meilensteinplan für Embedded Design Thinking

Der Meilensteinplan ordnet den Design Thinking Zyklus (siehe Abbildung 1) in einen Zeitplan ein mit dem Ziel, einen finalen hochaufgelösten Prototyp hervorzubringen. Der Meilensteinplan hatte sich im Vorfeld im akademischen Umfeld seit mehreren Jahren bewährt und wurde für das Embedded Design Thinking übernommen. Im Rahmen dessen wurde festgelegt, dass pro Projekt alle Meilensteine innerhalb von mindestens 4,5 Monaten zu durchlaufen sind.

Der Meilensteinplan basiert auf unterschiedlichen Prototypenarten, die im Verlaufe eines Embedded Design Thinking-Projektes erstellt werden. Diese Prototypenarten werden in zwei Phasen unterteilt. In der ersten, divergierenden Phase, geht es darum, möglichst viele unterschiedliche Ideen zu generieren und dabei den Design Space, den Gestaltungsraum der Problemstellung zu erfassen. Die zweite Phase hat konvergierenden Charakter mit dem Ziel, die erfolgversprechendsten Elemente der vorhergehenden divergierenden Phase zu konsolidieren, um die beste Lösung zu generieren. Dabei wird vor allem eine detailliertere Ausarbeitung dieser besten Lösung in Form eines finalen Prototyps fokussiert (vgl. Übungsbeispiel Tabelle 1).

Jede einzelne Prototypenart ist ein Meilenstein, der eine bestimmte Zielsetzung verfolgt (vgl. Tabelle 1). Die Meilenstei-

Abbildung 2
Embedded Design Thinking – Projektmeilensteinplan

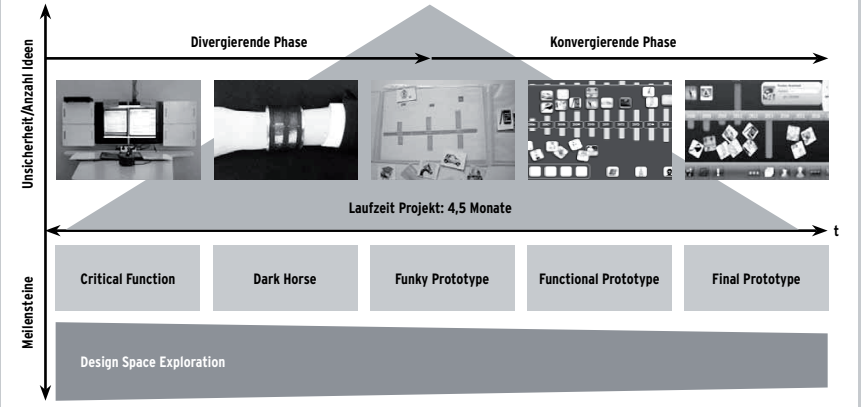


Tabelle 1
Beschreibung Meilensteine anhand eines Übungsbeispiels

Meilensteine	Beschreibung der Meilensteine / Prototypenarten	Übungsbeispiel
Design Space Exploration	Der Design Space oder Projektbereich wird möglichst umfassend abgetastet, um das zentrale Problem zu erfassen.	Beratung in einer Filiale, welche z.B. den Kunden, die Filiale, die Bankberater und die damit zusammenhängenden Prozesse beinhaltet.
Critical Function Prototype	Die kritischen Funktionen sind für die finale Lösung erfolgsrelevant und werden als einzelne kritische Funktion in Form von Prototypen getestet.	Im Rahmen der Beratung wird beispielsweise die Interaktion als kritische Funktion definiert.
Dark Horse Prototype	Im vorhergehenden Meilenstein wurden kritische Funktionen und somit zentrale Annahmen getroffen. Diese werden in dieser Phase umgekehrt, ausgeweitet oder völlig weggelassen. Diese Phase dient der zusätzlichen Erweiterung der Erkenntnisse in der divergierenden Phase, und die veränderten Annahmen müssen wiederum mit den Prototypen getestet werden.	Die Annahme, dass Interaktion innerhalb der Beratung von einem Bankberater geleistet werden muss, wird über Bord geworfen. Die Beratung läuft nun über eine Interaktion zwischen Bankkunden und Bankkunden.
Funky Prototype	Die erste Prototypenart in der konvergierenden Phase soll die besten Elemente der vorhergehenden Phasen in Bezug auf menschliche Bedürfnisse zusammenbringen.	Die vorhergehenden Phasen haben gezeigt, dass u.a. Interaktion am besten über ein Tablet funktioniert. Diese Erkenntnis wird nun mit anderen zentralen Erkenntnissen kombiniert.
Functional Prototype	Der Functional Prototyp zeigt in den Grundstrukturen bereits auf, wie der finale Prototyp funktionieren sollte, allerdings in einer tieferen Auflösung. Der Functional Prototyp lässt aber die finale Version schon erkennen.	Aus der Funky Prototypenart resultiert ein Tablet Beratungsprototyp. Er zeigt Videos zu einer angebotenen Beratungsleistung, die Erfahrungen von anderen Kunden zu dieser Leistung zeigen.
Final Prototype	Der Final Prototype beinhaltet die Erkenntnisse aller Phasen und weist die höchste Auflösungsstufe an Prototypen im Rahmen eines Embedded Design Thinking-Projekts auf.	Der Tablet Beratungsprototyp wird nun so fein ausgearbeitet, dass die Beratungssituation mit Videoeinspielungen maximal nacherlebt werden kann.

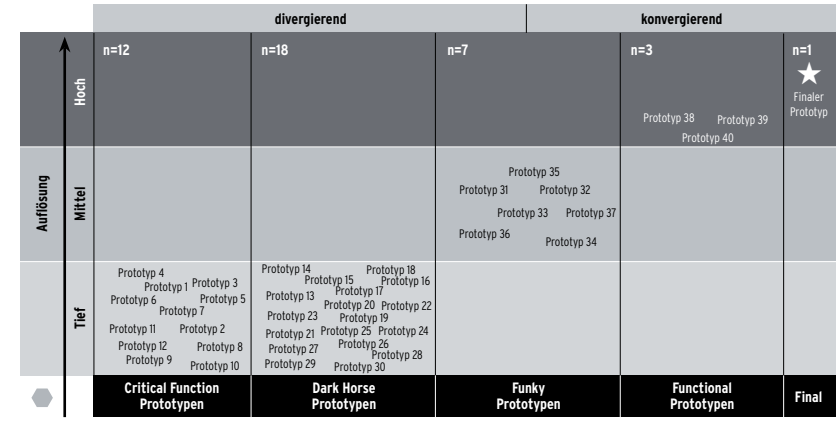
ne haben einen bestimmten Auftrag im Sinne eines verbesserten finalen Prototyps. Die Reihenfolge der einzelnen Meilensteine wurde über Jahre innerhalb des akademischen Design Thinking-Netzwerks validiert. Beispielhafte Meilensteine wurden im Embedded Design Thinking-Projekt durchlaufen (vgl. Tabelle 1). Der beiliegende Fall illustriert ein Übungsbeispiel aus dem Bankenumfeld. Aus Vertraulichkeitsgründen darf hier kein Beispiel der Bank genannt werden.

Die einzelnen Prototypenarten werden nacheinander erstellt. In der ersten, divergierenden Phase werden pro Meilenstein mehrere Prototypen gebaut, jeder mit einer unterschiedlichen Ausrichtung, um die einzelnen Aspekte einer möglichen Lösung zu testen. Nachfolgende Abbildung 3 zeigt exemplarisch, wie sich die Anzahl der Prototypen über den Verlauf des Projektes verändert.

«Jede einzelne Prototypenart ist ein Meilenstein, der eine bestimmte Zielsetzung verfolgt.»

Sobald die Phase des Dark Horse Prototype durchlaufen und die Projektphase des Funky Prototype eingeläutet ist, wird ersichtlich, wie gleichzeitig der Wechsel von der divergierenden

Abbildung 3
Darstellung Prototypen im Projektverlauf



zur zweiten konvergierenden Projektphase erfolgt und die Anzahl der Prototypen sinkt, so dass schlussendlich ein bis zwei finale Prototypen entstehen.

«Durch den Embedded Design Thinking-Prozess ergab sich eine Verschiebung der IT gegenüber dem Fachbereich, da nun beide Seiten Endkundenkontakt hatten.»

Rollen innerhalb des Rollenmodells

Unter dem Rollenmodell wird eine Visualisierung verstanden, die den Zusammenhang zwischen den definierten Rollen im Embedded Design Thinking-Projekt zeigt (vgl. Abbildung 4). Basierend auf der jeweiligen Definition haben alle Rollen zum Ziel, Design Thinking nachhaltig zur Implementierung zu verhelfen und das damit einhergehende Innovationsverständnis zu festigen. In Bezug auf Prototypen soll vor allem die Innovationsdiffusion aus dem jeweiligen Design Thinking-Projekt in die Unternehmung forciert werden. Die Rollen in einem Embedded Design Thinking-Team sind in Tabelle 2 ausführlich dargestellt.

Lerneffekte aus Embedded Design Thinking

In den drei Jahren Embedded Design Thinking wurde jedes Jahr ein Projekt aufgesetzt, das ein bis zwei Teams beinhaltete, die an unterschiedlichen Problemstellungen arbeiteten. Ergebnisse aus diesen Projekten waren je ein bis zwei finale Prototypen pro Team und zahlreiche weniger hoch aufgelöste Prototypen. Die folgenden Ausführungen zeigen zentrale Lerneffekte aus dreijähriger Erfahrung mit Embedded Design Thinking:

- **Projektkonstellation innerhalb von Embedded Design Thinking führte zur Förderung des Business-IT-Alignments**
  Typischerweise ist die IT-Abteilung der Zulieferer für die Fachbereiche. Durch die Konstellation im Rahmen des Embedded Design Thinking ergab sich eine Verschiebung der IT gegenüber dem Fachbereich, da nun beide Seiten Endkundenkontakt hatten. Diese Verschiebung steht in direktem Zusammenhang mit dem Embedded Design Thinking-Projekt, das den eigenständigen und direkten Zugang zum Endkunden für die IT-Abteilung ermöglichte. Durch die Integration von Problemstellungen aus den Fachbereichen ergab sich gesamthaft eine Win-Win-Situation. Die Prototypen der Design Thinking-Teams waren allesamt bereits

Abbildung 4
Rollenmodell des Embedded Design Thinking

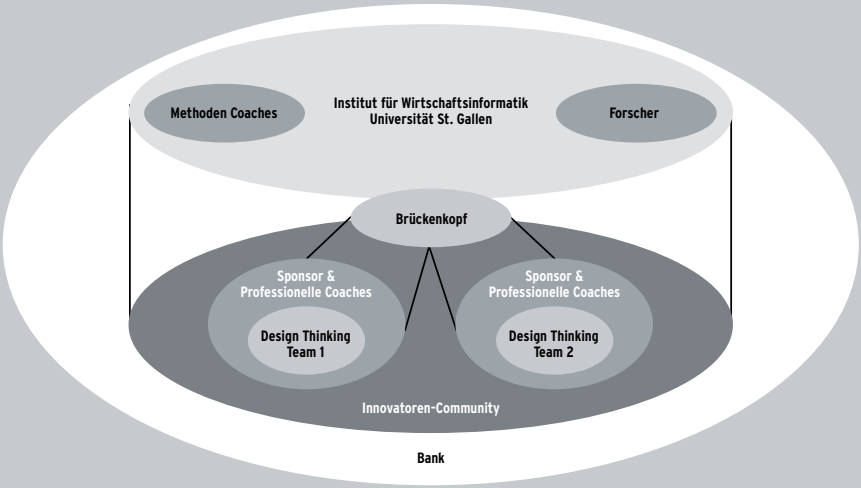
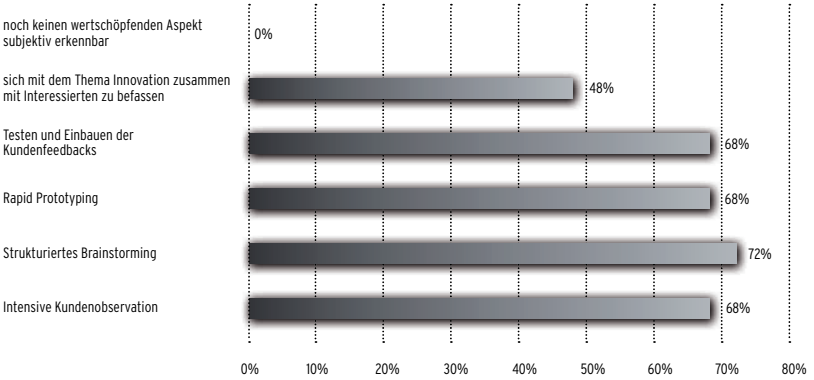


Tabelle 2
Eigenschaften der einzelnen Rollen des Rollenmodells

Rolle	Eigenschaft
Design Thinking Team (DT Team)	Die Design Thinking-Teams standen im Zentrum des jeweiligen Embedded Design Thinking-Projekts und bearbeiteten die vordefinierten unterschiedlichen Problemstellungen. Die Auswahl der Teammitglieder (Hochschulabsolventen, die explizit für dieses Projekt gewonnen wurden) erfolgte nach Bank- und Design Thinking spezifischen Kriterien (siehe hierzu auch Wilde, 2007 & Rath, 2007).
Brückenkopf	Der Brückenbauer war damit beauftragt, die Aufgleisung und Durchführung des Projekts operativ durchzuführen. Das beinhaltete sowohl die Koordination der Kommunikation, als auch die Verzahnung des Design Teams mit der Organisation.
Sponsor & Professionelle Coaches	Der Sponsor gab die Problemstellung in Auftrag und betraute die ausgewählten Professionellen Coaches damit, ihr Expertenwissen situationsabhängig mit den Teams zu teilen. Für eine fachlich-adäquate Unterstützung erhielten diese Personen eine methodische Einführung («Boot-Camp») zu Beginn des Projekts und nahmen an Methodenworkshops während des Projekts teil.
Innovatoren Community	Die Innovatoren-Community bestand aus einem breiten Feld an innovationsinteressierten Mitarbeitern der Bank und bildete einen äußeren Kreis um das Design Team und die Professionellen Coaches. Die Community wuchs über die Jahre hinweg auf eine Anzahl von ca. 80 Mitgliedern.
Methoden Coaches & Forscher	Die jeweils zwei Methoden Coaches vom Institut für Wirtschaftsinformatik der Universität St. Gallen besetzten eine Doppelrolle: Zum einen ermöglichten sie die Vermittlung und Sicherstellung der Methode und zum anderen begleiteten sie das jeweilige Projekt durch ihre Forschungsarbeiten. Außerdem waren sie dafür verantwortlich, den Teams für die Erarbeitung von Prototypen größtmögliche Freiheiten einzuräumen, ihnen methodische Unterstützung anzubieten und die Teamdynamik durch gezieltes Coaching zu optimieren. Diese Rolle war die einzige, welche unternehmensextern besetzt war.

Abbildung 5
Mehrwert von Design Thinking (N=25)



durch Endkundenkontakt validiert und konnten vom Fachbereich übernommen und gleichzeitig in die Umsetzungsphase überführt werden. Trotzdem wurden jeweils nicht alle Prototypenelemente des finalen Prototyps in der Umsetzungsphase übernommen. In Zukunft sollte vertieft analysiert werden, welche Stellhebel zu einer vollständigen Übernahme aller zentralen Elemente des Fachbereichs führen könnten, um das Business-IT-Alignment zusätzlich zu verstärken.

«Es sollte tiefer analysiert werden, welche Stellhebel zu einer vollständigen Übernahme aller zentralen Elemente des Fachbereichs führen könnten.»

- **Gezielte Kommunikation stärkt die Stellung von Embedded Design Thinking im Unternehmen**
  Der innovativste Prototyp nützt in Unternehmen wenig, wenn er nicht entsprechend kommuniziert wird. Dieser Tatsache wurde mit einem Kommunikationskonzept Rechnung getragen. Das Ziel war, die Innovationsdiffusion vom Design Team in die Organisation über die Innovatoren-Community anzutreiben (Cohen & Levinthal, 1990; O'Neill et al., 1998). Dies war deshalb wichtig, da die Design Teams stark isoliert vom Alltagsgeschäft arbeiteten. Intensive und kontinuierliche Kommunikation war notwendig, um die Sensibilität für das Thema Innovation durch Design Thinking und den einzeln erarbeiteten Prototypen zu fördern. Abbildung 5 zeigt, dass die zentralen methodischen Elemente von Design Thinking als sehr wertschöpfend empfunden werden:

- **Die Open Door Policy**
  Die Teams bewegten sich in einem Start-up ähnlichen Umfeld mit eigener Budgetverantwortung und eigenen Räumlichkeiten. Interessierte Mitarbeiter der Bank konnten jederzeit die Arbeitsräume der Teams betreten, um z.B. Prototypen zu testen und Feedback zu einzelnen Funktionen der Prototypen zu geben. Die Open Door Policy wurde v.a. aufgrund der Arbeitsbelastung der Community Mitglieder aus dem Alltagsgeschäft nur von wenigen Personen genutzt. Dies deckt sich mit den Erkenntnissen aus der Forschung, dass die Arbeitsbelastung des Alltags häufig als ein Grund für Schwierigkeiten der Verbreitung des Change betrachtet wird. (Christensen, 1997; Doppler & Lauterburg, 2007)

- **Die Kommunikation mit den Design Thinking Teams**
  Die Design Thinking-Teams bauten sich ein Netzwerk im

Unternehmen auf und konnten auf zahlreiche persönliche Kontakte zurückgreifen. Zusätzlich kommunizierte der Brückenkopf tagtäglich informell über elektronische Kanäle (E-Mail, internes Facebook etc.) sowie persönliche Kontakte. Die Kommunikation erfolgte stark situationsgetrieben. Die Community Mitglieder kommunizierten meist direkt mit beiden Teams, da beide Problemstellungen inhaltlich nahe beieinander lagen.

- Die Meilenstein-Präsentationen
  In diesen Präsentationsterminen wurden Zwischenergebnisse, wie beispielsweise die Dark Horse Prototypen, und methodische Einführungen zum Dark Horse präsentiert und diskutiert. Die Professionellen Coaches nahmen an allen Meilenstein-Präsentationen teil. Die Community Mitglieder wünschten sich nebst der Teilnahme an Meilenstein-Präsentationen detailliertere Informationen zu den einzelnen Teams und deren Ideen, z.B. über einen regelmäßigen Newsletter. Dies hätte vermutlich zu einem noch besseren inhaltlichen Verständnis zu den einzelnen Lösungsansätzen geführt.

- Der Wissenstransfer benötigt Zeit
  Für den Wissenstransfer wurden Workshops für Professionelle Coaches und methodische Workshops für Interessierte der Innovatoren-Community organisiert. Die Inhalte definierten sich über die methodischen Elemente von Design Thinking. Zusätzlich wurde an den Meilensteinpräsentationen ein methodischer Block eingebaut, um den Wissenstransfer zu fördern. Dies führte insgesamt dazu, dass 96 Prozent der Befragten eine Möglichkeit sahen, Elemente aus dem Design Thinking auf die tagtägliche Arbeit zu übertragen.

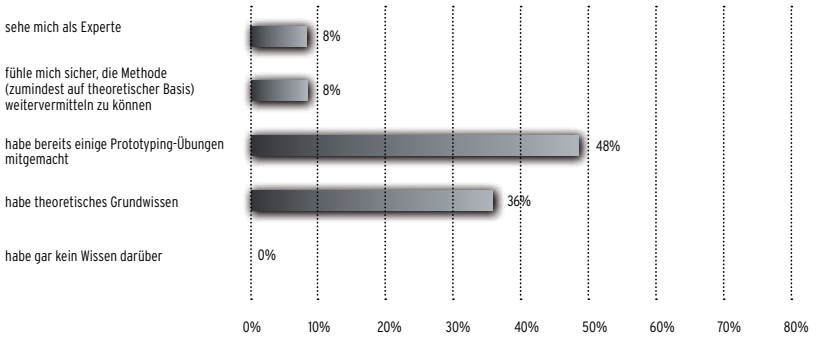
  Nichtsdestotrotz war der Transfer auf die tägliche Arbeit nicht immer möglich. Ausbildungsmodule, in denen die einzelnen Elemente auf den konkreten Arbeitsalltag des jeweiligen Interessierten angewendet werden, hätte die Adaption vereinfacht. Interessanterweise zeigt die Abbildung 6, dass sich die meisten Community Mitglieder eines gewissen theoretischen Grundwissens sicher fühlen (26 Prozent). Acht Prozent der Befragten sagten aus, dass sie die Methode weitervermitteln könnten und weitere acht Prozent bezeichneten sich sogar als Experten.

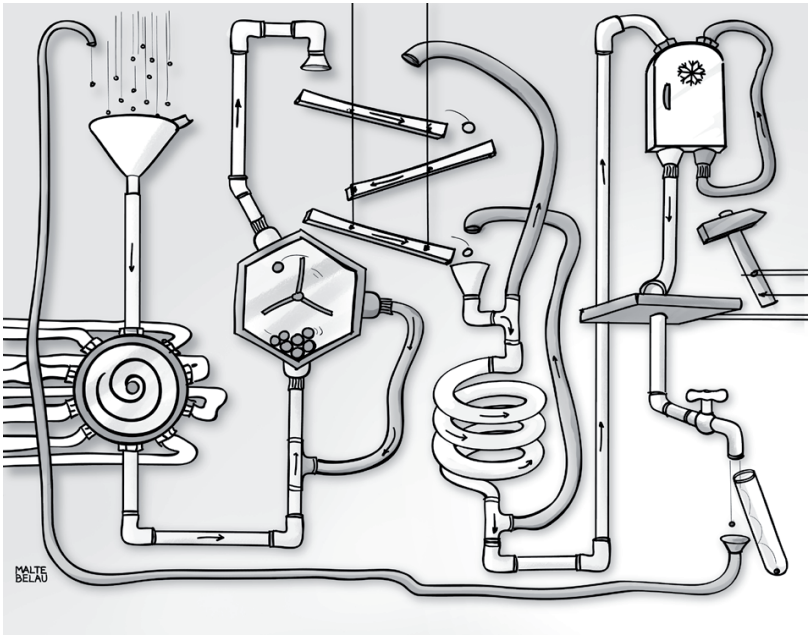
  Nach drei Jahren zeigt sich, dass einzelne Kernelemente der Methode angewendet und das Innovationsverständnis durch Embedded Design Thinking sicherlich in der IT verstärkt wurde. Trotzdem sollte beachtet werden, dass gemäß dem Sprichwort: «Steter Tropfen höhlt den Stein» jeder Wissenstransfer Zeit benötigt.

Das Rollenmodell und die enthaltenen Rollen haben sich bewährt

Über den Verlauf der letzten drei Jahre entstand für jede Rolle ein klares Profil. Die Einbindung gewisser Rollen in Aufgaben-

Abbildung 6
Einschätzung Wissen über Design Thinking (N=25)





gebiete der Embedded Design Thinking-Projekte forcierte den Wandel der Innovationskultur. Diese Personen erhielten mit Design Thinking ein Werkzeug, um Innovation greifbar zu initiieren. In Bezug auf den Unternehmenswandel nahmen die Rollen ihre Aufgaben vor allem hinsichtlich zweier Punkte wahr: Die Verbreitung der Prototypenideen und die Verbreitung des menschenzentrierten Design Thinking Innovationsverständnisses. Besonders hervorzuheben ist die zentrale Rolle der Community Mitglieder, die sich v.a. als Botschafter für die Methode und des Konzepts Embedded Design Thinking verstehen. Mit dem klaren Rollenmodell und der Sprechung zentraler Ressourcen, wie die des Brückenkopfs und beispielsweise zehn Prozent der Arbeitszeit von Professionellen Coaches, konnte die Gefahr eines Scheiterns des Embedded Design Thinking minimiert werden (vgl. Christensen, 1997; Doppler & Lauterburg, 2007).

Resümee

Der Artikel zeigt wie Design Thinking erfolgreich in die IT-Abteilung einer Großbank eingebettet wurde. In drei Jahren Embedded Design Thinking konnten wir feststellen, dass die in der Bank implementierte Projektkonstellation für Embedded Design Thinking das Business-IT-Alignment stärkt.

Der Transfer des methodischen Verständnisses von Design Thinking in die Organisation benötigt kontinuierliche Anstrengungen. Es braucht dementsprechend Zeit, bis das Wissen absorbiert werden kann. Das implementierte Rollenmodell mit seinen definierten Rollen und deren Beziehungen zueinander begünstigen dabei die Innovationsdiffusion. Somit kann letztendlich auch die Umsetzungswahrscheinlichkeit eines finalen Prototyps erhöht werden. Damit jedoch kundenorientierte Innovation geschehen kann, müssen vor allem Freiheiten gewährt werden. Die im Rahmen des Embedded Design Thinking unternommenen Bemühungen lassen den Design Teams den Raum, intellektuell wie physisch, innovative Lösungen zuzulassen. Der Meilensteinplan, das Rollenmodell sowie die bewusste Kommunikation über Embedded Design Thinking können jedoch die richtigen Rahmenbedingungen für tiefgreifende Innovation nicht vollständig kompensieren. Aus Managementsicht bedeutet dies konkret die Reduzierung von Ma-

nagementstrukturen, was unvermeidlich zu Kontrollverlust und Verunsicherung führt. Der Versuch, Design Thinking den Unternehmensprozessen anzupassen, kann eine Reaktion von Seiten des Managements sein. Dies kann die Anwendung von Design Thinking einschränken und so das Potenzial für radikale Innovation reduzieren.

Embedded Design Thinking ist die Einbettung von Design Thinking in eine bestehende Organisation, die das Schaffen von Freiräumen ermöglicht, Innovationen und Veränderungen fördert und eine intensive Einbeziehung der Mitarbeiter erfordert. Trotz unserer ersten Ergebnisse bedarf es weiterer intensiver Forschung, um die Erfolgsfaktoren für eine nachhaltige Implementierung zu identifizieren und langfristig zu sichern.

Christophe Vetterli

Wissenschaftlicher Mitarbeiter/ Doktorand am Institut für Wirtschaftsinformatik der Universität St. Gallen

Kontakt:
christophe.vetterli@unisg.ch

Prof. Dr. Falk Uebernickel

Assistenzprofessor und Projektleiter am Institut für Wirtschaftsinformatik der Universität St. Gallen

Kontakt:
falk.uebernickel@unisg.ch

Prof. Dr. Walter Brenner

Geschäftsführender Direktor des Instituts für Wirtschaftsinformatik der Universität St. Gallen

Kontakt:
walter.brenner@unisg.ch

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How Deutsche Bank's IT Division Used Design Thinking to Achieve Customer Proximity

Design thinking is a customer-centric approach for integrating end customers in the innovation process. This article describes the evolution of design thinking in Deutsche Bank's IT division and its role in solving specific problems, better integrating the business and IT divisions, and bringing the bank's IT closer to its customers. The lessons learned can be used by CIOs and other business leaders striving for customer-centricity in their value-creation processes.[1,2]

Christophe Vetterli
Institute of Information Management of University of St. Gallen (Switzerland)

Falk Uebernickel
Institute of Information Management of University of St. Gallen (Switzerland)

Walter Brenner
Institute of Information Management of University of St. Gallen (Switzerland)

Charles Petrie
Institute of Information Management of University of St. Gallen (Switzerland)

Dirk Stermann
Deutsche Bank AG (Germany)

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Customer-Centricity is a Challenge for Banks

Customers need to have more trust in their banks, and to achieve this there needs to be more transparency in the way banks deliver products and services. One way of gaining trust is to incorporate customer-centricity in the innovation process and to provide information about the risks and potential benefits of a specific service. Despite a clear need for customer-centricity, banks (and other large companies) face barriers in fully taking account of customers' needs in their innovation processes.

Banks need to develop a deep understanding of customers' needs and be able to address customer concerns as they develop new services. This raises the question as to when banks should involve their customers in the development of new products and services. At present, they do not involve potential customers until they present them with finished, "perfect" solutions. However, banks would have a lot to gain if potential customers were engaged with unfinished solutions or prototypes and could therefore challenge ideas throughout the development process. Although this approach has succeeded in many other industries, it is rare in the banking sector.

Moreover, even if bank customers are involved in the innovation process, they typically engage with a specific business division (e.g., the retail banking division) but rarely, if ever, with divisions such as IT. These divisions are instead involved only in the later stages of the innovation process, such as during implementation. Understanding and conveying the details of customer needs to a bank's IT division is complex. As the information passes from the business division to the software architect, to the coder and so on, misunderstandings and distortions can occur (as in "Chinese whispers").

The complexity of ensuring that IT fully understands customers' needs is at the heart of why integrating IT with business operations in large companies remains a major challenge. To address this challenge, the IT division needs to interact directly with potential customers and understand their needs as much as the business division does, so that both can build a common understanding of customers and their needs.

A problem that many banks now face is that customers receive very attractive financial services offerings from new, non-traditional, players. In fact, over 50% of the innovations in the financial sector are being made by non-traditional institutions.[3] This means that banks' traditional development and innovation processes have to compete with the research and development environments of non-banks. Large technology players such as Google or Apple, which have acquired banking licenses, are starting to make inroads into the banking sector. Startups are targeting the financial services industry as well; these are highly agile organizations that can quickly bring to market powerful customer-centric services.

To respond to these challenges, traditional banking institutions clearly have to get better at innovation. Understanding this need, Deutsche Bank adopted an approach—based on the principles of design thinking (DT)—to increase its IT division's involvement with customers as new products and services were being developed. This approach allows the IT division to get customer feedback on quickly developed, and incomplete, prototypes of new services. It's the IT equivalent of the bank's highly agile

[3] Oliveira, P. and von Hippel, E. "Users as service innovators: The case of banking services," *Research Policy* (40:6), 2011, pp. 806-818.

DT team testing out rough ideas, in the form of cardboard prototypes, at a German train station.

This article first provides an overview of the key elements of design thinking—a customer-centric approach for integrating end customers in the innovation process. (The research method used to create this case study is described in the Appendix.) We then explain how design thinking was embedded in Deutsche Bank and describe the radical changes the approach offered to the bank. Finally, we summarize the lessons learned from adopting design thinking at Deutsche Bank, which are valuable not only for CIOs but also for other leaders in large organizations.

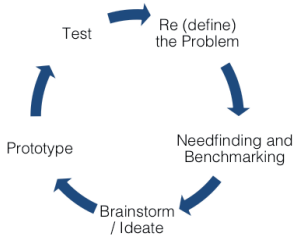
Key Aspects of Design Thinking in a Corporate Context

Design thinking is a well-tested approach that enables organizations to see the world through the eyes of their customers. Applying the approach in the IT division will help CIOs and their teams to better understand the needs of end customers. Although the DT methodology has too many components and principles to describe here fully,[4] there are a few that must be mentioned to understand why it was both helpful and challenging for Deutsche Bank.

[4] The following give a broad overview of design thinking: Cross, N. *Design Thinking: Understanding How Designers Think and Work*, Berg, 2011; Martin, R. L. *The Design of Business: Why Design Thinking is the Next Competitive Advantage,* Harvard Business Press, 2009; Brown, T. *Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation,* Harper Collins, 2009; and the four *Design Thinking Research* volumes from HPI/Stanford published between 2010 and 2014. See also, Vetterli, C. *Embedded Design Thinking in Organizations: A Literature Review,* University of St. Gallen, 2015.

Customer-centricity involves a systematic and iterative discovery of customer[5] needs[6] (which may be latent). A key aspect of customer-centricity is that end customers are continuously integrated into the organization's innovation process in a way that deepens the company's knowledge about end customers' contexts, needs and motivations. The design thinking approach enables the organization to receive continuous feedback from end customers, thereby giving it access to their real needs beyond what they might have initially stated. Figure 1 shows how a potential customer is systematically involved in the iterative needs-discovery process. The process is illustrated below by a fictional example from the banking industry.

Figure 1. Needs-Discovery through the Design Thinking Cycle[7]



The first step of the cycle focuses on a "wicked problem"[8] or a situation where the company feels it lacks customer-centricity. In the banking industry, such an issue might

[5] "Customer" refers to the person or group that will be using the developed service/product, and can be internal or external. For the rest of this article, we use the term "end customer" (of the solution).
[6] Plattner, H., Meinel, C. and Leifer, L. *Design Thinking: Understand – Improve – Apply (Understanding Innovation),* Springer, 2010.
[7] Source: Mechanical Engineering Class 310 of Stanford University (ME310), which has had a decisive influence on the global design thinking movement. The design cycle originated as part of ME310 and serves as base for many other authors and publications (see http://web.stanford.edu/group/me310/me310_2014/about.html).
[8] Wicked problems are defined in Buchanan, R. "Wicked Problems in Design Thinking," *Design Issues* (8:2), 1992, pp. 5-21.

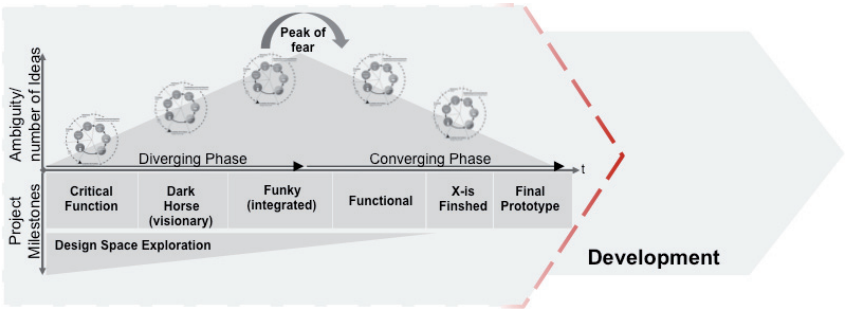
be whether physical credit cards will still be needed by the year 2020. The next step, *needfinding,* then focuses on and explores the credit card context via observations of end customers and involved parties, interviews, experiencing credit card usage and so on. This step creates "instant expertise" about credit-card-related issues. Needfinding may also delve more deeply into the context of end customers' liquidity issues (their need for easy access to funds to pay for something), or even the issue of lending. A need that might emerge could be the need for liquidity in any situation. This would most probably vary around the globe, depending on whether the customer is on the streets of Zurich, at the flower markets of Bangkok or at the shopping center in an African airport.

The next step, *brainstorming,*[9] focuses on generating a large number of ideas for several needs, one of which might be the need for customers to have easy access to funds at all times. Ideas might include a smartphone application or a mobile money printing machine. Instead of discussing these ideas out of context, they are prototyped in a tangible way so they can be directly tested by end customers. This tangibility provides immediate feedback from (future) end customers. Suddenly, unexpected problems might emerge, such as the battery of the smartphone dies when the customer is standing at the cashier or the mobile printing machine can only print money in one currency. This feedback often help revise the team's assumptions about customers' needs as well as the initial problem.

In fact, a failed prototype can be as valuable as one that is close to a future solution. The iterations through successive prototypes will provide deeper insights into everything

from who the customers are (for instance, by building personas), to the ideal customer journey (a common question would be, "And then what would you have?"), and to what concrete solutions need to be built (by making tangible value-proposition prototypes) to ideally address the identified customer needs. This process, called rapid prototyping, not only helps test ideas concretely, it also helps the company understand its customers' future needs and to put the customer continuously at the center of its efforts. The sequence of designed tangible prototypes follows the milestone-oriented project structure shown in Figure 2.

Figure 2. Milestone-Oriented Design Thinking Project Structure



The diverging phase allows an in-depth exploration of the consequences of various potential solutions. The "Dark Horse" milestone explicitly moves the solution search outside of what might be normally considered reasonable; the result is that DT teams often hit on successful solutions that were previously considered to be too "crazy." The diverging phase is followed by the converging phase, which integrates all the knowledge

[9] Brainstorming is one way of ideating for creative ideas. Other methods include brainwriting, bodystorming, 6-3-5 Methods, braindrawing etc.

acquired in the diverging phase. One or two of the prototype solutions are created in depth before traditional IT development begins, which means the idea has been developed in depth before programming begins. Table 1 summarizes the prototype milestones. A DT project will involve several systematic needs-discovery iterations through these milestones.

Table 1. Design Thinking Milestone Descriptions

Milestone	Description
Design Space Exploration (ongoing)	The problem design space is explored (concurrently with the following milestones)
Critical Functions	Critical functions are extracted from the problem space that need to be integrated in the ultimate solution
Dark Horse (visionary)	Previous assumptions are challenged to explore unlikely-to-succeed ideas, knowing that if they succeed the performance payoff will be relatively large
Funky (integrated)	The most successful elements from the previous milestones are connected; this milestone includes roughly connected concepts
Functional	The first concrete preview of the ultimate solution that integrates working functionalities is developed
X-is Finished	One key functionality, 'x', is completed
Final	The final prototype includes the solution for one/several key identified needs and delivers the experience of using the real product (even before development starts)

The team creating prototypes of future services should be carefully constructed to include people with diverse backgrounds (in terms of, e.g., personality and education). The quest for diversity is typically a big challenge for a large company's HR department, since it is usually involved in highly focused profile searching. However, including diverse personalities and different professional backgrounds—such as business, IT, HR and marketing, and also potential end customers—allows companies to overcome the limitations of their organizational silos.

It is crucial that all prototypes are tangible. Experts and end customers frequently misunderstand each other right up to when the product is in the development phase. Rapidly produced, tangible, prototypes provide a way to ground communications not only between team members but also between team members and end customers. Further, developing successive prototypes guarantees the team explores the greatest number of innovation opportunities.

Design thinking poses some specific challenges in addition to those already faced by companies pursuing innovation initiatives, especially in the area of end-customer proximity. At present, in most large firms, especially banks and their IT divisions, developers are not in contact with end customers. Further, IT divisions are accustomed to having requirements delivered to them at the start of a project without questioning them. With the DT approach, project requirements are not only revised but continually develop as the understanding of customers' problems increases through iterative prototyping and discussions with customers. This results in a refined set of requirements that may be very different from what was initially thought.

Another challenge of the DT approach to innovation is that it goes against companies' desire to be "lean" and minimize waste. DT requires resources to be allocated to exploring new ideas, many of which will be abandoned. Moreover, the approach encourages "fail early and often," which runs directly counter to most business practices, especially in IT. Middle-European companies, which interpret failure as a sign of weakness and even of incompetence, find it particularly difficult to overcome this counterintuitive mindset. Thus, developing prototypes that could lead to failure is not usually perceived as worthwhile.

In summary, the DT approach is a valuable option but it can be hard to implement in large organizations. Providing the IT division with direct proximity to end customers is very different from current innovation practices. The case study of how Deutsche Bank faced the challenges of adopting the DT approach in its IT division provides insights into an evolutionary path for embedding this approach in IT operations.

Embedding Design Thinking In Deutsche Bank's IT Division

Deutsche Bank is a large multinational bank headquartered in Frankfurt, Germany. Founded in 1870 in Berlin, it is the largest bank in Germany and the largest currency dealer worldwide. The Group, Technology & Operations (GTO) division is the bank's "DNA." GTO provides the processes, systems, data and infrastructure needed for running the bank, enabling it to thrive in the market. GTO has about 24,000 employees, representing over 20% of Deutsche Bank's total full-time-equivalents (the bank has about 100,000 employees worldwide).[10] It is not surprising that design thinking, as a catalyst for change within Deutsche Bank, began in GTO.

In 2008, the bank's IT2B Director, who was responsible for business-IT alignment, started focusing on the problem of the IT division delivering solutions to the business divisions without being in touch with end customers. Though this is common in modern industry, he found it to be a very unsatisfactory situation. He was concerned about how the IT division could supply products and services to the business without having any idea of what end customers really wanted, or how the solutions it provides are actually

[10] As of 2013.

deployed. He was convinced that, to enable customer proximity and the alignment of IT and business, end customers must be involved directly at the intersection of business and IT.

The IT2B Director received substantial support from the CIO, who agreed that end customers' perspectives should have more influence on the business to enable it to deliver customer-centric innovations. Deutsche Bank's vision at that time was to be the leading customer-centric, global universal bank[11] with a focus on innovation. The IT division started to rethink how, on the one hand, end customers could be better embedded within customer-bank interactions and, on the other hand, how the CIO could get the IT division closer to the business processes. The CIO was aware that he needed to work intensively with the bank's end customers.[12] He determined that the DT approach should first target the redesign of branch advisory processes in retail banking, where he knew that new technologies can be easily implemented. Because the bank had not used DT previously, this first DT-driven innovation was, in essence, trying out DT.

Deutsche Bank's IT2B Director had an excellent IT background, and he recognized the increasing importance of IT for the banking industry and the growing competition from non-financial industries. He reached out to the University of St. Gallen, Switzerland, and its Institute of Information Management (IWI-HSG), to discuss the possibility of putting the IT division in direct contact with the bank's end customers. This was the starting point of embedding design thinking in Deutsche Bank's IT

[11] The vision is available at https://www.db.com/en/content/company/Vision-and-Brand.htm
[12] Weill, P. and Woerner, S. L. "The Future of the CIO in a Digital Economy," *MIS Quarterly Executive* (12:2), 2013, pp. 65-75.

division. Embedded design thinking is the integration of DT in a company that focuses on continuous end customer integration and continuous needs-discovery, that follows successive prototyping phases, that adapts its organizational structure and that uses diverse team staffing. The Deutsche Bank projects described below illustrate how design thinking can be adapted for use within the financial services industry.

The Evolution of Design Thinking Within Deutsche Bank

The evolution of the still-developing design thinking practices at Deutsche Bank has, to date, spanned six years and many projects, communication initiatives, employee skill-building measures and the fostering of a common customer understanding. The key to success was to start with small projects and small teams, and then constantly grow the adoption of DT. This evolution can be divided into three phases: learning, adapting and diffusing. All three phases are characterized by the dimensions given in Table 2.

Table 2. Evolution of Design Thinking at Deutsche Bank

Dimension		Evolution Summary		
		Phase 1: **Learning** (year 1-2)	Phase 2: **Adapting** (year 3)	Phase 3: **Diffusing** (year 4 onwards)
Organizational structure	Strength of connectivity between DT project structures and organizational structures	Weak—isolated from other initiatives	Stronger—simplifying DT elements for use and company projects	Strong—core management of all DT projects
	Project staffing of the DT team	Externally hired interns	Externally hired interns mixed with internal staff	Mixed team: externally hired interns; externally hired interns with internal staff; internal staff
Developing customer proximity mindset	Employee design thinking capabilities	Key tools and interdependencies of tools	Understanding of holistic customer-centric innovation approach	Development of skillset for future work
	Understanding of customer integration	Singular exchange points	Institutionalized in DT projects	Institutionalized beyond DT projects
	Focus of DT	Business-IT alignment	Fostering customer-centricity and understanding customers	Application beyond DT projects
Triggers of evolution	Triggers for each phase	Visibility of tangible project milestones and their outcomes Strong sponsorship from strategic level Externally coached learning for quick internal learning Speed of development	Simplifying DT project structure for different project needs Transfer of DT staff to development staff (especially after DT projects) Systematically managed and taught innovation community	Visibility of DT as methodology and innovation hub Standardization of DT toolbox DT principles taught at executive level, operational level, IT division and business division

Projects	See detailed descriptions in boxes	E.g., Financial timeline (2009)	E.g., Accessing stored documents (2011)	E.g., Attracting new brokerage clients (2013)

Phase 1: Learning

Deutsche Bank started its DT journey in 2008 with a focus on fostering business-IT alignment. Although several alignment efforts had previously been initiated, none were successful or sustainable. Retrospectively, one key reason for this was that the IT division had not had any contact with end customers. DT provided a promising approach for involving end customers in the IT development process and thus fostering alignment. Due to resource scarcity, the set-up process for this new approach needed to be lean with a minimum of resources.

One difficulty was the requirement for every member of the newly created DT team to be assigned full time. Because the DT initiative was disconnected from all other projects, assigning three to five internal staff working on current projects and jobs would have been very difficult, given the short ramp-up time. At that time, Deutsche Bank wanted to learn about design thinking and decide if it could add value in the future. The IT division therefore hired interns for the first DT project. This decision also provided the opportunity to hire people (such as engineers, designers, physicians etc.) who did not have the typical profile of bank employees. The interns brought with them a fresh spirit and outlook; none of them had banking qualifications or had previously worked in the banking industry. This made it easier for them to get to grips with the new DT approach. Innovation was crucial at this point in the evolution of DT at Deutsche Bank.

The DT team, which comprised three to four people, was multidisciplinary. Experience of using the DT approach for innovation in other industries showed that mixed teams of this size were crucial for success. The downside of hiring interns, however, was that the DT team did not have a pre-existing network for accessing and interacting with the bank's staff.

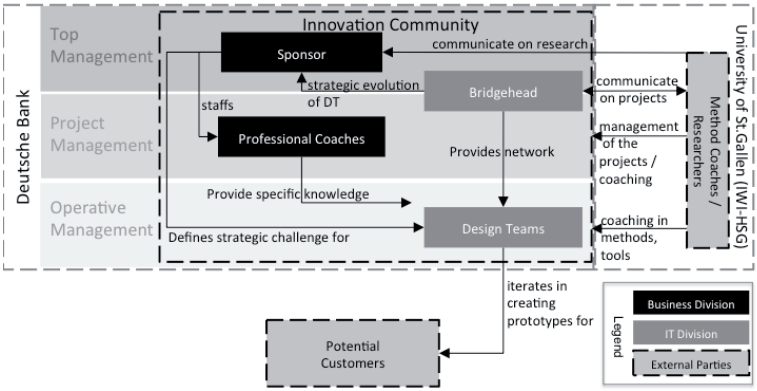
Table 3 provides an overview of all the roles involved in the evolution of design thinking at Deutsche Bank. Figure 3 shows how the roles relate to each other. This structure tapped into the full potential of end customer integration and thus helped to overcome the constraints of the company's divisional silos. This role model, with the DT team at its heart, defined the completely disconnected DT project structure from the very beginning of the embedding evolution.

Table 3. DT Role Descriptions

Role Descriptions
DT Team Applying the DT methodology to relevant strategic challenges at the core of all activities to create a final prototype
Bridgehead Responsible for the internal strategic evolution of DT. Also responsible for connecting the DT teams with the organization and vice versa through networking
Sponsor Representing top management, defining the challenge (with other members of the top-management panel) and assigning professional coaches to the DT teams
Professional Coaches Providing specific know-how and expertise to DT teams and attending DT teams' activities (presentations, workshops etc.)
Innovation Community Not formally assigned to DT projects, but showing interest in DT activities via attendance at (educational) workshops, communication activities (presentations, newsletters etc.), spreading DT information by word of mouth; involves all internal roles at the bank

Method Coaches (initially external but later internal) Responsible for educating Deutsche Bank staff in the DT methodology and communicating method-related issues
Researchers (external) Identifying findings from DT projects and reintegrating the findings in future projects

Figure 3. DT Organizational Structure Showing Role Interdependencies



The bridgehead role served as a network and communication hub between the DT team and the rest of the organization especially ensuring that the team had space to work in free from interference by the usual stakeholders. Additionally, this role (in collaboration with the university) was responsible for the internal evolution of applying the DT methodology to meet the company's needs. Other organizational DT roles were situated at different organizational levels. The sponsor role provided the strategic perspective and was located in the business department, not in IT, for business-IT alignment reasons. Sponsors included professional coaches who provided situational internal expert knowledge for the DT teams. The researcher and method coach roles were performed by people from the university's Institute of Information Management, who were responsible for educating Deutsche Bank personnel performing the other DT

roles, all of whom did not have any experience in design thinking. The innovation community comprised those employees with an interest in DT and built the base for the wider adoption of DT. Interestingly, the DT roles have not changed much over time, although some have switched from external to internal (see the Phase 2 column in Table 2).

The DT team, located in the IT division, was in direct contact with potential end customers, so learning about end customers took place in IT operations rather than within a business division. The business provided the challenges for DT projects, as the sponsor was from the business division. However, the DT initiative itself was attached to the GTO Retail Innovation Team, which was represented by the Core Banking CIO reporting to the Group CIO. A panel, staffed from the top management level, selected the challenges for the DT projects and ensured the fit with corporate strategies. The fit of the challenges was assured through the method coaches.

To get started, the DT team needed some basic tools. Team members attended a boot camp at the start of the evolution process to learn how to use these tools and to speed up their understanding of the DT methodology. The tools taught focused on iterative needs-discovery during the steps of the design thinking cycle (see Figure 1), with several tools being needed for each step. For example, tools for the needfinding step include ethnographic elements and interview and observation techniques to help create a deep understanding of the end customer within the targeted design space. Some DT team members already had experience of tools used at the ideation step (e.g., brainstorming).

A key success factor of the DT approach is the ability to prototype an idea immediately, to test it in a realistic environment and then to discuss the impact of the prototyped idea. The interdependency of the tools needed to achieve this required intensive coaching support, because of the difficulty of moving from ideas to concrete prototypes.

Once prototypes had been tested and evaluated, the DT team communicated the results to interested internal parties during presentations at the project milestones shown in Figure 2. The reaction to the first prototypes was mixed and generated a lot of controversy. On the one hand, prototypes were seen as attractive because they could generate feedback easily at low costs; on the other hand, some of the interested parties were initially skeptical that "low-resolution" prototypes could provide valuable information about an innovation. Banking personnel were not yet accustomed to talking about unfinished products that had already been tried out by end customers. Nevertheless, the DT team persevered and created increasingly detailed prototypes, which helped to raise awareness of the importance of making more efforts to understand the bank's end customers. In fact, Phase 1 of the evolution showed the benefits of customer proximity. Moreover, the speed of developing prototypes became obvious, especially when compared to other internal procedures.

The regular presentations showing the results of the DT team were combined with workshops on how to apply DT tools, which meant internal observers became familiar with the key tools. Additionally, the team was able to foster a rough understanding of the interdependencies between individual DT tools.

At this point of the evolution, the DT project structure was isolated completely from other IT projects, with DT projects focusing on singular end customer touch points related only to those projects. Inevitably, this led to fragmented views about customers' needs. However, during this Learning phase of the evolution, Deutsche Bank recognized that DT really did help in understanding customers, not least because of the tangible nature of the prototypes.

One factor that opened the path toward Phase 2 (Adapting) of the evolution was a managing director who continuously incorporated the DT results in strategic discussions and shepherded the market launch of the first final prototype. This managing director stated: *"I have the prototypes in my office—having them physically present is enough to start a relevant conversation with interested stakeholders."* The visibility and communicative power of tangible prototypes at different operational levels was one reason why the IT division became interested in DT in the first place.

Another factor was that the innovation community within the bank was increasingly interested in seeing the DT tools being used. In addition to the continuous coaching of the DT team, to guarantee a wider and high-quality understanding of DT tools, external coaching staff started to offer workshops about a single tool, such as rapid prototyping, needfinding or visualization techniques. Rapid prototyping is one of the key DT tools; the true nature of the problem is often found only by trying out new ideas. Nevertheless, adopting an attitude of simply doing something proved to be one of the hardest things to foster.

Finally, the speed of development of the first DT project (11 months from initial idea to market launch—see box) attracted other business sponsors for the DT approach, who became sponsors of new challenges for the next phase of the evolution. They were persuaded especially by what can be achieved with end-customer proximity, and how close IT was to end customers and how IT was building and testing prototypes embedded in an adequate (though still isolated) project structure.

Example Phase 1 DT Project: Financial Timeline for Drawing Younger Customers into Bank Branches

The business division identified the problem that was the first DT challenge for Deutsche Bank: most customers, especially younger ones, have hardly had any physical touchpoints with the bank in their lives. The final solution prototype (of the 23 different prototypes in total), developed over four months, was a financial timeline that drew young, potential customers into the bank and offered a fun way of planning their financial lives. These youngsters were attracted to the touch-screen application environment, which provided just enough concreteness about the financial wishes of the future customer. The requirements were defined in detail directly from the tangible final prototype and transferred into development.

Phase 2: Adapting

After the successful initial first application of DT within Deutsch Bank, Phase 2 of the evolution focused on adapting the structural and educational aspects of the approach. Although the DT project structure was still isolated from daily IT operations, the IT division did adopt some key DT elements, such as iterative needs-discovery and multidisciplinary teams. Structurally, the approach was simplified to single elements, such as single tools (e.g., rapid prototyping) and single project phases (e.g., one critical function and Dark Horse prototyping), although the DT team closely monitored how the simplification would impact the outcome.

The simplification had two main effects. First, Deutsche Bank succeeded in changing the IT division's approach to defining requirements. The traditional procedure strived to find *the* right solution. With DT, the problem scope expanded to search for and explore various solutions. As a consequence, different and wider options emerged rather than a supposed single, right solution. Second, the simplification enabled not only radical innovation but also incremental innovation. This meant that the IT division had fewer problems integrating the DT results into its current project structures. Compared to DT activities in Phase 1, this was the biggest adaptation of the DT approach, with DT projects enriching existing project teams with a customer-centric perspective.

The focus of DT on business-IT alignment also evolved. Ongoing learning about DT helped shift the focus from business-IT alignment to end customers' journeys, and thus helped to strengthen the focus on customer-centricity. Inferring concrete actions from the end-customers journey helped the IT division to more holistically understand the customer's situation (motivation, beliefs, triggers), which meant it could see things from the end customer's perspective, not just from Deutsche Bank's perspective. This holistic view ensured that customer-centricity was institutionalized throughout the complete DT cycle for innovation projects.

Although DT roles did not change much in Phase 2, there was a general movement from external to internal resources. The trigger for this movement was in 2012 when the external method coaches from the university started to transfer DT method knowledge to a fully dedicated internal method coach; the transfer was completed in 2013. This dedicated method coach was supported by the bridgehead role, which raised the level of method competence.

Deutsche Bank also adapted the project staffing profile by assigning a long-term employee as a full-time member of the DT team, working with externally hired interns. Hence, the DT team now included a mix of grounded Deutsche Bank knowledge and people without a banking background. As a consequence, involvement in DT became more attractive, and from Phase 2 onwards the DT initiative had more than one business sponsor and, therefore, more than one DT team. Up to three teams were now working concurrently on different strategic challenges.

The DT project structure shown in Figure 2 was also simplified, with the original diverging and converging prototyping phases being replaced by two sub-phases: diverging and converging. The diverging sub-phase (known as "DT Lite") was used as a pre-phase for IT projects, where it challenged the assumptions underlying traditional projects. This simplification shortened the DT project phase from four to two months without losing the learnings of the diverging sub-phase, which were directly integrated as a pre-phase of IT projects. The simplification also facilitated the transfer from the DT team to the IT development team.

DT Lite proved to be very successful in a credit app project. The new head of the credit division needed to deliver something quickly to show that he was innovating. By using DT Lite, his group was able to meet a real customer demand instead of just producing something that enabled him to "tick a box." Using DT Lite for this app demonstrated the value of gaining insights from customer needs.

DT Lite helped not only to enhance the perceived success of DT but also to speed up its adoption by reducing the cognitive dissonance between DT and the Deutsche Bank

culture. The connection between design thinking milestones in DT Lite with common project structures was a real boost to the evolution of DT within Deutsche Bank.

DT Lite was mainly enabled through earlier Phase 1 DT project milestone presentations and full transparency of deliverables, and this continued in Phase 2. An increasing number of internal parties attending milestone presentations started to be interested in the DT approach, and their curiosity about prototypes that addressed a particular challenge created a growing innovation community. A Deutsche Bank professional coach said, *"We had to see how it works, but as soon as parts of the results were presented in the milestone presentations, we were sure that this would help change our working behavior!"* To foster the innovation community, a systematic education program was developed that focused not just on DT tools but also on changing mindsets. For example, the program included conceptual discussions on how to continuously involve customers in different IT projects. This developed a well-educated innovation community, which comprised members of similar education levels and a continuously growing common mindset.

Another factor that triggered the Adapting phase of the evolution was the transfer of DT team members to the subsequent production development of the idea. This helped to transfer DT knowledge to IT development teams, and was a key aspect of the upcoming Diffusing phase.

The IT division soon recognized that the primary focus of DT on the bank's end customers could also be used for internal project needs (see box). The division continued

to keep the focus on end customers, but the other involved parties (sponsoring business divisions) started to see the potential for internal projects.

Example Phase 2 DT Project: Optimizing Access to Stored Documents

The challenge addressed by this project was that the various forms needed by different departments were widely distributed over the intranet. Further, the structures of these stored documents were incompatible and inflexible. The IT document management team had worked on solving this problem for several years, but with limited success. The solution was a new way of visualizing hyperlinked forms, based on a "mostly linked documents" algorithm, and taking account of the different search patterns used by individuals.

This challenge was very important because it was the first DT project connected by content to an existing IT project team working on the same challenge, and it provided a good base to adapt the DT approach to the existing IT project structure. The inputs from the DT team were directly integrated into the existing IT project team. A direct comparison with the existing project structure showed that the DT team produced a customer-centric prototype in less than four months and with significantly less funding than the IT team was consuming annually on solving this problem.

Phase 3: Diffusing

The focus of Phase 3 (Diffusing) was to move beyond DT projects and the IT department. In this phase, the DT teams started to become contact points for problems that had arisen in the bank several times before but had never been solved. Thus DT evolved to become a core methodology in the bank, with the DT teams perceived as reliable innovation partners. A person who was highly involved in the diffusion of design thinking said, *"For me, the biggest success is that people recognize a place within the bank that can be approached, especially for wicked problems that they were*

maybe already facing for a long time." A managing director added the business view: *"We have a problem here with customer proximity, and they [the DT teams] have the approach to solve it."* Business divisions now accepted the need for tangible prototypes in their pursuit of innovation efforts. This showed that the understanding of customer integration was institutionalized far beyond IT projects. Moreover, there was a continuous "pull" from the business divisions to learn how to use this new problem-solving approach.

In Phase 3, organizational capabilities were deepened to use DT in a multitude of ways, including as a greenfield approach to gain totally new insights, or as a way of minimizing risks in an ongoing project. Employees throughout the bank became more aware of the need to consider end customers, and of the ways to approach them and use their inputs for innovation initiatives.

A standard DT "toolbox" was developed as part of an internal DT education program. Participants in this program came from very different management levels, ranging from a managing director to a development programmer. The program also included a one-day module integrated in the global graduate education curriculum. This class was held on a regular basis as part of the Graduate Program for Group Technology and Operations allowing the IT department to educate the next generation of IT managers on the value and benefits of customer proximity in IT.

Thus in Phase 3, the value of DT increased—and not only from the customer-centric point of view. Employees now recognized DT as valid skillset for future work. One

employee stated: *"I want to have that in my CV; it is also a useful tool for internal project staffing."*

As the evolution continued, DT teams were staffed in multiple ways. The externally recruited interns were mixed with internally recruited team members. The internal DT team members were strong ambassadors for DT after their projects were completed. The bank realized that, compared to the start of the DT implementation process, mixed teams of internal and external members reduced the connectivity efforts needed within the organization. Additionally, the mixed teams were an excellent recruiting tool, as each year the bank could acquire new talent from the external members of the teams.

Diffusing DT as a customer-centric approach into regular project structures took six years. However, the experience of using DT over time helped to position the approach as a dominant way of challenging long-held assumptions. As a member of the innovation community stated: *"DT helped our team to constantly challenge the assumptions that we had built over the years; now, finally, we know that DT guaranteed the continuous integration of the customer's perspective in every project."* The deep diffusion of DT throughout the bank is confirmed by the common question now asked: *"Where is the tested prototype for that idea?"* Today, decision makers ask about prototypes almost more often than they ask about business case results. This is precisely what happened in the case described in the box.

Example of Phase 3 DT Project: Making a Brokerage System Attractive for New Clients

The purpose of this project was to find ways to attract new clients with no previous experience in brokerage to a self-service platform for the bank's brokerage business. A

challenge for the project team was team members' own lack of brokerage experience. Without this knowledge, it was difficult to create a helpful tool for beginners in this area. The greatest need was to provide an easy way for potential clients to increase their knowledge about this kind of business, its products and rules. The solution developed by the DT team enabled the bank to create a financial education system that provided the required information in the language of the client, and was easy to understand and use.

In summary, the evolution of design thinking at Deutsche Bank was characterized through organizational structures and mindsets, both of which focused on customer proximity. The IT division hosted the original DT team and was charged with testing and developing the DT approach. The division addressed the challenges of achieving customer proximity by putting IT staff in direct contact with end customers, and by creating an adequate project structure to enable continuous understanding of end customers' needs. The evolution resulted in a standardized DT skillset, in DT principles and tools being applied on projects at different hierarchy levels and different organizational divisions, and in ongoing communication about DT as a core methodology for innovation in Deutsche Bank.

Design Thinking Outcomes at Deutsche Bank

In Phase 1 (Learning), DT was mostly observed by members of the innovation community. As they saw results, they started to adapt and practice their own ways of using the DT approach, step by step (Phase 2: Adapting). They then started to diffuse these practices into the work culture, spreading awareness of customer-centric solutions (Phase 3: Diffusing). By 2015, the innovation community had grown to approximately 150 members who regularly attend presentations and have built a knowledge- and experience-exchange community. The innovation community now has members from all

divisions, which intensifies exchanges about DT between the IT division and other business-critical departments.

Another important outcome was the extent to which the DT teams located in the IT division had direct contact with the bank's potential end customers, which enhanced their understanding of customers and increased customer involvement. These contacts were made through needfinding and prototype testing. For each DT project, there were four iterations through the six milestones of the design cycle, leading to about 24 prototypes per project. Each prototype was tested directly with an average of about eight potential end customers. Thus, there were about 190 direct customer contacts for each DT project, as well as about 20 more direct touchpoints. Finally, over 200 direct end customer contacts were created in an average four-month DT project. This meant that the IT team achieved a significant increase in contact with end customers.

The DT projects described above show how customer integration as well as customer understanding can be successfully addressed by applying the DT approach. As highlighted at the start of this article, speed is decisive in addressing bank customers' needs. The solutions of the first two DT projects, started 2009 and 2010, were implemented in less than a year from the first prototype (for the 2009 project) and less than 18 months (for the 2010 project).

Another significant outcome of embedding design thinking in Deutsche Bank was that it provided an efficient and effective way to launch new customer-centric services in a short time period. Over a five-year period, eight DT projects were finished: three final prototypes were implemented (2009, 2010 and 2013), one was abandoned (in 2010)

because of personnel changes in the sponsoring business unit, and four were in different stages of development (2011-2012).

Lessons Learned

We have distilled five lessons for CIOs and other business leaders from the evolution of design thinking within Deutsche Bank. These lessons show that embedding DT in an organization takes time; it does not happen overnight.

1. Create an Enabling Organizational Structure

Sustainably embedding DT within a corporate environment requires an enabling organizational structure, the heart of which is an independent operational unit that conforms to the role model described earlier. This organizational structure, together with space and prototyping budgets, helps to apply DT, even at the start of embedding efforts when DT is significantly different from current practices. An independent organizational structure that cuts across the existing silo structure creates a "safe zone" that enables the first steps of applying DT. Hence the enabling organizational structure needs to be placed at the intersection of business and IT, where it will also foster business-IT alignment. This alignment occurs automatically when customer proximity is an integral part of the IT development process. The design thinking cycle shown in Figure 1 causes end customers' needs to be continuously discovered and thus promotes customer proximity. The business relevancy of DT projects is ensured by choosing challenges that have strategic relevance. Overall, the stability provided by an independent enabling organizational structure ensures that the CIO and the IT division deliver customer-centric solutions, and allows the DT approach to be embedded in a sustainable way.

2. Provide Design Thinking Education

Appropriate education is the key to success with DT. To follow an evolutionary path for embedding design thinking requires a well-thought-out mix of educational programs.

Design thinking is not just a set of principles; it also requires a certain mindset that is acquired by project-based training and experiences overseen by coaches who have previously acquired this mindset. It is absolutely essential to foster this mindset in team members from the very early stages of implementing DT practices. Applying DT principles without understanding the reasons for them and how they differ from current IT practices does not lead to real innovation in an IT context. Education on new DT tools and mindset should be phased, rather than trying to "swallow the elephant in one bite." The education program might include modules that quickly instruct employees on how to use the new DT approach. But whatever techniques are used, DT education should clearly explain what works and what does not. To reduce the barriers to attendance, DT education and activities should be conducted in easily accessible physical spaces (e.g., at the entrance areas of buildings where IT employees are located), especially at the beginning of the embedding process.

When an education program is designed for employees at a wide range of levels and seniority, the use case behind the course content is highly relevant. Although everyone will need to be familiar with the same underlying DT principles, different levels will need different DT perspectives to ensure they can recognize the relevance of DT to their particular circumstances.

3. Strategically Position Design Thinking Team Members

Strategically positioning people is crucial to overcome the typical walls between DT teams and IT development teams. Key insights gained from the DT prototypes will be lost at the development stage if no one from the DT team works with the IT team to supervise the development of the production-ready product. Alternatively, a former DT team member can become a fully integrated member of the IT development team. Such a move especially helps to overcome the "not invented here" problem. An IT team member who has "changed sides" sides in this way is well positioned to persuade his or her new colleagues to try the DT approach.

Another way of strategically positioning people is to recruit internal staff who have worked in the organization for a considerable time and therefore have a well-developed network of contacts within the business. Such people can then be assigned as DT team members and later move back into the business. This quote by one such Deutsche Bank employee shows the impact of this tactic: *"It is not only about the knowledge and expertise that I have gained, it's also about the curiosity toward innovation that started to grow."* Because DT requires direct and continuous engagement with customers to understand their real problems, DT team members from the business are hugely respected by their business units. Their exclusive and deep knowledge about end customers automatically positions them in a very favorable light.

To follow an evolutionary process for embedding DT in the organization, DT teams should comprise people with strategic, innovative and communication profiles.

4. Use Prototyping as a Key Tool

One of the most important aspects of design thinking is the use of physical prototypes. At Deutsche Bank, prototypes were the medium of communication for all stakeholders. Digital newsletters and Twitter feeds were tried, but nothing was as successful at communicating the successes of DT as physical prototypes. An IT management representative said: *"You cannot imagine how long we have talked about this rudimentary financial timeline after the presentation in our group, because we had the possibility to see how it should look like and try it out ourselves."* Fully functional prototypes of ideas are not necessary for getting people involved; a rudimentary, tangible prototype of a unique idea is sufficient to engage top-level managers and get them thinking about further usage scenarios, even during post-project phases. In fact, resources are more likely to be devoted to further development of ideas if senior managers are shown physical prototypes instead of presentation slides.

Deutsche Bank found that the series of prototypes from a DT project created a repository of ideas that may not be used in a particular final product, but which might turn out to be key in the development of future products, provided developers have access to the discarded prototypes. However, prototyping can be hard to implement and, to follow an evolutionary approach to embedding DT, must be accompanied by experienced method coaching.

5. Take an Evolutionary Approach to Building a Design Thinking Culture

A Relevant Starting Point Helps to Gain Awareness. As with any culture change, there will be in-built inertia to building a DT culture. The key to overcoming inertia is to start with small projects and small teams. As a starting point, the IT division should

choose a DT challenge that is strategically important, not only from an IT perspective but also from the perspective of the entire organization. Solving real problems, especially with real customers, is the best way of promoting the DT methodology because people become curious about this new customer proximity approach. No one will be persuaded by "toy" examples. Finally, to assure continuity in awareness, the bridgehead role, combined with senior management support, is critical.

Long-Term Resources Will Be Needed. An evolutionary approach to culture change needs resources that allow the work to continue over a long period of time. It is almost certain that a culture change of the type described in the Deutsche Bank case study could not be achieved by simply directing existing staff to learn a new methodology. Rather, the culture change has to develop organically, building on successes and excitement. This takes time, money and people. If an organization really is committed to this type of change, it must allocate substantial resources, such as personal resources, space, budget and freedom to work, to the initiative.

In Conclusion

Some say, that in the context of large firms, the term "innovative company" is an oxymoron because of the barriers to innovation large firms face. At first sight, this would seem to be especially true for large firms trying to use the DT approach for innovation initiatives. However, the Deutsche Bank case study shows that it is possible to overcome the barriers of using DT for innovation. The bank's customer involvement efforts, which aimed to deepen its understanding of end customers' needs, helped to address the problems outlined at the start of this article. Moreover, the case shows that

using the customer-centricity and physical prototyping features of design thinking leads to better alignment between business and IT operations.

Rather than trying to impose design thinking on the entire company at once, this innovation approach was introduced by Deutsche Bank using a kind of “guerrilla warfare” tactic. Once enough subversion had taken place, the new methodology was established as a part of the bank’s practices with the hiring of a Vice President for Design Thinking.

Deutsche Bank began its DT journey with a kernel of DT expertise provided by external method experts. These method coaches trained a small DT team, which then began to deliver successful DT projects. People from the DT team were then moved into the IT division, where they developed their own internal education program. Six years on, the internal use of design thinking in projects and the DT education program continue to expand in Deutsche Bank, not least to address the problem of recruiting in a competitive market for talent. Today, the evolution of design thinking within Deutsche Bank has reached the point where employees can receive help with “wicked” problems from dynamic, innovative rapid-prototyping-oriented teams that provide iterative, tangible prototypes and that can develop the final prototype into a production-ready solution. The time-to-market for these solutions is very much shorter than with traditional IT development processes. Moreover, the DT teams achieve all this with continuous and deep customer involvement.

Changing an organization’s innovation culture demands full commitment from numerous players and parties. To embed DT in the organizational culture, each player

and party must push customer-centricity to a level where customer involvement becomes a continuous part of a project. Customer-centricity is the key to creating a competitive advantage for the company through innovative offerings. It took Deutsche Bank six years to a fully integrate the DT approach into its regular IT project development process. As many of the involved parties stated, there is no shortcut to reaching the level of maturity required to move on to the next phase of design thinking evolution.

Finally, the Deutsche Bank case not only offers important learnings for CIOs and IT directors, but also for other business leaders who are striving to achieve customer proximity in their innovation processes.

Appendix: Research Method

Since 2009, we have studied the application of DT in Deutsche Bank's IT division at its headquarters in Frankfurt, Germany and other selected global locations (New York, Singapore and London). We used several research methods to create this case study, primarily semi-structured interviews with Deutsche Bank employees and detailed analysis of the company's structure and development over the years. We conducted 71 face-to-face interviews between July 2009 and February 2015 with executives and senior managers and other involved parties from the IT and business divisions. At least two researchers participated in all interviews. The interviews were recorded, transcribed and analyzed by two researchers using qualitative data analysis. Most of the involved people were interviewed several times over the years and therefore provided an evolutionary view on the development of DT within the bank (some were interviewed up to eight times over the course of the study). Additionally, the long-term analysis of the data ensured we gained a long-term critical perspective and helped us to investigate different

reasons for certain developments. The analysis of the evolutionary cultural change toward customer-centric IT was complemented by intensive discussions with senior experts on organizational IT environments from university institutes as well with IT managers in other companies.

About the Authors

Christophe Vetterli

Christophe Vetterli (christophe.vetterli@bluewin.ch) was a research associate at the Institute of Information Management at the University of St. Gallen (HSG) and led the Deutsche Bank design thinking projects. He received a graduate degree in business administration and a doctorate from the University of St. Gallen (HSG) under the direction of Professor Walter Brenner. His PhD focused on embedding design thinking into the corporate IS environment, and he has published several scientific articles within this field. Christophe also serves as a manager at an international Swiss-based consultancy firm, as a lecturer and as a board member of a construction firm.

Falk Uebernickel

Falk Uebernickel (falk.uebernickel@unisg.ch) is an assistant professor at the University of St. Gallen. He started his professional design thinking career in 2008 with projects at Deutsche Bank. In conjunction with Stanford University, Falk teaches design thinking for masters students and delivers executive lectures at companies. Other his research interests are the Internet of things and Industry 4.0. He is responsible for the global design thinking alliance program—called SUGAR—which coordinates more than

15 universities around the globe. He is also author of over 120 research publications on innovation and information management.

Walter Brenner

Professor Walter Brenner (walter.brenner@unisg.ch) joined St. Gallen University in 2001 after having held Chairs at University of Essen (Germany) and Freiberg University of Mining and Technology (Germany). He received a graduate degree in business administration and a doctorate from the University of St. Gallen. His research focuses on information management, consumer data, innovation and digital industrial services. He has authored and edited 30 books and more than 300 publications. Professor Brenner also he practices as a consultant and is an entrepreneur. Prior to joining academia, he was Head of Application Development at Alusuisse-Lonza AG (Switzerland).

Charles Petrie

Charles Petrie (cjpetriejr@gmail.com) is a senior research scientist at the University of St. Gallen, where he teaches and coaches in innovation via design thinking. In 2012, he was a guest professor at St. Gallen and Karlsruhe University, Germany. He is a retiree from the Stanford University Computer Science Department where he was a senior research scientist. He has also been a consulting assistant professor with the Stanford Center for Design Research, and was the founding executive director of the Stanford Networking Research Center. He received his Ph.D. in computer science from The University of Texas at Austin.

Dirk Stermann

Dirk Stermann (dirk.stermann@db.com) joined Deutsche Bank in Frankfurt in 2007, where his responsibilities have included heading up the IT strategy and IT innovation teams as well as driving the cooperation with the University of St. Gallen, focusing on design thinking. Prior to joining Deutsche Bank, he worked for 10 years as a financial services consultant at different management consultancies, where he advised financial service companies on strategic and process-related topics. Dirk Stermann has a PhD in banking from the University of Zurich.

Curriculum Vitae

Personal Information

Name:	Christophe Julien Vetterli
Date of Birth:	December 21, 1982
Place of Birth:	La Chaux-de-Fonds, Switzerland
Nationality:	Swiss
E-mail:	christophe.vetterli@bluewin.ch

Education (extract)

2010 – 2013	Doctoral Studies in Business Innovation at the University of St.Gallen
2008 – 2010	Master in Business Administration at the University of St.Gallen
2008 – 2009	(ME310 with Stanford University, California, USA)
2003 – 2007	Bachelor in Business Administration at the University of St.Gallen

Work Experience (extract)

2014 – 2015	Senior Consultant at walkerproject ag
2009 – 2013	Senior Design Thinking Coach at Deutsche Bank AG and Zürcher Kantonalbank
2009 – 2013	Senior Design Thinking Method Coach at Design Thinking @HSG Course
2008 – 2009	Junior Research Assistant at the Chair of Prof. Dr. Hubert Österle, Institute of Information Management, University of St.Gallen
2007 – 2008	Junior Consultant and Consultant at walkerproject ag
2006 – 2007	Junior Research Assistant at the Chair of Prof. Dr. Oliver Gassmann, Institute of Technology Management, University of St.Gallen
2006 – 2007	Junior Research Assistant at the Chair of Prof. Dr. Hubert Österle, Institute of Information Management, University of St.Gallen

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